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[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Abroma. *Abroma angustum* L. f. (Fam. *Sterculiaceae*.)—Under the name of *Olutkombul*, the glutinous sap of this plant has long been used in India in dysmenorrhea. According to Sircar (*Indian Medical Gazette*, 1900) and other English practitioners, it is a very efficient remedy in congestive and neuralgic dysmenorrhea when given in doses of two drachms (7.7 Gm.) at the time of the first premonitory pains and continuing to the end. The fresh root is sometimes used. Dose, half a drachm (2 Gm.).

Abrus. *Abri Semina. Jequirity. Prayer Beads. Abrus Seeds. Abrus precatorius* L. (Fam, *Leguminosae*.) —The seeds of this plant, which grows in India and also in Brazil, are employed in India as a standard weight by druggists and jewelers, and also for criminal poisoning. The seeds are ovoid, from 5 to 8 mm. in length, smooth, shiny and of a bright scarlet, having a black marking at the lower, or hilum, portion. They are said to be inert when taken whole into the stomach. They contain abric acid, $C_{21}H_{24}N_3O$, and, according to the researches of Sidney Martin (*P. J.*, Sept., 1887; *Proc. Roy. Soc.*, 1889, vol. xlvi), two proteid poisons, a paraglobulin and an albumose (together called *abrin*), which are almost identical in their physiological properties with principles found in snake venom, although less powerful. According to Flexner, the toxic action of these substances also closely resembles that of true toxins, the most characteristic result being focal necroses in various organs. Flexner suggests that these in turn are due to a lesion in the blood-vessel walls caused by the abrin. (*J. Ex. M.*, 1897, vol. ii.) The ordinary lethal dose of abrin for animals is said to be 0.00001 Gm. per kilo of weight. (Consult *The Non-Bacillous Nature of Abrus Poisoning*, J. H. Warden and L. A. Waddel, Calcutta, 1884; Bufalini, *Ann. di Chim. e di Farm.*, No. 2, 1886; Kobert, *W. M. Bl.*, Nov., 1889.) The root of Abrus, known as *Indian liquorice*, possesses toxic properties like the seeds and should not be used in place of licorice. According to David Hooper, it contains *glycyrrhizin*. (*P. J.*, 1894.) Abrin is used in the treatment of certain chronic diseases of the eye, especially in corneal opacities, and trachomatous pannus. It excites a purulent inflammation of the conjunctiva, which appears to lead to an increase in the local circulation, provoking thereby an absorption of inflammatory exudates. The remedy is capable of great harm in unsuitable cases, and extreme caution must be employed in its use. The infusion of jequirity, which was formerly employed for this purpose, has been almost abandoned because it was liable to cause an uncontrollable inflammation which in some instances has entirely destroyed vision. The infusion of the crude drug was employed

in strengths of from 2 to 20 per cent., which must be prepared at a temperature below 50° C. (112° F.). According to Ehrlich, the solution of abrin should not be stronger than one part in 500,000; any increase of strength must be made with great care. Both Ehrlich and Calmette succeeded in immunizing rabbits against abrin, and obtained an antitoxic serum. P. Romer (Graefe's *Archiv. f. Ophthalm.*, vol. lit, 1901) has introduced two preparations: *jequiritol*, an abrin solution, sterilized, of four different strengths; jequiritol serum, which, as commercially supplied, has such immunizing power that 0.1 mil suffices to protect a white mouse from the effects of a hundredfold lethal dose of jequiritol when the latter and jequiritol serum are injected con jointly. (For details and methods of use, see *Th. M.*, May, 1902; *M. R.*, 1902; Kattwinkel, *Jequiritol*, Bonn, 1902; Seefelder, *Klinische monatsblatter*, 1905, p. 273; Schoen, *Hospitalstidende*, No. 37, p. 921.)

Absinthium. *N. F. IV. Wormwood.*—It was official in the U. S. P. 1890 and is now recognized by the National Formulary. The definition is as follows: "The dried leaves and flowering tops of *Artemisia Absinthium* Linne (Fam. *Compositae*), without the presence of more than 5 per cent. of foreign matter." *N. F. IV.* Several species of *Artemisia* have enjoyed some reputation as medicines. The leaves of *A. Abrotanum* L., or *southernwood*, are reported by Craveri to contain a crystallizable alkaloid, *abrotine*; they were formerly employed as a tonic and anthelmintic. *A. pontica*, L. has been substituted for common wormwood, but is weaker. *A. vulgaris* L., or *mugwort*, has been used in Germany in epilepsy, chorea, and amenorrhea. *A. ludoviciana* Nutt., a native of the southwestern regions of the United States, has been commended as a stimulant to the hair. (*A. J. P.*, 1872, p. 106.) In China, moxa is prepared from *A. chinensis* L. and *A. indica*, Willd.

Wormwood, also known as *Madderwort*, *Wermuth*, *Mugwort*, *Mingwort* and *Warmot*, is a shrubby, more or less herbaceous, finely canescent plant, growing to a height of 2 to 4 feet. The leaves are 1 to 3 pinnately divided, the lobes being lanceolate or obovate, the basal leaves being petio-late while the floral ones are linear and entire; the flowers are all fertile, yellowish, and occur in hemispherical paniced heads. The plant is a native of Europe and is to some extent cultivated in the United States. It is now naturalized and rather common in eastern Canada to Pennsylvania, growing along roadsides and waste places. It should be gathered in July or August, during flowering.

The *N. F.* description is as follows: "Stems and leaves gray-green, finely silky-hairy and glandular throughout; largest leaves reaching 10 or 12 cm. in length, and of nearly equal breadth, on long petioles, two to three times pinnately lobed or divided, the ultimate segments oblong or obovate, obtuse, entire or slightly toothed; upper leaves becoming shorter petioled, small and narrower, the uppermost being only about 2 cm. in length and resembling the ultimate segments of the larger ones; heads racemose-paniculate, drooping on short peduncles, greenish-yellow, from 3 to 4 mm. in breadth, round-ovoid, the outer bracts linear-oblancheolate, obtuse, the inner broader and scarious-margined; receptacle hairy; outer flowers sometimes pistillate. Odor characteristic, aromatic; taste very bitter. The powdered drug is brownish to yellowish-green and, when examined under the microscope, exhibits numerous, characteristic, T-shaped, non-lignified hairs, consisting of a short, one- to four-celled stalk bearing & single apical cell attached near the center and up to 0.8 mm. in length

and 0.035 mm. in width. Many of the hairs are more or less collapsed, twisted or broken; glandular hairs, some with one- or two-celled stalk, the glandular portions consisting of from four to eight secreting cells surrounded by a membrane; few simple hairs from the flowers, some of which are very long and up to 0.085 mm. in width; epidermal fragments with elliptical stomata, the latter up to 0.035 mm. in length; fragments of mesophyll and palisade cells containing chloroplastids; tracheae mostly spiral, up to 0.035 mm. in width; few sclerenchymatous fibers, with thick, usually lignified walls and simple pores, up to 0.02 mm. in width; pollen grains few, somewhat spherical or triangular in outline, up to 0.03 mm. in diameter; calcium oxalate crystals in rosette aggregates about 0.01 mm. in diameter. Absinthium yields not more than 10 per cent. of ash." N. F.

The volatile oil (*oleum absinthii*) is usually dark green, sometimes yellow or brownish or even blue, having a strong odor of the plant, an acrid peculiar taste, and the sp. gr. 0.925 to 0.950. It is sometimes adulterated with alcohol, oil of turpentine, etc., which lessen its specific gravity. It is composed of: *thujone* (*absinthol*), which has the specific gravity 0.926, composition $C_{10}H_{16}O$, boiling point $200^{\circ} C.$ ($392^{\circ} F.$) to $205^{\circ} C.$ ($401^{\circ} F.$), and when heated with phosphorus pentasulphide or zinc chloride yields cymene ($C_{10}H_{14}$); thujyl alcohol ($C_{10}H_{18}O$), both free and as the esters of acetic, isovaleric, and palmitic acids; phellandrene and possibly pinene; cadinene; and a *blue oil* of as yet undetermined composition. (Gildemeister and Hoffmann, *Aetherische Oele*, 1899.) The *absinthic acid* found by Braconnot is said to be succinic acid. Caventou first obtained *absinthin* in an impure condition. (See U. S. D., 14th ed., p. 5.) P. Senger (*A. Pharm.*, 230, p. 94) has obtained abainthin as a yellow substance of an intensely bitter taste melting at $55^{\circ} C.$ ($131^{\circ} F.$). He gives it the formula $C_{15}H_{20}O_4$ and considers it to be a glucoside, as on boiling with diluted sulphuric acid it yields dextrose and absinthic acid. Kromayer gives the formula for absinthin as $C_{40}H_{56}O_8 + H_2O$. Absinthin is soluble in water, alcohol, and ether and has been introduced into medicine for use in the treatment of *constipation* and *chlorosis*. Dose, one and one-half to three grains (0.1-0.2 Gm.). Adrian and Trillat isolated a new crystalline body ($C_{53}H_{51}O_{20}$) from wormwood by treating an alcoholic extract with amyl alcohol, the absinthin having been previously removed. They also isolated another crystalline principle, *anabsinthin*, $C_{18}H_{24}O_4$ (*P. J.*, 1899, 1, 75). The old salt of wormwood (*sal absinthii*) was impure potassium carbonate, made from the ashes of the plant.

Wormwood, which was formerly in vogue as a stomachic tonic, antiperiodic, and anthelmintic, is at present very seldom used. The volatile oil is an active narcotic poison. In dogs and rabbits from thirty to fifty drops (1.5-2.5 mls) of it will cause trembling, stupor, hebetude, and even insensibility; one to two fluidrachms (3.75-7.5 mls) of it causes violent epileptiform convulsions, with involuntary evacuations, unconsciousness, and , stertorous breathinh, which may or may not end in death. (Marce, *B. G. T.*, Mai, 1864; Amory, *B. M. S. J.*, March, 1868, p. 83.) In man the oil acts similarly; a half ounce (15 mls) of it caused, in a male adult, insensibility, convulsions, foaming at the mouth, and a tendency to vomit; though the patient recovered under the use of emetics, with stimulants and demulcents. (*L. L.*, Dec. 6, 1862'.) According to J. L. Corning, the volatile oil is a powerful local anesthetic, locally useful in rheumatic pains. Bohm. and Kobert affirm that the oil escapes through the

kidneys unchanged. Dose, of wormwood in substance, from twenty to forty grains (1.3-2.6 Gm.); of the infusion (one ounce in a pint of boiling water), from one to two fluidounces (30-60 mils) ; of the oil, one to two minims (0.06-0.12 mil).

Absinthe is a liqueur containing oils of wormwood, angelica, anise, and marjoram. According to Baudrimont, the *absinthe ordinaire* contains 47.66 per cent. of alcohol, the *demi-fine* 50 per cent., the *fine* 68 per cent., and the *absinthe Suisse* 80.66 per cent. The preparation, if manipulated properly, possesses naturally a bright green color, brought to an olive-green by slight addition of caramel coloring; but artificial coloring was formerly often resorted to, and indigo, turmeric, cupric acetate, and aniline green have been used to produce the proper shade. The importation of absinthe liqueur into the United States is now prohibited by law. *Absinthism* differs from ordinary alcoholism in its manifestations; its characteristic symptoms are restlessness at night, with disturbing dreams, nausea and vomiting in the morning, with great trembling of the hands and tongue, vertigo, and a tendency to epileptiform convulsions.

ACACIA. U. S. (Br.) ACACIA Acac. [Gum Arabic]

"The dried gummy exudation of *Acacia Senegal* Willdenow, and of other African species of *Acacia* (Fam. *Leguminosae*)." U. S. "A. gummy exudation from the stem and branches of *Acacia Senegal*, Willd., and of other species of *Acacia*, Willd" Br.

Acaciae Gummi, Br.; Gummi Africanum; Gummi Mimosa; Gum Acacia; Galam Gum; 'Gomme Arabique Vraie, Fr.; Gummi Arabicum, P. G.; Arabisches Gummi, G.; Gomma Arabica, Gomma del Cordofan. It.; Goma Arabiga, Sp.: Samagh Arabee, Arab.

The name *Acacia* was employed by the ancient Greeks to designate the gum tree of Egypt, and has been appropriately applied to the genus in which that plant is included.

The most important of the gum-yielding Acacias is the official *A. Senegal* Willd. This is a small tree rarely exceeding a height of 6 m., with a grayish bark, the inner layers of which are strongly fibrous, bipinnate leaves, dense spikes of small yellow flowers longer than the leaves, and broad pods containing 5 or 6 seeds. It forms large forests in Western Africa, north of the river Senegal, and is abundant in Eastern Africa, Kordofan, and Southern Nubia. It is known by the natives of Senegambia as *Verek* and of Kordofan as *Hashab*.

Nearly all species of *Acacia* growing in Africa yield a gum. The commercial Somali gum, which is usually of fair quality, is yielded by *A.*

glaucophylla Steud. and *A. abyssinica* Hochst., shrubs growing in Abyssinia and the Somali country. The following species yield a gum having a brownish or reddish color (called *Amrad Gums*), and hence are less valuable, viz., *A. arabica* Willd., *A. stenocarpa* Hochst., *A. Seyal* Del. and *A. Ehrenbergiana* Hayne. Inferior gums are also yielded by the following: *A. horrida* Willd., which furnishes the so-called Cape gum and is distinguished by being very brittle and yielding a less adhesive mucilage. *Talca* or *Sennarr gum* is derived from *A. Fistula* Schweinf. This gum has a greenish tinge and yields a ropy mucilage. Australian gum has a reddish color, said to be due to the presence of tannin. This gum is also spoken of as *Wattle gum* or *Australian gum*, and is derived from the *Golden Wattle* (*A. pycnantha* Benth.), a shrub growing in New South Wales, Victoria and Southern Australia. For commercial history of the several varieties of gum arabic, see *U. S. D.*, 19th edition, p. 2. For further information in regard to gum bearing trees of Northern Africa, see *P. J.*, Aug., 1873; *C. R. A. S.*, t. Ixxix, p. 1175; *Toxicologie Africaine*, vol. ii.

The bark and unripe fruit of the acacia contain both tannic and gallic acids. The dried juice of the pod was used by the ancient Greeks; and an extract is still sold in the bazaars of India under the name of *Akakia*. This extract is heavy, hard, of an agreeable odor, varying in color from greenish to dark-reddish, or, when seen in bulk, blackish. It has a sweet, astringent taste, and yields a mucilaginous infusion. A similar preparation, *acacia nostras*, has been prepared in Europe by expression and inspissation from the unripe fruit of *Prunus spinosa*, or wild plum tree.

The gum of the acacias exudes spontaneously from the bark, and hardens on exposure; but incisions are sometimes made in order to facilitate the exudation. The gum is said also to be found immediately under the bark, where it is sometimes collected in regular cavities. It is formed within the plant by metamorphosis of the cells of the inner bark. The tissues involved are chiefly those of the sieve and the cambiform cells. While to some extent it is a natural change, yet it is usually looked upon as being in part a pathological production, as gummosus develops more largely upon the wounding of the trees. The attack of the Acacia plants by various parasites is held by some to account for the enormous production of gums in these plants. The investigations of Smith tends to show that all vegetable gums are of bacterial origin and that the differences in the several gums are due to the differences in the nature

of the bacteria producing them. (*Proc. Linn. Soc. N. S. Wales*, 1904, p. 217;) For further discussion on the origin of acacia gum see Tschirch, "*Handbuch der Pharmakognosie*."

The trees are not tapped for gum until they are about six years old. The annual yield varies very greatly, being from 188 to 2856 Gm. in young trees and from 379 to 6754 Gm. in large trees. The average annual yield of gum from young trees is about 900 Gm. and from old trees over 2 kilos. (Edie, 4th Report of the *Wellcome Tropical Research Laboratory*.)

It is stated by Jackson that, in Morocco, the greatest product is obtained in the driest and hottest weather, and from the most sickly trees. An elevated temperature appears to be essential, for in cooler climates, though the tree may flourish, it yields no gum. It is probable that some species of acacia yield finer gum than others, but it is also certain that the same tree will often yield some gum of the finest quality in regular tears or globular masses, and some irregular shaped, dark colored fragments of inferior value. Thus, from the same tree it will exude frothy or thick, and clear or dark colored, and will assume, upon hardening, different shapes and sizes; so that the pieces, when collected, require to be assorted before being delivered into commerce. This sorting is usually done on its arrival in European ports and only the selected or picked gum corresponding to the U. S. P. description should be used.

Commercial History and Varieties.— There are two principal commercial varieties of gum arabic: 1. The *Khordofan, Turkey or Arabian Gum* and 2. The *Senegal or West African Gum*, both of these being derived from *A. Senegal*. The former of these has the finer commercial qualities, being nearly white or faint yellowish-white and yielding a more or less transparent viscid mucilage.

KHORDOFAN, TURKEY, OR ARABIAN GUM.—This variety was formerly the only kind designated as gum arabic and entered commerce almost exclusively through Egypt, being collected in Upper Egypt, Nubia, Khordofan, Darfur, and other regions of the Upper Nile, and carried to Alexandria, from whence it passed directly into the world's commerce or entered the latter through Smyrna, Trieste, or some other Mediterranean entrepot. At one time the more or less colored varieties were known as *gum gedda*, while the white and fine drug was known as *gum turic*, names derived from Jiddah and Tor, Red Sea ports, through which the varieties were supposed to be respectively exported.

Three chief commercial varieties are recognized. (a) *Hashabi* or *Khordofan gum*, the finest of these varieties, was collected in the country westward of the White Nile; formerly it constituted the bulk of the superior gum arabic of commerce. (b) *Sennari gum* was an inferior variety, yielding a mucilage which turned sour more quickly than that produced by Khordofan gum. It was collected in a country eastward of the White Nile, and in the region of the Blue Nile. (c) *Ghezzirah* or *Gezireh gum* is obtained from Ghezzirah and neighboring countries and sent to Trieste. It has much of the same appearance as the official Khordofan gum.

Formerly, Khordofan gum was collected in all parts of the Soudan and Upper Egypt, and forwarded on the backs of camels to Assouan, at the head of the Nile navigation, often being many months en route. The closure of the Soudan by the Mahdi caused Egyptian gum almost to disappear from commerce, but the reopening of the region by the British government has resulted in large quantities of the gum being brought by rail to Assouan, whence after being sorted into three varieties it is put in palm-leaf sacks and sent down the Nile. The finest Egyptian gum consists of large roundish or smaller more or less irregular fragments, transparent but usually rendered opaque upon the surface by innumerable minute fissures. The inferior gum varies from yellow to dark-reddish as the quality deteriorates, and often contains impurities. H. C. Wood found that the gum arabic comes into Assouan in sacks or mats which are simply piled in rectangular roofless spaces surrounded by walls about ten feet high, made of dry mud. He was informed by the traders that the gum is gathered during the months of January, February and March by collectors having vested rights in a certain portion of the forests. Long incisions are made vertically through the bark and the exuding gum allowed to harden, the trees not being injured by the process, the collections going on from year to year. *Gedda gum*, sometimes spoken of as an Egyptian gum, enters commerce through Geddah, or Jiddah, on the Arabian side of the Red Sea. It seems to be the same as *Mecca* or *El Wisch* or *Aden* gums, which are sometimes spoken of as Egyptian gums, but are probably produced in the triangular peninsula which forms the eastern extremity of Africa.

Suakin gum, *Taica* or *Talha gum*, from *A. stenocarpa* and *A. Seyal*, is exceedingly brittle, and usually semi-pulverulent. It is a mixture of nearly colorless and brownish gums, is exported at Alexandria, and is sometimes termed *gum savakin*.

SENEGAL OR WEST AFRICAN GUM.—This variety is sometimes incorrectly referred to as synonymous with the official gum. It is derived from *A. Senegal* and other species of *Acacia* growing in the Soudan and Senegal. It yields a good adhesive mucilage and is valuable for technical purposes. Some of the best qualities of Senegal gum are also adapted for certain pharmaceutical uses. There are a number of different commercial varieties named from their geographical sources. It was introduced into Europe by the Dutch. The French afterwards planted a colony on the western coast of Africa, and took possession of the trade. St. Louis, at the mouth of the Senegal, and Portendic, considerably farther north, are the ports in which the commerce in gum chiefly centers. Immense forests exist in the interior, containing many species of the genus *Acacia*, all of which are said to yield gum, as is affirmed do also various trees belonging to other genera. The chief harvest begins in October and ends in December, although gum is also collected in March. The dry winds, which prevail after the rainy season, cause the bark to crack; the juice flows out and hardens in masses, which are often as large as a pigeon's egg, and sometimes as that of an ostrich. It is affirmed that the exudation is also largely caused by a parasitic plant, *Loranthus Acaciae* Zucc., the gummy exudation freely oozing out at the point where the parasite penetrates the bark. (*Ph. Centralh.*, Aug., 1895.) Senegal gum is usually in roundish or oval unbroken pieces, or in straight or curled cylindrical pieces of various sizes, in the finest grades whitish or colorless, but generally yellowish, reddish, or brownish red. The pieces are larger than those of Turkey gum, less brittle and pulverizable, and breaking with a more conchoidal fracture. In recent years the commercial supply of gum Senegal has been a variable one. In 1911 the gum was extremely scarce, there was practically none on the market, owing to a failure of the crop.

INDIA GUM.—*Persian gum*, which is said to be sent from Persia to Assouan to be packed as genuine gum arabic, can be distinguished from the latter, which it closely resembles, by its not dissolving in water. Sickenberger thinks that it is the product of *Prunus bokharensis* or of *P. puddum*. India gum is not produced in India, but reaches Bombay from Aden and the Red Sea ports, and is almost certainly the product of the Soudan, being therefore identical with Egyptian gum. It occurs in India in two forms, "*Maklai*," in large round tears or vermicular pieces, white, yellow or reddish, and much fissured; and "*Maswai*," in fragments and vermicular pieces similar in color and fissuring to the other variety. It is

often crudely adulterated before reaching Europe, especially with *Bassora gum*, distinguished by its insolubility in water. Of recent years various India gums have come into commerce in increasing quantities as substitutes for true gum arabic. India gum is brought to this country partly from Calcutta or Bombay, and partly by way of England. It usually comes in large cases. We have seen a parcel said to have come directly from the Red Sea, enclosed in large sacks made of a kind of matting, and bearing a close resemblance to the gum from Calcutta, except that it was more impure, and contained numerous large, irregular, very brittle masses, not much less than the fist in size. The term India gum should not be confused with *India gum Tragacanth*, which is called simply by the name India gum in the confectionery and ice cream trades where it is used as a filler and to give bulk and firmness; nor with *Indian gum*. (See *Gummi Indicum*.)

SUBSTITUTES FOB GUM ARABIC.—According to A. Mander, the East India gums appearing in the London market are:

Amrad, Amra or Oomra Gum.—A name applied to various East Indian gums having a reddish color and being in more or less irregular stalactitic pieces. (See *U. S. D.*, 19th ed., p. 4.)

Ghatti Gum.—A pale gum consisting of rounded or vermiform pieces varying in size, clear internally, but dull and roughened on the surface, apparently caused by shrinkage in drying; from brownish-yellow to perfectly colorless and transparent. According to the *Pharmacographia Indica*, this gum is readily distinguished from all others by its dull white, roughened surface and glassy fracture free from cracks; it possesses about double the viscosity of gum arabic.

Ghatti gum is said to be obtained from *Anogeissus latifolia* Wallich in enormous quantities, to be much used in India, and to be exported from Bombay in the pure state.

Small quantities of gum are produced in India by a large number of trees often having no botanical relations with the Acacias. For an account of these gums see *Pharmacographia Indica*, vol. i.

Under the names of *Brazilian gum*, *Para gum*, and *gum angico*, large quantities of a gum occurring in large dark-amber or dark-brown glossy drops, soluble in water, are occasionally found in commerce. It is said to

be the product of *Acacia angico*. Its mucilage is very adhesive, but usually too dark in color for pharmaceutical purposes. It must be distinguished from the gum resin often known as Brazilian gum, which is said to be obtained from *Hymenaea courbaril*, and is used in making varnishes.

Chagual or *Maguey gum* of Chili occurs in hollow cylindrical pieces from 0.2 to 1.5 cm. in thickness, occasionally having the form of stalactites or irregular tubers. On their inner surface they are longitudinally streaked, while their outer surface is usually numerously fissured, the fissures penetrating deeply toward the interior. In the absence of these, the pieces are of glassy brightness, transparent, and of very dense structure internally. The color varies from colorless, through yellowish and brownish to a tolerably deep brown, isolated pieces being almost black. According to the experiments made by Guehm, the commercial drug is scarcely fitted for technical use as a gum, but the clear pieces when made into a concentrated mucilage by prolonged heating answer the purposes of the calico printer well. *Puya chilensis*, *P. lanuginosa*, and *P. lanata* are commonly said to be the sources of the gum, though the researches of Hartwich make this uncertain. The exudation is asserted to be the result of the bite of a caterpillar, *Kastina elegans*. (*Zeit. Oest. Apoth. Ver.*, Aug. 1, 1896.)

Specimens of gum arabic are sometimes found in commerce, which are soluble in water with difficulty. According to Kochlin, if ten parts of such gum, fifty parts of water, and three parts of a 12 per cent. solution of hydrogen dioxide be heated together for two or three hours, the gum is rendered easily soluble. (*Nat. Drug.*, 1894, 176.) Related to the acacia gums are *wood gum*, from the wood of foliage trees, yielding xylose on hydrolysis; *cherry gum*, the gum of cherry and almond trees, yielding β -arabinose on hydrolysis; *peach gum*, from the peach tree, yielding arabinose and galactose on hydrolysis; *barley gum*, obtained in the nitrogen-free extractive material of cereals, yielding galactose and xylose. Martina examined twenty-seven varieties of gum, and the composition of some of the principal ones is given in the table below.

Origin.	Source.	Ash.	Lime.	Mucic Acid.	Galactose.	Furfurol.	Penta-glucose.	Total Glucoses.
Gum Arabic.....	Arabia.....	3.60	1.84	22.98	30.66	13.57	27.14	58.3
	Senegal.....	3.25	0.90	19.72	26.29	12.97	25.94	57.58
	Gezireh.....	2.75	0.94	12.42	17.89	19.32	36.62	60.66
	Aden.....	3.70	1.33	18.68	24.90	15.26	30.52	56.90
	Mogador.....	3.50	0.78	18.10	24.13	13.90	27.80	50.31
	N. Holland.....	0.50	....	45.82	61.09	10.85	21.70	43.75
Mimosa nilotica.....	Indies.....	4.16	0.97	14.75	19.66	17.98	35.96	56.52
	Egypt.....	2.80	1.36	5.91	7.88	21.44	42.88	49.13
Acacia dealbata.....	Van Diémen....	0.65	....	39.09	52.12	8.89	17.68	73.93
Acacia angico.....	Brazil.....	2.89	....	1.23	1.63	40.35	80.70	74.22
Gum of Apricot.....	.....	4.20	1.85	9.16	12.21	17.27	34.52	43.48
Gum of Plum.....	.....	2.15	1.07	5.19	6.92	31.03	62.06	66.47
Gum of Cherry.....	.....	2.50	1.00	6.13	8.17	23.07	46.14	56.38

Thos. Maben gives the following method of testing mucilage obtained from various gums sold for gum arabic as the best that he has been able to devise after much experimentation. Two or three drops of the mucilage prepared from the gum are placed on a glass or porcelain slab, and one or two drops of the following reagents added; these are then stirred together with a glass rod and the results compared. In the case of borax, acacia mucilage at once agglutinates or hardens into a gummy mass, similarly with basic lead acetate and ferric chloride, while it gelatinizes or forms a softer mass with potassium silicate. Similar reactions are given by the Senegal gums, the Indian Amrad gums, white Barbary, white and brown Cape, and Geddah gums. Barbary brown and Amrad give a jelly only with borax, otherwise they react as acacia. Australian gum agglutinates with borax, but only gelatinizes with basic lead acetate, and has no reaction with ferric chloride and potassium silicate. Brazilian gum has no reaction with potassium silicate, but gelatinizes with borax and ferric chloride and slightly with basic lead acetate. Ghatti gum gelatinizes with all four reagents, but in a slight degree only with potassium silicate. Oomra gum reacts similarly to acacia, except that it is entirely unaffected by basic lead acetate, and forms a softer jelly with ferric chloride. There are, of course, shades of difference in the various reactions which cannot be indicated by these terms, but, generally speaking, a fair idea is given of the nature of the gum. (*P. J.*, March 1, 1890, 717.)

General Properties.—Gum arabic is "In ovoid, more or less spheroidal tears, or in broken, angular fragments from 2 to 30 mm. in diameter, varying from white or yellowish-white to light amber-colored; translucent; very brittle; fractured surface glass-like, sometimes iridescent; nearly inodorous; taste insipid, mucilaginous. Insoluble in alcohol; slowly and almost completely soluble in twice its weight of

water, forming a mucilaginous liquid, which has a slight, characteristic odor and is acid to litmus. When either 0.1 mil of basic lead acetate T.S., or 0.1 mil of a concentrated solution of sodium borate, or 0.1 mil of ferric chloride T.S. is added to 10 mils of a 10 per cent. aqueous solution of Acacia, a gelatinous precipitate is produced. The precipitate produced with ferric chloride T.S. is neither black nor brownish-black (*tannin*). The powder is whitish, with few or no starch grains or fragments of vegetable tissues. Not more than 1 per cent. of powdered Acacia is insoluble in water (*plant tissues, sand, or dirt*). Acacia yields not more than 4 per cent. of ash, and the powder contains not more than 15 per cent. of moisture." U. S.

"When dissolved in an equal weight of water, the solution is not glairy, and after admixture with more water, yields no gummy deposit on standing. An aqueous solution (1 in 10) exhibits slight laevorotation (absence of dextrin, certain sugars, etc.). 10 millilitres of the same solution are not precipitated by *solution of lead acetate*; are not, after previous boiling and cooling, colored blue or brown by 0.1 milli-litre of *N/10 solution of iodine* (absence of starch and dextrin), or bluish-black by *T. Sol. of ferric chloride* (absence of tannin). Ash not more than 4 per cent." *Br.*

The commercial gum arabic contains 17 per cent. of water and 3 per cent. of ash, consisting almost entirely of calcium, potassium and magnesium carbonates.

The gum dissolves slowly, at ordinary temperature, in twice its weight of water, forming a thick glutinous liquid of distinctly acid reaction. It is insoluble in alcohol, ether, and the oils. One hundred parts of 22 per cent. alcohol, by volume, dissolve 57 parts of gum, diluted alcohol containing 40 per cent. alcohol takes up 10 parts, and 50 per cent. alcohol only 4 parts (Fluckiger). On adding hydrochloric acid to the aqueous solution and precipitating with alcohol, a colorless amorphous substance is obtained. This is arabic acid. On hydrolysis, it yields *galactose, arabinose*, and a pentabiose named *arabinon*. The *arabin* (or arabic acid) may also be prepared by placing a solution of gum, acidulated with hydrochloric acid, on a dialyzer, when calcium chloride will diffuse out, leaving behind solution of arabin.

Arabic acid dried at 100° C. (212° F.) has the composition $2C_5H_{10}O_5 + H_2O$; the water separates when it unites with bases. It has a decided

tendency to form acid salts. Concentrated nitric acid forms with it nitro-compounds; diluted nitric acid, on the other hand, gives rise to mucic and saccharic acids, together with oxalic and a little tartaric acid. Diluted sulphuric acid on prolonged boiling gives rise to *arabinose*, or *arabin sugar* (*pectinose*, or *pectin sugar*), $C_2H_{10}O_5$, which reduces alkaline copper solution and turns the plane of polarization 121° to the right. Kiliani (*Ber. d. Chem. Ges.*, 1887, 339) first established the formula as given above, and it is now recognized as belonging to the class of pentoses. They are not fermentable, and, on prolonged boiling with diluted hydrochloric acid, lose the elements of water and yield *furfural*, $C_5H_4O_2$. Neutral lead acetate does not precipitate an aqueous solution of gum arabic, but the basic acetate forms, even in a very diluted solution, a precipitate.

Prolonged heating of the dry gum causes it to change readily into *metarabic* (*metagummic*) *acid*, which is identical with the *cerasin* found in the beet and in cherry gum. Sulphuric acid will also change arabic into metarabic acid. 25 Gm. pure gum arabic are covered with 50 mils strong alcohol, 10 mils water, and 5 mils sulphuric acid, and allowed to stand twenty-four hours. On pouring off the fluid, and washing the residue with alcohol and with water, metarabic acid remains behind as a voluminous mass, which dries to a white, tasteless, and odorless powder of acid reaction. (*Graeger, Jahresbericht der Chem.*, 1872, 781.) The *metapectic* acid which is prepared by Scheibler from the sugar beet is identical with metarabic acid.

The principle separated by cold water from the soluble arabin proves to be the same as metarabic (metagummic) acid prepared direct from the pure gum arabic by heating, or by the action of sulphuric acid. It is also identical with gum extracted from the sugar beet by Scheibler. In the normal and sound beet this gum is insoluble in water, and merely swells up like metarabic acid, while in altered beets there is found a portion (arabin) soluble in water. (Scheibler, *Ber. d. Chem. Ges.*, 1873, p. 612.)

The similarity of the reactions and composition of *arabinose* and *galactose* (from sugar of milk by inversion) led Kiliani to assert the identity of these two varieties of sugar, but later studies by himself, Claesson, and Scheibler have shown that they are distinct. Thus, galactose is fermentable, while arabinose is not; galactose yields mucic acid when oxidized with nitric acid, and dulcitol when reduced with sodium amalgam, while arabinose does not yield either; the fusing

point of the crystallized galactose is given at 142° to 144° C. (287.6°-291.2° F.), while that of arabinose is 160° C. (320° F.); galactose yields with phenylhydrazin a light yellow compound, fusing at 170° to 171° C. (338°-339.8° F.), while arabinose forms a brownish-yellow compound, fusing at 157° to 158° C. (314.6°-316.4° F.). (Scheibler, *Ber. d. Chem. Ges.*, 17, 1731.) Arabinose is said to be obtainable only from those varieties of gum arabic that yield no mucic acid when treated with nitric acid. (Claesson, *Ber. d. Chem. Ges.*, 14, 1271.)

Gum arabic undergoes no change by age, when kept in a dry place. Its concentrated aqueous solution remains for a considerable time unaltered, but ultimately becomes sour, from the production of acetic acid. The disposition to sour is increased by employing hot water in making the solution. The tendency of a weak solution to become moldy is said to be obviated by adding a few drops of sulphuric acid, and decanting from the calcium sulphate deposited. (*A. J. P.*, 1872, 353.) Solution of gum arabic does not ferment upon the addition of yeast, saliva, or gastric juice; the addition of chalk and cheese, however, starts a fermentation which gives rise to lactic acid and alcohol, but not to mannite or glycerin. The addition of a solution of gum to an acidified albumin solution causes a precipitate, which disappears on further addition of gum, but the solution will then curdle and become flocculent on application of heat. Gum may be distinguished from dextrin by the following tests: 1. Gum contains no dextroglucose, which, however, is present in dextrin, and may be recognized by the copper test. (See *Alkaline Cupric Tartrate Volumetric Solution*, Part III.) 2. Gum contains a lime compound; hence its solution is rendered milky by oxalic acid, while a solution of dextrin remains almost clear. 3. Gum gives a slimy, yellow deposit when its solution is mixed with a neutral ferric salt.

J. Henry Schroeder examined twelve specimens of powdered acacia, and states that dextrin is not frequently used as an adulterant, and that if in using the alkaline cupric tartrate test the heat be prolonged during twenty minutes, a well denned reduction was produced even when pure Senegal gum was used. (*A. J. P.*, 1897, 195.) R. G. Shoults (*A. J. P.*, 1900, 267) supplemented the conclusions of Schroeder and proposed to use the difference in rotatory power of acacia and dextrin as a test. He found a solution of pure acacia to have a laevorotatory power of -18°, while one of dextrin was dextro-rotatory varying to the extent of from +120° to +138°. This method of testing the presence of dextrin may be replaced by the simpler one with the microscope. (See also Kebler's

paper, Am. Drug., 1901, 343.) The following test is given in the *Ph. Post*, 1894, 563. Add 3 mils of a solution consisting of 15 drops of solution of ferric chloride, 15 drops of a saturated solution of potassium ferrocyanide, 5 drops of HCl (1-125), and 60 mils of water to a 20 per cent. solution of the gum. If the gum arabic is pure, it will remain a clear yellow for from eight to ten hours. If there is dextrin present, the color change's to blue.

The properties above enumerated belong to gum arabic generally. There are, however, varieties with differences which deserve notice.

1. *Gum that is transparent and readily soluble.* This constitutes by far the greater portion of the commercial varieties distinguished by the names of Turkey and Senegal gum. It is characterized by its transparency, ready solubility, and the comparatively slight degree of thickness and viscosity of its solution. Under this head may be included the *gomme blanche fendillee* of Guibourt. It is distinguished by the whiteness and deficient transparency of the pieces, attributable to the minute cracks or fissures with which they abound, and which render them very brittle and easily pulverizable. This peculiar structure is generally ascribed to the influence of solar heat and light, but is conjectured by Hayne to arise from the exudation of the juice in the frothy state noticed by Ehrenberg. Though the unbroken pieces are somewhat opaque, each minute fragment is perfectly transparent and homogeneous. This variety, in consequence of its prompt and entire solubility, is usually preferred for medicinal use and for most purposes in pharmacy.

2. *Gum less transparent and less soluble.* Guibourt has proposed for portions of this gum the name of *gomme pelliculee*, from the circumstance that the masses are always apparently covered, on some part of their surface, by a yellowish opaque pellicle. Other portions of it have a mammillary appearance on the surface. It is less transparent than the former variety, is less freely and completely dissolved by water, and forms a more viscid solution. It dissolves with difficulty in the mouth, and adheres tenaciously to the teeth. It is found in all the commercial varieties of gum, but least in that from Egypt. Its peculiarities have been ascribed to variable proportions of *bassorin* or *cerasin* associated with the soluble *arabin*. Between these two varieties there are insensible gradations, so that it is not always easy to classify specimens.

E. Bourquelot (J. P. C., 1904 [6], 19, 473, 474) states that acacia contains an active oxidizing ferment which renders it unsuitable for use in many pharmaceutical preparations, and that, notwithstanding the wide use of acacia as an excipient, it is possible that certain active ingredients may become altered in its presence. Nor is acacia the only gum which contains a ferment; myrrh, frankincense and bdellium also contain an oxydase. Among the substances stated as being incompatible with acacia are **pyrogallol, morphine, vanillin, ordinary phenol, cresylol, ortho- and metaxyolol, thymol, carvol, a- and b-naphthol, pyrocatechol, guaiacol, phenols, lysol, cresols, acetylguaiacol, veratrol, creosol, eugenol, acetyleugenol, methylaniline, ethylaniline, paratoluidine, crude aniline, xylidine, a-naphthylamine, pyramidon apomorphine, eserine, adrenaline, isobarbaloin, caffeotannic acid, gallic acid and tannin.** Paraxylenol, hydroquinone, resorcinol, anisol and phenetol do not appear to be affected. Nor is the action confined to chemical substances; acacia is incompatible with the **opium** and **Calabar bean** products, suprarenal extract, aloetic preparations, and all substances flavored with **vanillin, tannin-containing extracts,** such as those of **rhatany, catechu, and rhubarb; fluidextract of viburnum prunifolium,** and **kola preparations.** Obviously, in cases where mucilage of acacia is concerned, this oxidizing action may be eliminated by heating the liquid to 100° C. (212° P.), and thus destroying the ferment.

Impurities and Adulterations.—As gum arabic is usually collected in huge piles at Khartoum before being shipped to Port Soudan the sand and impurities are likely to sift to the bottom. As a consequence the first orders are likely to be filled with the cleaner article while the latter containing the siftings may run as high as 4 per cent. of ash. The inferior grades are often mixed with, or substituted for, the better kinds, especially in powder. Very occasionally flour or foreign starch is fraudulently added to the powder, but may be easily detected by the use of the microscope and the blue color which it produces with tincture of iodine. In consequence of the impurities and difference in quality, gum arabic should generally be garbled. In fact, it is surprising what a good effect the removal of 1 or 2 per cent. of objectionable matter has upon the remainder of the drug. It has been proposed to change the arabinic acid of the sugar beet, by the method of Scheibler, into metarabinic acid, as the foundation of a true artificial gum arabic, but the artificial gums

of the market have no such close chemical relation with the natural gum; many of them are mixtures of various substances, others are produced from starch by the action of sulphuric acid or by other means. Universal gum, a patented product obtained from potato starch, has been highly commended for the permanency and adhesiveness of its mucilage, but is said not to act well as an emulsifier. A substitute has also been made from Irish moss. (See *Chondrus*.) Gelatin is sometimes added to acacia as an adulterant; formaldehyde has been recommended by Trillet (Ph. Post, 1899, 629) as an agent for its detection. (See also *Proc. A. Ph. A.*, 1900, 643.)

Uses.—Acacia is used in medicine chiefly as a demulcent. Hence it is advantageously employed in catarrhal affections and irritation of the fauces, by being held in the mouth and allowed to dissolve slowly. It has been used as a food, but has very little if any nutritive value. In pharmacy, gum arabic is extensively used for the suspension of insoluble substances in water, and for the formation of pills and troches. Two kinds of powdered gum arabic are used, one a coarse powder called *granulated*, the other *finely dusted*. The granulated dissolves more readily in water, according to Hager, because it has lost during desiccation only two per cent. of moisture, while in preparing the "finely dusted" powder the high heat necessarily used to thoroughly dry it drives off ten per cent. of water. Its easy solubility and absence of tendency to form "lumps" cause the coarse powder to be preferred for solutions, emulsions, etc.

Acacia is incompatible with strongly alcoholic solutions, solutions of ferric chloride and lead subacetate, and strong solutions of sodium berate.

Off. Prep.—Mucilago Acacias, *U. S., Br.*; Pulvis Greta Compositus, *U. S.*; Syrupus Acacise, *U. S.*; Syrupus Morphinae et Acacise (from Syrup of Acacia), *N. F.*

ACACIAE CORTEX. Br. ACACIA BARK

"Acacia Bark is the dried bark of *Acacia arabica*, Willd., and also the dried bark of *Acacia decurrens*, Willd.; obtained from wild or cultivated trees not less than seven years old, and, after being dried, kept for one year before use." *Br.*

Wattle Bark; Black Wattle; Babul Bark; Neb-neb.

The Acacias are known not only for their gums, but a number of them contain large quantities of tannin and hence are used in tanning. Among the latter are the so-called wattle barks of Australia, and also catechu. The chief of the Australian trees is the black wattle (*A. decurrens*), the bark of which yields from 24 to 42 per cent. of tannin, and is employed as an astringent. More recently *A. arabica* has been similarly used in East Africa.

Characters.—"Bark of *A. arabica* hard and woody, rusty brown, and tending to divide into several layers. Outer surface of the older pieces covered with thick blackish periderm, rugged, fissured longitudinally and transversely. Inner surface red, longitudinally striated and fibrous. Taste astringent and mucilaginous."

"Bark of *A. decurrens* usually in curved or channelled pieces, 1.5 to 3 mm. thick. External surface greyish-brown, darkening with age; often with irregular longitudinal ridges, and, sometimes, transverse cracks. Inner surface reddish-brown, longitudinally striated; fracture irregular and coarsely fibrous, freshly fractured surface pale. Slight tan-like odor; taste astringent." *Br.*

Acacia bark owes its medicinal properties to the tannin it contains. It is used as an astringent in diarrheas, being usually employed in the form of a decoction (1 :16), in *doses* of one-half to two fluidounces (15-60 mils).

Acalypha. *Br. Add.* 1900.—The fresh and the dried herb, *Acalypha indica* L. This euphorbiaceous plant is said to have expectorant and emetic properties similar to those of ipecac, and also to be employed by the native Indian practitioners in the form of the fresh leaves as a poultice for ulcers, and as a suppository for constipation in children. The *Succus Acalyphae*, *Br. Add.*, 1900, is prepared by adding one volume of 90 per cent. alcohol to three volumes of the juice expressed from fresh leaves, with subsequent filtration. It is given in doses of from one to four fluidrachms (3.75-15 mils). The liquid extract (*Extractum Acalyphae Liquidum*, *Br. Add.*, 1900), made with a menstruum of 90 per cent. alcohol, is given in doses of from five to thirty minims (0.3-1.8 mils).

Achillea. U. S. 1870.—The flowering tops of *Achillea Millefolium* L. *Milfoil*, or *yarrow* is a perennial herb, very common both in Europe and America. It is from a foot to eighteen inches in height, and is specifically distinguished by its doubly pinnate, downy, minutely divided leaves, with linear, dentate, mucronate divisions, from which

it derived the name of milfoil, by its furrowed stem and involucre, and by its dense corymbs of whitish flowers, which appear throughout the summer, from June to September. The whole herb has medicinal properties. *Achillea nobilis*, L., and *A. moschata* Jacq., or *Iva* of Europe, are sometimes used as substitutes for *A. Millefolium*.

Both the flowers and leaves of *A. Millefolium* have an agreeable, though feeble, aromatic odor, which continues after drying, and a bitterish, astringent, pungent taste. The aromatic properties are strongest in the flowers, the astringency in the leaves. The plant contains a blue volatile oil, tannin, and a peculiar principle, *achillein*, which was discovered by Zanon. (*Ann. Ch. Ph.*, lviii, 21.) As analyzed by von Planta (*Ann. Ch. Ph.*, civ, 1870) its formula is $C_{20}H_{38}N_2O_{15}$. It occurs in a brownish-red mass of a strongly bitter taste, soluble in water, more feebly in alcohol, and not at all in ether. *Achilleic acid*, also discovered by Zanon, is affirmed by Hlasiwetz to be identical with aconitic acid. The oil, which may be obtained separately by distillation with water, has a beautiful azure-blue color, and the peculiar flavor of milfoil. Schimmel & Co. (*Ber. d. Chem. Ges.*, 1894, p. 50) found its most important constituent to be cineol, $C_{10}H_{18}O$. The high boiling blue portion is probably identical with the assulein of chamomile oil. *Ivain*, $C_{24}H_{42}O_5$, has also been isolated; it occurs as a dark-yellow resinous mass, insoluble in water, readily soluble in alcohol, and producing an intensely bitter solution.

The active principles of the drug are extracted both by water and alcohol. Milfoil is a mild aromatic sudorific tonic and astringent. Pappi states that *achillein* given in divided doses up to from thirty to seventy-five grains (2-5 Gm.) causes marked irregularity of the pulse. The infusion is sometimes used in *acute suppression of the menses*. The dose of achillea is thirty to sixty grains (1.9-3.9 Gm.); the volatile oil has been used in doses of ten to fifteen minims (0.6-1.0 mil).

Acocanthera.—The Wa Nyika, the Wa Gyriama, and the Wa Kamba tribes of Eastern Africa, and the natives of Obok on the Gulf of Aden, prepare vegetable arrow poisons probably from different species of plants, although the names *wabayo* and *ouabaw* seem to have been used as synonyms by missionaries and others sending the extract to Europe.

The botanical sources of these arrow poisons are uncertain. It is certain that several species of the apocynaceous genus *Acocanthera* are used for arrow poisons by the natives of Africa. Of the four principal species, *A. schimperi* B. and H. is found abundantly in the highlands of Abyssinia and throughout a great portion of Eastern Africa; *A. deflersii* Schwf., which resembles the last-named species closely, but, according to Schweinfurth, differs in that its flowers are larger, sweet-smelling and pure white, has been found in the neighborhood of Yemen; *A. ouabai* Arnaud is a native of Somaliland, and *A. venenata* Don, of South Africa. For details, see *A. de S.*, cvii, p. 1162; abs. in *J. P. C.*, 1889, p. 245. From *Acocanthera abyssinica* is prepared *Shashi-poison* of German Eastern Africa.

In 1882 Arnaud obtained from an unidentified species of the genus *Acocanthera* (which he named provisionally *A. Ouabaioides*), a crystalline glucoside, and in 1893 Lewin separated from the *Acocanthera Deflersii* an amorphous glucoside.

Owing to the imperfect identification of the plants from which the principles have been obtained, there has been much confusion in the names which have been applied to the principles which various investigators have separated from these arrow poisons. According to Lewin (*B. K. W.*, 1906, p. 1583), there are two glucosides found in the various species of *acocanthera*, one of which is crystalline, and the other amorphous. The amorphous substance, or, as it is generally known, *amorphous ouabain*, corresponds to the *abyssinin* of Brieger (*A. I. P. T.*, 1903), and the *carissin* prepared by Bancroft from the *Carissa ovata* R. Br. (Fam. *Apocynaceae*), an Australian plant. The *acocantherin* of Frazer he regards as identical with the crystalline ouabain of Arnaud, and probably is isomeric with the amorphous variety. It is generally conceded that the crystalline ouabain is chemically identical with the glucoside discovered by Thoms in the *Strophanthusgratus* (see page 1068). Its action seems to be precisely the same as that of *strophanthus*. Ouabain was apparently first employed clinically by Stadelmann (*B. K. W.*, 1906, vol. xliii, p. 1586), and has more recently been used by others with more or less success in the treatment of various forms of cardiac weakness. Stadelmann used an amorphous glucoside prepared by Merck from the wood of the *Acocanthera Schimperii*, in doses of from one three-hundredth to one two-hundredth of a grain (0.0002-0.0003 Gm.) three times a day.

ACONITUM. U. S. (Br.)

ACONITE Aconit. [Monkshood Aconite Root Aconiti tuber P. I.]

"The dried tuberous roots of *Aconitum Napellus* Linne (Fam. *Ranunculaceae*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter, and yielding not less than 0.5 per cent. of the ether-soluble alkaloids of Aconite. If made into a fluid extract and assayed biologically the minimum lethal dose should not be greater than 0.00004 mil for each gramme of body weight of guinea-pig." *U. S.*
"Aconite Root is the dried root of *Aconitum Napellus*, Linn." *Br.*

Aconiti Radix, *Br.*; Aconite Root, Monkshood, Wolfs-bane, Wolfroot, Friar's cap, Cuckoo's cap, Blue rocket; Racine d'Aconite, Aconit, Coqueluchon, Aconit Napel, *Fr.*; Tubera Aconiti, *P. G.*; Eisenhut, Eisenhutknollen, Sturmhut, Monchskappe, Akonitknollen, *G.*; Aconite, *It., Sp.*

The name Aconite is derived, according to Pliny, from the Black Sea port, Acone. While the drug was used by the ancient Chinese as well as

by the hill tribes of India, it was introduced into modern medicine by Storck, of Vienna, in 1763. The genus *Aconitum* is a relatively large one, there being some sixty well-defined species, nearly half of which have been used in medicine. The species which is official and recognized by nearly all the Pharmacopoeias is *Aconitum Napellus*. It is indigenous to the mountainous regions of Middle Europe and is found growing in Northern Europe, Siberia and Central Asia. It is extensively cultivated in temperate climates for its foliage and flowers and has been successfully grown in the testing garden of the U. S. Department of Agriculture. Schneider reports that it has become naturalized to some extent in California. There are five species of *Aconitum* which are indigenous to the mountainous regions of the Northern United States, two of these being found in the Rocky Mountains and on the Pacific Coast. Holm describes the morphology and structural characteristics of the wild Monkshood of the United States, *A. uncinatum* L., in *Merck's Rep.*, 1907, p. 65.

The roots or rhizomes of several other species of *Aconitum* are found in commerce, these being chiefly used in the manufacture of the alkaloids.

(1) The tuberous roots of *A. variegatum* L. and of *A. Stoerkianum* Reich, are sometimes found in the commercial drug. These are smaller, not so pungent, although quite active.

(2) Japanese Aconite is derived from *A. Fischeri* Reich and *A. japonicum* Thunberg. The roots are light gray in color, fleshy, being smaller than the official tubers. They have a circular cambium and the starch grains are more than 0.015 mm. in diameter. They are largely imported into Europe and to some extent. to this country.

(3) Indian Aconite is derived from *A. ferox* Wall., a plant growing in the Himalayas and in Nepal. The roots are from 5 to 10 cm. long and from 2 to 4 cm. in diameter, being externally grayish-brown and deeply furrowed. They are hard, the fracture being either horny or mealy and the inner surface is either yellowish-brown or whitish. The cambium is 7- to 9-rayed and the taste resembles that of the official Aconite.

(4) Another species of *Aconitum* that is very poisonous is *A. Lycoctonum* L., of Europe and Northern Asia. This, however, does not produce a tuberous root, but develops an oblique rhizome surrounded with numerous roots. (

5) The fleshy roots of *A. heterophyllum* Wallich., a plant growing in the West Himalayas, are somewhat ovoid and flattened at the summit and base. Externally they are grayish-brown. The odor resembles that of black pepper and the taste is bitter and acrid. The rhizome contains an amorphous bitter alkaloid, *atisine*, which is not toxic. Under the name of *Utees*, *Atees*, or *Atis*, the rhizome and roots of *A. heterophyllum* are said to be largely employed in doses of 20 grains as an antiperiodic. *Wakhma* is the root of *A. palmatum* Don, in which Jowett found *aconitic acid* and the alkaloid *atisine*, $C_{22}H_{33}NO_3$, which, according to Cash, is physiologically very feeble. (*J. Chem. S.*, 1896.)

Aconitum Napellus is a perennial herbaceous plant, with a conical-shaped, tapering root, seldom exceeding 10 cm. in length and 2 cm. in thickness near the summit, brownish externally, whitish and fleshy within, and sending forth numerous long, thick, fleshy rootlets. When the plant is in full growth, there are usually two roots joined together, of which the older is dark brown and supports the stem, while the younger is of a light yellowish-brown, and is destined to furnish the stem of the following year, the old root decaying. The stem is erect, round, smooth, leafy, usually simple, and from two to six or even eight feet high. The leaves are alternate, petiolate, divided almost to the base, from two to four inches in diameter, deep green upon their upper surface, light green beneath, somewhat rigid, and more or less smooth and shining on both sides. Those on the lower part of the stem have long footstalks and five or seven divisions; the upper, short footstalks and three or five divisionis. The divisions are wedge-form, with two or three lobes, which extend nearly or quite to the middle. The lobes are cleft or toothed, and the lacinise or teeth are linear or linear-lanceolate and pointed. The flowers are of a dark violet-blue color, large and beautiful, and are borne at the summit of the stem upon a thick, simple, straight, erect, spike-like raceme, beneath which, in the cultivated plant, several smaller racemes arise from the axils of the upper leaves. Though without calyx, they have two small calycinal stipules, situated on the peduncle within a few millimeters of the flower. The petals are five, the upper helmet-shaped and beaked, nearly hemispherical, open or closed, the two lateral roundish and internally hairy, the two lower oblong-oval. They enclose two pediceled nectaries, of which the spur is capitate, and the lip bifid and revolute. The fruit consists of three, four, or five follicles. The seeds are wrinkled or scaly and very acrid.

The plant is abundant in the mountain forests of France, Switzerland, and Germany. It is also cultivated in the gardens of Europe, and has been introduced into this country as an ornamental flower. All parts of the plant are acrid and poisonous. The leaves and root are used. The leaves should be collected when the flowers begin to appear, or shortly before. After the fruit has formed, they are less efficacious. The *fresh leaves* have a faint narcotic odor, most sensible when they are rubbed. Their taste is at first bitterish and herbaceous, afterwards burning and acrid, with a feeling of numbness and tingling on the inside of the lips, tongue, and fauces, which is very durable, lasting sometimes many hours. When long chewed, they inflame the tongue. The dried leaves have a similar taste, but the acrid impression commences later. Their sensible properties and medicinal activity are impaired by long keeping. They should be of a green color, and free from mustiness. The root is much more active than the leaves, and an extract from the latter is said to have only one-twentieth of the strength of one made from the former. It should be gathered in autumn or winter after the leaves have fallen, and is not perfect until the second year. It has been mistakenly substituted for horseradish root, as a condiment, with fatal effect. The wild plant is said to be more active than the cultivated. (Schroff.) Procter found the roots of the plant cultivated in this country richer in active alkaloidal principles than the imported roots, having obtained as much as 0.85 per cent. from the former. (*Proc. A. Ph. A.*, 1860.) The studies of P. W. Squire seem to show that in the autumn the root is the most active. So far, however, as concerns the whole plant, the practical difficulty is that the root of *A. paniculatum* Lam. cannot be distinguished from that of *A. Napellus*, except by taste; so that the custom which seems to prevail of gathering the root about the flowering period is probably well founded. The plant is being cultivated to some extent for medicinal purposes in England, but much of the stock is of doubtful nature, owing to the extraordinary tendency of *A. Napellus* to hybridize with other species and to alter under cultivation. (See *P. J.*, 1889, 645.) For Kelleris test for aconite root and leaves, see *Proc. A. Ph. A.*, 1895, 539.

Aconite root is generally brought into market in packages or bales, either from the continent of Europe or from India. It is of variable quality, some parcels being unobjectionable, while others contain a considerable proportion of inert or defective roots. Among these roots that of *Imperatoria Peucedanum Ostruthium* has been especially observed. (*P. J.*, vii, 749.) The best test is the taste; roots should be

rejected which have not in a fair degree the characteristic properties in this respect described below, especially the production of the sensation of numbness and tingling on the tongue, lips, and fauces. One shipment of aconite consisted entirely of Japanese aconite. The powdered drug is sometimes adulterated with the endo-carp of the olive or so-called "olive pits." The latter is not easily detected, as aconite contains a large number of stone cells. The latter, however, have relatively thin walls and the various forms have been described by Stingel in *A. J. P.*, 1913, p. 391.

Nepaul aconite, known in India as "*Bikh*" or "*Bish*" aconite, is supposed to be derived from *A. spicatum* or *A. laciniatum*. There is a question about this as the Nepaul aconite of European commerce yields the alkaloid pseudo-conitine and this principle is only present in the roots of *A. deinorrhizum* and *A. Balfourii*. (*Bulletin of the Imperial Institute*, 1906, p. 32.) Nepaul aconite is composed of elongated fusiform or nearly cylindrical roots which are more or less flattened, longitudinally furrowed and from 7.5 to 10 cm. in length.

Properties.—The German Pharmacopoeia restricts aconite to the bud-crowned tubers of wild growing plants. Most of the other Pharmacopoeias permit the use of stem-crowned roots. In the former case the daughter tubers terminated by their buds are employed, whereas in the latter the older tubers which have developed foliage and flower stems are used. The commercial drug shows considerable variation and is usually a mixture of six or seven different kinds of tubers, as follows:

1. Single fleshy tubers which are smooth, light brown and full of starch.
2. Single tubers which are single, somewhat elongated fusiform, crowned with short stems, dark brown and longitudinally furrowed.
3. Twin tubers, one of which is bud-crowned and the other having a short stem at the summit.
4. Very small single tubers usually crowned with stems, the lower portion being acute or pointed.
5. Single tubers which are almost cylindrical, crowned with stems and either fleshy and nearly smooth or more or less shrunken and furrowed.

6. Dark brown resinous tubers.

7. And finally fragments of small and nearly filiform roots.

The root has a feeble earthy odor. Though sweetish at first, it has afterwards the same effect as the leaves upon the mouth and fauces. It shrinks much in drying, and becomes darker, but does not lose its acidity. Aconite root is officially described as being " more or less conical or fusiform, from 4 to 10 cm. in length and from 1 to 2 cm. in diameter at the crown; externally dark brown or grayish-brown, smooth or longitudinally wrinkled, the upper end with a bud, remains of bud-scales or stem-scars, the other portions with numerous root-scars or short rootlets; fracture short, homy or somewhat mealy; internally, bark light or dark brown, 1 to 2 mm. in thickness, cambium zone usually 5- to 8-angled, with a small fibrovaseular bundle in each angle, pith whitish or light brown, from 2 to 7 mm. in diameter; odor very slight; taste sweetish, soon becoming acrid and developing a tingling sensation, followed by numbness. Under the microscope transverse sections, made near the middle of the tuberous root of Aconite, show an outer layer consisting of one or more rows of cells with blackish-brown walls; a primary cortex of 8 to 15 rows of parenchymatous cells and interspersed with characteristic stone cells, which occur either singly or in small groups; a more or less modified endodermis; a secondary cortex, consisting chiefly of starch-bearing parenchyma and interspersed with a few small fibrovascular bundles; a more or less star-shaped and characteristic cambium with from 5 to 12 collateral fibro-vascular bundles; and a pith composed of large, starch-bearing parenchyma cells. The powder is grayish-brown; starch grains numerous, spherical, somewhat plano-convex, single or 2- to 5-compound, the individual grains from 0.003 to 0.015 mm. in diameter and frequently with a central cleft; trachea? mostly with slit-like, simple pores, sometimes with spiral or reticulate thickenings or with bordered pores; stone cells single, tabular, irregular in shape or elongated to fibers, from 0.1 to 0.4 mm. in length, walls from 0.008 to 0.025 mm. in thickness, strongly lignified and having large, simple pores; fragments of cork few, yellowish-brown; fragments of parenchyma numerous, the cells being filled with starch grains; bast-fibers from stems few, very long, with lignified walls about 0.005 mm. in thickness, and marked by transverse or oblique, slit-like pores. Aconite yields not more than 6 per cent. of ash." *U. S.*

The following standards for aconite root are given in the British Pharmacopoeia: "From four to ten centimetres long, and from one to two centimetres wide at the upper extremity. Conical, dark brown, with numerous root scars, and crowned with base of the stem or the remains of a bud. Internally solid and starchy. In transverse section a stellate cambium with small vascular bundles at the projecting angles; primary cortex narrow, with isolated thick-walled sclerenchymatous cells; cells of parenchymatous tissue contain numerous small simple or compound starch grains. No marked odor; taste at first slight, followed by persistent sensation of tingling and numbness." *Br.*

The British Pharmacopoeia formerly recognized the flowering tops of the Aconite (*Aconiti Folia*). To be effective they should be collected just as the flowers are beginning to expand, at which time they are richest in alkaloid. The dried leaves are stated to contain about 0.3 per cent. and the flower-buds about 0.4 per cent. of aconitine. In the absence of any reliable chemical tests for aconitine E. R. Squibb suggested that a fluidrachm of a highly diluted solution of the various preparations be taken into the anterior part of the mouth (after the latter has been thoroughly rinsed) and held there for one minute exactly, and then discharged. The peculiar numbing sensation should be experienced within fifteen minutes, and it should continue for fifteen or thirty minutes. Tested in this way, he found the commercial aconitines, in solution of the strength of 1/900 grain in 1 fluidrachm of water, to have the following relative strengths; 1 grain of good powdered aconite root is equal to 1 grain of ordinary commercial aconitine, 1/8 grain of Merck's ordinary aconitine, 1/29 grain of Merck's pseudaconitine, 1/111 grain of Duquesne's crystallized aconitine (really aconitine nitrate). He also found by this approximate method that 1 grain of powdered aconite root was equivalent to 1.5 minims of Fleming's tincture, 9 grains of powdered aconite leaf, 1.5 grains of alcoholic extract of dried aconite leaf, 1 grain of Alien's English extract of fresh plant, and 72 minims of tincture of aconite leaf. For methods of assaying aconite, reader is referred to A. B. L. Dohme's paper (*Proc. A. Ph. A.*, 1895, 206); also *P. J.*, 1895, 860; *D. C.*, 1900, 69, 132.

Assay.—The quality of aconite root is officially determined by an assay as follows: "Proceed as directed under *Belladonna Radix*, using 15 Gm. of Aconite in No. 40 powder and ether only as the immiscible solvent throughout the assay. Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 64.539 milligrammes of ether-soluble alkaloids

of Aconite." U.S.

"Yields not less than 0.40 per cent. of ether-soluble alkaloids when assayed by the following process: Into a small stoppered glass percolator, provided with a glass tap and suitably plugged with cotton wool, introduce 10 grammes of Aconite Root in No. 40 powder and 75 millilitres of *alcohol* (70 per cent.). Macerate for four hours, shaking occasionally. Then allow percolation to proceed slowly until the liquid ceases to drop. Continue the percolation by the addition of more of the same menstruum until 150 millilitres have been collected or the Root is exhausted. Evaporate the percolate to dryness in a shallow porcelain evaporating basin, at a temperature not exceeding 60° C. (140° F.). Dissolve the residue in 5 millilitres of *N/10 solution of sulphuric acid* diluted with 20 millilitres of *water*. Filter into a separating funnel, washing the dish and filter with about 30 millilitres of *water*. Add to the mixed filtrate and washings 25 millilitres of *ether* and 2 millilitres of *solution of ammonia*, and shake for one minute. After separation draw off the lower layer into a flask, and filter the ethereal solution into a beaker. Return the contents of the flask to the separator, add 20 millilitres of *ether* and again shake for one minute, separating the aqueous liquid and filtering the ethereal solution into the beaker. Repeat the operation with two other portions, each of 20 millilitres, of *ether*. Evaporate the mixed ethereal solutions to dryness, dry the residue at 60° C. (140° F.), dissolve it in 5 millilitres of *N/20 solution of sulphuric acid* diluted with 20 millilitres of *water*, and titrate back with *N/20 solution of sodium hydroxide*, *tincture of cochineal* being used as indicator. Deduct the number of millilitres of the alkaline solution required from 5, multiply the difference by 0.3217; the result will be the percentage of ether-soluble alkaloids in the powdered Root." *Br.*

Biologic Assay.—Because of the great variation in the activity of the various alkaloids of aconite a chemical assay does not offer an accurate criterion of the activity of a sample of this drug", and the Pharmacopoeia has very properly, therefore, permitted a standard of toxicity. As the different alkaloids resemble each other very closely in the type of their effect varying only in degree, it is not necessary to standardize the drug for any one physiological effect, and, as the sharpest physiological end reaction is death, the best test for the activity of a specimen of aconite is determination of its lethal dose. The test recommended by the Revision Committee for aconite is based upon the determination of the minimum lethal dose for guinea-pigs.

"The guinea-pigs to be utilized should be of average size and not too large; preferably from 250 to 350 Gm. in weight and in healthy condition. The drug may be administered in the form of fluidextract, extract, or tincture, which in the preliminary trial may be injected subcutaneously into a series of guinea-pigs in doses having sufficiently wide limits. If the extract is to be standardized, it must be dissolved in sufficient solvent to produce a liquid preparation before injection. The animals after injection are placed in cages and at the end of the observation (twelve hours), note is taken of those living and dead. After this preliminary test, the limits of the doses for a second series of animals are further narrowed and, if necessary to still further confirm the earlier results, additional series may be injected until the minimum lethal dose for the guinea-pig is found.

"*Standard.*—A satisfactory preparation of the Fluidextract of Aconite should kill guinea-pigs when administered in doses of 0.00004 mil for each gramme of body weight of guinea-pig; a satisfactory Tincture of Aconite should prove fatal to guinea-pigs when given in doses of 0.0004 mil for each gramme of body weight of guinea-pig and a satisfactory Extract of Aconite should have a minimum lethal dose not greater than 0.00001 Gm. for each gramme of body weight of guinea-pig." *U. S.*

It is well to take a series of four guinea-pigs, each of which will be injected respectively with 0.03, 0.04, 0.045, and 0.05 milligramme for each gramme of body weight. If none of the animals survive the drug is too strong, if none of them die it is too weak. If some survive and some die it is necessary to test the drug on a second series in which case the test should be 0.038, 0.04, 0.042 milligramme; it is well to have at least two animals who receive the middle dose of these three. If the drug be of official quality those who receive 0.038 should survive, those which receive 0.042 should die, and of those which receive 0.04 some should die and some survive. In testing the crude drug-it may be made up conveniently in the form of a fluidextract and diluted with nine volumes of water. The syringe used must be standardized and graduated in tenths of a mil. The injection should be made subcutaneously, preferably beneath the skin of the abdomen. After the injection the animals are marked or placed in separate cages and at the end of 12 hours notice taken of those living or dead.

Uses.—Aconite was well known to the ancients as a powerful poison,

but was first employed as a medicine by Baron Storck, of Vienna, whose experiments were published in the year 1762.

Locally aconite is actively irritant and also a paralyzant to the peripheral sensory nerves. When applied to a mucous surface it produces at first a burning tingling sensation followed in a few minutes by a numbness. This sensation may even be perceptible after the systemic ingestion of very large doses. When administered internally the most marked changes are seen in the circulation. The first effect is generally a slowing of the pulse, due to stimulation of the cardio-inhibitory centers, with consequent fall in the blood pressure. After somewhat larger doses, however, there is a weakening of the force as well as reduction of the rate of the pulse brought about by a direct action on the heart muscle. After poisonous doses various irregularities of heart action are produced and often there will be complete lack of harmony between the contraction of the auricle and ventricle. After fatal doses the heart is arrested in complete diastole and will respond to neither electrical nor mechanical irritation. In the frog, large quantities of aconite produce a loss of reflex activity, which is apparently due to a paralysis of sensation as voluntary motion is preserved for some time later, although it too may eventually be abolished. The drug appears to affect both the sensory nerves and the receptive side of the spinal cord, although the latter is involved comparatively late in the poisoning. In mammals this depressant action upon the nervous system can scarcely be demonstrated because of the powerful depressant effect upon the circulation.

Aconite is used chiefly as a circulatory sedative in conditions attended with excessive action of the heart or high arterial tension. Thus in *valvular lesions of the heart* in which the muscle tone is good, but the heart is over acting, in the so-called *irritable heart* seen in improperly trained athletes and similar conditions, it is often a remedy of great service. The choice between aconite and digitalis in such cases will depend largely upon the condition of the heart muscle; when the latter is strong and of good tone aconite may be used, but if there be a tendency towards dilatation, digitalis is generally preferred. In chronic *high blood pressure*, by retarding the pulse rate it will often produce a sensible reduction in the tension but in acute hypertension or threatened *apoplexy* it is less certain in its effects than the nitrites, but may at times be advantageously combined with them, By virtue of the lowering of the blood pressure aconite tends to increase the sweat and is

frequently used as a sudorific, especially in febrile conditions. In sthenic fevers its effect in restraining the heart as well as its diaphoretic tendency often renders it a drug of much use.

Aconite is also frequently employed for its local effects. The combination of local irritant effects with anesthetic action suggests strongly its use in peripheral *neuralgias*. It must not be forgotten, however, that if used too freely for this purpose it may be absorbed through the skin in sufficient quantities to cause serious poisoning. It is also occasionally employed as a local anesthetic to the stomach in various types of *vomiting* or *gastralgia*, but on account of its systemic effect is practically of secondary value.

For internal use the best preparation is the tincture which may be given in doses of from five to fifteen minims (0.3-0.9 mil). For external application the fluidextract may be employed, but generally an ointment is preferred. This may be made by rubbing up the extract with two or three parts of lard, or the *ointment of aconitine* of the British Pharmacopoeia may be used. The U. S., 1870, recognized a *plaster of aconite*.

Toxicology.—Aconite is a rapidly acting and powerful poison. The symptoms produced by overdose of it are sensations of warmth in the stomach sometimes with nausea but usually without vomiting, with slowing of the pulse and of the respiration, the skin is cool and moist and there is profound prostration. As the poisoning progresses the respirations become more slow and shallow, the pulse more and more feeble and towards the end may become rapid or very irregular. A characteristic symptom, in fact the only symptom of diagnostic importance, is the peculiar numbness and tingling first felt in the lips and mouth, but later also often in the fingers. At times there is dimness of vision, the pupils may be either contracted or dilated and occasionally delirium and stupor or convulsions may precede the fatal termination.

In the treatment of aconite poisoning the patient should be kept absolutely in a horizontal position or with the feet higher than the head. For the purpose of emptying the stomach the stomach pump is preferable to emetics as the latter involve a more or less serious strain upon circulation. Circulatory stimulants, such as strychnine, ammonia, and atropine, may be given hypodermically. Body temperature should be maintained by external application of heat.

Dose, of aconite root, one-half to one grain (0.032-0.065 Gm.).

Off. Prep—Extractum Aconiti, *U. S.*; Fluid-extractum Aconiti, *U. S.*; Linimentum Aconiti, *Br.*; Tinctura Aconiti, *U. S.*; *Br.*; Linimentum Aconiti et Chloroformi (from Fluidextract), *N.F.*

Actaea. *Actaea spicata*, L. *Baneberry. Herb Christopher. Radix Christophoriana; Racine de Saint Christophe*, Fr. *Christophswurz, Wolfs-wurz*, G.—This is a perennial herbaceous plant (Fam. *Ranunculaceae*) growing in the woods of mountainous regions from Japan to Central Europe as well as in Siberia. Its dark-brown, bitterish, somewhat acrid root resembles that of *Helleborus niger*, for which it is said to be occasionally substituted. It is an active emeto-purgative, capable of producing, when in overdose, dangerous effects. There are two American species which probably have medicinal properties similar to those of *A. spicata*,—namely, *A. alba* (L.) Mill., or white cohosh, and *A. rubra* (Ait.) Willd., or red cohosh, distinguished by the color of their berries. *Actra racemosa* was the former name of the official *Cimicifuga racemosa*. (*Proc. A. Ph. A.*, 1858.)

Actinomeris. *Verbesina helianthoides* Michx. (*Actinomeris helianthoides* Nutt.) (Fam. *Compositae*.)—At one time known as *Gravel Weed, Diabetes Weed*, now known as *Sunflower Grown-beard*. It is a perennial herb growing in the thickets and on dry prairies from Ohio and Missouri to Texas and Georgia. The root is said to be largely used in Upper Georgia in *dropsy* and *chroniccystitis*. *Dose* of infusion (one ounce to a pint), one fluidounce (30 mils),

Adansonia. *Adansonia digitata*, L. *Baobab*.— A tree of enormous magnitude, belonging to *Bombacaceae*. It is a native of Africa, extending quite through that continent from Senegal to Abyssinia, and has been introduced into the West Indies. The leaves and bark of this tree abound in mucilage, and have little odor or taste. By the Africans the leaves are used as a diaphoretic, and the subacid pulp of the fruit in *dysentery*. Under the name of *cream-of-tartar tree* various trees have been described. Their fruits contain, or have been supposed to contain, potassium bitartrate. The most important of these is the *Adansonia Gregorii* F. Muell, of North Australia. Another cream-of-tartar fruit is yielded by a tree of South Africa, which, according to E. M. Holmes, is probably the *Adansonia madagascariensis* Baillon. This fruit has been examined by E. J. Millard (*P. J.*, April, 1890), who found that it contains no cream of tartar at all. It is probably identical with a cream-of-tartar fruit examined by F. L. Slocum. (*A. J. P.*, 1880). Heckel and Schlagdenhauffen (*Nouv. Rem.*, xxi, 487) have found in the fruit of the *Adansonia digitata* as much as 2 per cent. of free tartaric acid and 12 per cent. of potassium bitartrate. Duchassaing, of Guadeloupe, West Indies, and Pierre, of France, commended the bark of *A. digitata* highly as an antiperiodic. (*A. G. M.*, 3e ser., xxiii, 535.) It is said to be acceptable to the stomach, and to produce no other observable physiological effect than increase of appetite, increased perspiration, and perhaps diminished frequency of pulse. An ounce may be boiled in a pint and a half of water to a pint, and the whole taken in a day. (*J. P. C.*, 3e

ser., xiii, 412 and 421.)

Adenanthera. *Adenanthera pavonina* L. *Zangavara*.—Rochebrune (*Toxicologie Africaine*) states that he has obtained from this plant a crystalline principle which resembles in its activity physostigmine, but does not affect the muscles.

Adenia. *Adenia venenata* Troost.—A climbing passion-flower of Africa, said by Schweinfurth to be used as a vesicant. (*P. J.*, March, 1874.) The *Adenium hongkii* is employed by the natives of the Soudan as an ordeal poison. Perrott and LePrince (*P. J.*, 1910, lxxxiv, p. 82) have separated an active principle which is neither glucosidal nor alkaloidal, and which has a strophanthin-like effect.

Adhatoda. *Br. Add.* 1900. (Fam. *Acanthaceae*.) —The fresh and dried leaves of *Adhatoda Vasica* Nees. (*Justicia Adhatoda*, L.) "The fresh leaves are four or six inches (about ten to fifteen centimeters) long and about an inch and a half (nearly four centimeters) broad, they are opposite lanceolate, entire short petiolate, taper-pointed, smooth on both sides. The dried leaves are of a dull brownish-green color which becomes much lighter when the leaves are powdered. They have a strong characteristic tea-like odor and a bitter taste." *Br. Add.*, 1900.

The leaves are stated to contain an alkaloid, *vasicine*, and an organic acid, *adhatodic acid* (see *Pharmacog. Indica*, vol. iii). Vasicine, isolated by Hooper, is soluble in water, sparingly in benzine and carbon disulphide, readily soluble in ether and chloroform. The claim is made for it that it exerts a powerful toxic influence upon lower forms of vegetable and animal life, and is not poisonous to the higher animals. The leaves are stated to be actively poisonous to frogs and are considerably used in India as an expectorant and antispasmodic, especially in the treatment of asthma. The *Br. Add.* recognized the liquid extract (*Extractum Adhatodae Liquidum*, *Br. Add.*, 1900), made with alcohol and given, in doses of from twenty to sixty minims (1.3-3.75 mls); the freshly expressed juice (*Succus Adhatodae*, *Br. Add.*, 1900), dose, from one to four fluidrachms (3.75-15.0 mls); the *tincture* (*Tinctura Adhatodae*, *Br. Add.*, 1900), dose, from one-half to one fluidrachm (1.8-3.75 mls).

Adiantum. *Maidenhair*.—Tradition has attributed to various species of this genus of ferns valuable properties in chronic pulmonic catarrhs. *A. pedatum*, L., of America, *A. Capillus-Veneris*, L., of Europe, *A. lunulatum* Burm., of India, are the most important of these alleged medicinal species. The European species is sometimes employed on the Continent as an emmenagogue under the name of *polytrichi*, *polytrichon*, or *kalliphyllon*, and is given in the form of infusion, sweetened with sugar or honey, and a syrup prepared from it is said to be popular in France under the name of *sirop de capillaire*, and is official in the French Codex.

Adonis. *N. F. IV. Vernal Pheasant's Eye. Sommerteufelsauge*, G.—It is official in the *N. F. IV*, in which it is defined as "the dried, overground portion of *Adonis vernalis* Linne (Fam. *Ranunculaceae*), without the presence of more than 5 per cent. of foreign matter." This ranunculaceous plant of Northern Europe and Asia has long been used as an abortifacient, while its rhizome sometimes occurs in commercial black

hellebore as an adulteration. Linderos examined the leaves and found in them 10 per cent. of *aconitic acid*. (*Ann. Ch. Ph.*, 1876, 340.) Cervello, in 1882, obtained from the plant a glucoside, to which he gave the name of *adonidin*. For improved method of preparation, see *P. J.*, vol. xvi, 145, and *A. J. P.*, 1887, 609. This glucoside occurs in the form of a somewhat hygroscopic, canary-yellow powder of an intensely bitter taste; soluble in water, alcohol, and in amyl alcohol; insoluble in anhydrous ether, chloroform, oil of turpentine, or petroleum benzin. Its reaction is neutral. It reduces Fehling's solution, if previously heated with a few drops of hydrochloric acid. It exists in small quantities in all portions of the plant. For further details as to reactions, see *P. J.*, xv, 145. Podwysstozki found commercial samples of adonidin to be mixtures of the active principle with other constituents of the plant. He gives the name of picroadonidin to the active principle, which he describes as an amorphous glucoside having an excessively bitter taste, possessing the properties of a cardiac poison in the highest degree, and being easily soluble in water and alcohol and entirely soluble in ether. (*P. J.*, xix, 1888, 346.) According to Fockelman, confirmed by Mercier (*Nouv. Rem.*, 1914), commercial adonidin is a mixture of a neutral body with a hemolytic acid, *adonic acid*. Cervello states (*A. E. P. P.*, xv) that adonidin exists also in the *Adonis cupaniana* of Southern Europe, and F. Borgiotti affirms the value of *A. aestivalis*, L., in heart affections. (*D. M. Ztg.*, Aug., 1888.) Tahara asserts that the glucoside of *Adonis autumnalis*, L., is distinct, and calls it *adonin* (C₂₄H₄₀O₉) (*Ber. d. Chem. Ges.*, xxiv), while Y. Inoko (*A. E. P. P.*, xxviii) affirms that the glucoside of *A. amurensis* of Japan is also peculiar, and assigns to it the formula C₂₀H₄₀O₉, allied to adonidin, but much less powerful.

Merck has described an additional crystalline principle, which fuses at 102° C. (216° F.), is very soluble in water and warm alcohol, and crystallizes in clear needle-like prisms. It has a neutral reaction, does not reduce Fehling's solution, and is not colored brown by alkalies. Its analysis seems to indicate a formula C₅H₁₂O₅, and Merck considers that it is a hitherto undescribed pentatomic alcohol, and calls it *adonite*. Whether it be identical with the *adonidulcite* announced in a preliminary communication by Podwysstozki shortly before his death, Merck is not able to state, as no details of fusing point, formula, or chemical reactions were given by the former. (*M. Bull.*, Jan., 1893.) E. Fischer (*Ber. d. Chem. Ges.*, 1893, 633) confirms the formula C₅H₁₂O₅ given by Merck, as well as the statement that it is a pentatomic alcohol; by oxidation with sodium hypobromite it is changed into *ribose*, C₅H₁₂O₅, which treated with sodium amalgam again yields adonite.

The National Formulary description is as follows: "Glabrous, with the exception of the younger portions, which maybe slightly grayish-puberulent; stems from 15 to 50 cm. in length, thick, but soft and weak; shining, simple or branched, the branches mostly from near the base and similar to the main stem; naked below, except for some scale-like leaf-vestiges, densely leafy above; leaves from 2 to 4 cm. in length and two-thirds or more as broad, pin-nately divided into several segments, the larger of which are again divided, the ultimate segments being narrowly linear, and acute; flowers terminal, yellow but usually drying to a cream color, from 3 to 6 cm. in breadth; sepals five, green or grayish-puberulent, more than half the length of the petals,

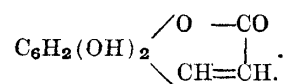
oblong, obtuse, finely nerved; petals from five to twenty, oblong, obtuse, finely nerved; stamens indefinite; pistils numerous, in fruit forming an ovoid, obtuse, dense head of ovoid akenes, which are tipped with the very small, persistent styles. Odor faint; taste bitterish, afterward somewhat acrid. The powdered drug is grayish-green and, when examined under the microscope, exhibits numerous fragments of pith parenchyma, the cells with few simple pores, up to 0.05 mm. in width and 0.25 mm. in length; groups of long narrow sclerenchyma fibers, mostly with lignified walls from 0.005 to 0.007 mm. in thickness and having a few rounded or oblique simple pores; tracheae spiral or with bordered pores and up to 0.017 mm. in width; epidermal cells from the stem and petiole, elongated in surface view and with elliptical stomata, the latter about 0.064 mm. in length; fragments of the epidermal tissue from the lamina of the leaf, composed of finely striated cells with wavy, vertical walls; associated with broadly elliptical stomata, the latter up to 0.047 mm. in length; brownish colored fragments from the scales at the base of the stem, composed of elongated cells with somewhat rounded ends and yellowish-brown walls; starch grains and calcium oxalate crystals few or absent. Adonis yields not more than 12 per cent. of ash."

Adonidin belongs physiologically to the digitalis group. Although in Hare's experiments (*T. G.*, 1886) the frog's heart was arrested in diastole. Cervello (*A. E. P. P.*, xv) and De Guirilat found that the arrest is systolic. The pulse is slowed by stimulation of the inhibitory apparatus. In the experiments of Henrijean (*B. A. R. B.*, 1909, xxiii, p. 363) in the early stages of the action, electrical stimulation of the pneumogastric nerve produced an unwonted degree of retardation of the pulse rate, which would indicate an increased excitability of the peripheral ends of the nerves. All investigators are in accord that the slowing of the pulse is to a large extent abolished by section of the vagi, so that the inhibitory influence must be largely also of central origin. There occurs also a pronounced rise of the blood pressure, which, according to Hare, is due partly to a stimulant action upon the heart, and partly to an effect upon the vasomotor mechanism. In the more exact experiments of Henrijean, vasoconstriction appeared only late in adonidin poisoning. After large toxic doses, the heart becomes irregular, and the blood pressure falls. According to Kakowski (*A. I. P. T.*, xv, p. 21), adonidin differs from most of the other digitalis group in that it dilates the coronary arteries, while most of these drugs produce constriction.

Adonis vernalis was introduced as a cardiac tonic by Bubnow in 1879. Clinical experience confirms the conclusion of the pharmacologist, that it resembles digitalis in its action, and is a useful agent in the treatment of chronic heart disease. The advantages which have been claimed for it are, that it is more prompt in its action, and that it manifests less cumulative tendency than digitalis, but it appears to be less certain in its effect. Bechterew asserts that it is a useful remedy in epilepsy when used in conjunction with the bromides. The dose of adonis vernalis is from two to ten grains (0.12-0.6 Gm.), which may be given in the form of an infusion. The glucoside adonidin may be given in doses of one-twelfth to one-fourth of a grain (0.005-0.015 Gm.).

Aesculus. *Horse-chestnut.*—Chestnut (*Aesculus Hippocastanum*, L.) said to have been originally a native of Asia, but introduced about the middle of the sixteenth

century into Europe, whence it has spread to this country. It is to this species that this article especially applies, though it is probable that any medicinal properties which the tree may have are shared by the other species of the genus. The seed or nut abounds in starch, but its bitter, disagreeable taste has prevented its general use as a food, although as long ago as 1856 starch was made from it in France, and recently a pleasant and nutritious article of diet is said to have been prepared by removing its bitter principle by means of alcohol. For analysis of the oil it contains, see Stillesen, *Proc. A. Ph. A.*, 1909, lvii, p. 201. In the leaves Rochleder found guercitrin, and a bitter principle, *esculin* (aesculin); and in the capsules of the fruit a peculiar acid, *capsulaesic acid* (*J. P. C.*, May, 1859; Aug., 1860). (For Rochleder's method of extracting esculin, see *U. S. D.*, 18th edition; for a second process, see *A. J. P.*, xliv, 400.) Esculin is in shining, white, prismatic crystals, inodorous, bitter, but slightly soluble in cold water, more soluble in boiling water, and very readily so in boiling alcohol and in alkaline solutions. Its solution, which is fluorescent, is precipitated by lead sub-acetate, and its formula, according to Schiff, is $C_{15}H_{16}O_9 + 1\frac{1}{2}H_2O$. When treated with dilute sulphuric acid, it is converted into grape sugar and a substance called *esculetin*, $C_9H_6O_4$, which is now known to be a *dioxycoumarin*,



Tannin is found in all parts of the tree, including the leaves as well as the bark and fruit. According to Rochleder, when pure, it is white and soluble in water, alcohol, and ether; becomes red by the absorption of oxygen; colors ferric salts green, but violet on the addition of a little alkali; fluorescent when it is in alkaline solution; in concentrated solution is precipitated, at least partially, by sulphuric, hydrochloric, and metaphosphoric acids, but not by acetic acid, and forms also, with potassium and sodium sulphites and ammonium sulphide, precipitates which are readily dissolved by dilute acetic acid. (*J. P. C.*, Jan., 1868, 72.)

The powdered kernel of the nut is a sternutatory. The extract of the wood has been used in dyeing silk black. The fixed oil, extracted from the kernels by ether, has been employed in France as a topical remedy in *rheumatism*; and the bark as an antiperiodic in doses of half an ounce (16 Gm.) in the twenty-four hours, given in the form of decoction. The flowers are stated to contain quercitrin. In the United States a decoction of the leaves is popularly employed for *whooping cough*, and to the seeds themselves, when "carried in the pocket of the patient," is attributed the marvellous property of curing *hemorrhoids*, *rheumatism*, etc. Esculin has also been administered in *malarial disorders*, in fifteen-grain (1 Gm.) doses repeated once during the intermissions. (*Ann. Ther.*, 1859, 1860.) The glucoside esculin has the property, like other fluorescent substances, of absorbing ultra violet rays which are then gradually given off. Because of these properties, it is used on the one hand, as a protective against the effects of sunlight and on the other as a means of continuing the effect of heliotherapy. Thus Freund has found it useful not only against sunburn, but as a prophylactic against snow blindness (*Zeit. f. Neuere Physikal. Med.*, 1908, ii), and Graham (*L. L.*, 1905, ii, p. 1769) recommends it in the Finsen light treatment of *lupus vulgaris* and similar conditions. For this purpose he injected five minims (0.3 mil) of a

2 or 3 per cent. solution immediately beneath the skin in the region to be treated by the light. Under the name of *zeozon* and *ultra-zeozon* there are upon the market pastes whose exact compositions are not stated but which are claimed to contain oxy-derivatives of esculin.

The fruit of the *Aesculus pavia* L., or *Red Buckeye* of the Southern United States, is said to be an active convulsant. E. C. Batchelor (*A. J. P.*, xlv, 144) found in the cotyledons of the seeds about 2¹/₂ per cent. of a peculiar glucoside. *Aesculus glabra* Willd., the *Ohio Buckeye*, is asserted to be useful in *portal congestion*. (*N. P.*, ii, 21.)

Aethusa. *Fool's Parsley.* *Aethusa Cynapium*, L. (Fam. *Umbelliferae*.)—A fetid herb naturalized from Europe and growing in waste places or cultivated grounds in the northern United States and Canada. In 1859, Walz stated that the fruit of the *Aethusa Cynapium* contains a volatile base similar to coniine. This statement has been confirmed by Power and Tutin (*J. Am. C. S.*, 1905, xxvii) who recovered, besides various inert matters, about one forty-thousandth of 1 per cent. of the volatile alkaloid. This plant has been variously attributed with poisonous properties, but Harley (*P. J.*, 1880, xi, p. 43) denies any noxious quality, and, in the experiments of Power and Tutin, the extract from five hundred grammes of the dry herb caused in a small dog, vomiting and salivation, but the animal entirely recovered.

AGAR. U. S. AGAR [Agar-agar]

"The dried mucilaginous substance extracted from *Gracilaria* (*Sphaerococcus*) *lichenoides* Greville and other marine algae growing along the eastern coast of Asia, particularly several species of *Gelidium*, or *Gloiopeltis* (Class *Rhodophyceae*)." U. S.

Quite a number of the algae belonging to the *Rhodophyceae*, growing on the coast of Southern and Eastern Asia, contain large quantities of mucilage which is extracted and sold under the name of agar-agar. The most important species are those recognized by the U. S. Pharmacopoeia. The algae are collected, spread out upon the beach until they are bleached and then dried. They are then boiled with water and the mucilaginous solution strained through a cloth. The filtrate is allowed to harden and thoroughly dry in the sun. The algae are usually collected during the summer and fall, bleached and dried, but the process of the manufacture of agar-ag'ar does not take place until cold weather and usually extends from November to February.

The following varieties of agar are known:

1.—*Ceylon Agar-agar*, consisting chiefly of *Gracilaria lichenoides*, Ag.,

the alga used by the *Hirundo esculenta* in the formation of its edible nest.

2.—*Macassar Agar-agar*, coming from the straits between Borneo and Celebes, consisting of impure *Eucheuma spinosum*, Ag., incrustated with salt.

3.—*Japanese Agar-agar*, known as *Japanese isinglass*, derived from several algae, especially *Sphaerococcus compressus*, Ag., *Gloiopeltis tenax*, J. Ag., *Gelidium corneum*, Lam. and *G. cartilagineum* Gaill. It occurs in European commerce either in transparent pieces, two feet long and as thick as a straw, prepared in Singapore by putting the alga named in hot water, or, more frequently, in yellowish-white masses, a foot long and upward of an inch in width. It is the latter kind of agar-agar that is suitable for the culture of bacteria, and is employed in medicine. (*P. J.*, 1885, 188.)

Morin has investigated the *gelose* of Payen, contained in the agar-agar. When a solution of gelose is cooled, even that of 1 in 500 parts of water, a colorless, transparent, and stiff jelly is obtained, which, when heated with moderately strong nitric acid, yields mucic and oxalic acids. It dissolves on heating with acidulated water without yielding a jelly on cooling.

Gelose leaves 3.88 per cent. of ash, and when air-dried contains 22.85 per cent. of moisture. When dissolved there also separates out a flocculent mass amounting to 1.9 per cent. Alcohol precipitates gelose, but it cannot be obtained pure in this manner, as the precipitate contains some ash. (*C. E. A. S.*, No. 90, 921-926.)

Under the name of *gelosine* a mucilaginous substance, extracted from a Japanese alga, has entered commerce in the form of dry, whitish leaves. Gelosine is soluble in alcohol and water, and is said when wet to gradually contract and expel water and the medicinal substances which it may contain. It has been proposed as a pharmaceutical basis for various preparations for local use. (See *B. M. J.*, vol. ii, 1886.) Glycerin suppositories have been made with agar-agar as a vehicle, but they contain only 70 per cent. of glycerin as compared to 90 per cent. in the official suppositories made with sodium oleate.

Properties.—Agar-agar occurs "mostly in bundles from 4 to 6 dm. in

length, consisting of thin, translucent, membranous, agglutinated pieces from 4 to 8 mm. in width; externally yellowish-white or brownish-white; tough when damp, brittle when dry; odor slight; taste mucilaginous. A fragment mounted in water and examined under the microscope gradually becomes more transparent, showing a granular structure and a few diatoms, notably the frustules of *Arachnoidiscus Ehrenbergii* Baillon, which are disk-shaped and from 0.1 to 0.2 mm. in diameter, and also fragments of the spiculas of sponges; upon the addition of iodine some of the granules or hyphal portions are colored bluish-black. Insoluble in cold water, but slowly soluble in hot water. A solution made by boiling 0.1 Gm. of Agar in 100 mils of water, upon cooling yields no precipitate upon the addition of tannic acid T.S. (gelatin), and does not produce a blue color upon the addition of iodine T.S. (starch). Boil 1 part of Agar for about ten minutes with 100 parts of water, and replace the water lost by evaporation; it yields a stiff jelly upon cooling. The powder is pale buff; when mounted in water and examined under the microscope it shows transparent, more or less granular, striated angular fragments, occasionally containing frustules of diatoms; with iodine T.S., fragments for the most part are colored bright red, certain more or less definite areas being stained bluish-black. Agar yields not more than 5 per cent. of ash." *U. S.*

To detect agar in jams, jellies, etc., in which it is often used as an adulterant, it is usually considered necessary to ash the sample and examine the acid insoluble ash for presence of the characteristic diatoms. Albert Schneider [Pac. Pharm., 1912, p. 35] states that the ashing is unnecessary and often destructive of the diatoms and that they may be collected by dissolving 10 Gm. of the sample in 200 mils of distilled water and centrifuging for thirty minutes, after which the sediment may be placed on a microscopic slide and examined.

Uses.—Under the name of agar-agar a jelly-like substance has been used as a culture medium by bacteriologists for many years. (See *Diagnostical Reagents*, Part III.) Although agar contains sixty per cent. of carbohydrates, according to Saiki (J. B. C., 1906), the human digestive tract is able to utilize but a very small percentage of the food value. Its therapeutic importance depends upon the ability of the dry agar to absorb and retain moisture. Being indigestible, it passes through the intestinal tract, swelling up somewhat, owing to the absorption of water from the stomach, and gives bulk to the intestinal contents. In other words, it acts mechanically in an analogous manner to the cellulose of

vegetable foods, and aids in maintaining the regularity of the bowel movements. It has been widely used in the treatment of chronic constipation. Of itself, when there is more or less atony of the intestinal muscles, it does not originate peristaltic movements, and therefore is frequently combined with small doses of eascara, or one of the other vegetable cathartics. It is best administered cut up in small pieces, and eaten like a cereal with the addition, if desirable, of cream and sugar. Ordinarily, from two to four drachms (7.7-15.5 Gm.) of the dry agar may be administered once a day.

Agaric. *Agaricus Albus*. *White Agaric*. *Larch Agaric*. *Touchwood*. *Spunk*. *Tinder*. *Funpurgatif*, Fr. *Larchenschwamm*, G.—It is defined in the National Formulary IV as "the dried fruit body of the fungus *Polyporus officinalis* Fries (Fain. *Polyporaceae*) [growing on one or more species of *Pinus* Linne, *Larix* Adanson, and *Picea* Link (Fam. *Pinaceae*)], deprived of its outer rind, and without the presence of more than 10 per cent. of foreign matter." The term Agaric is more properly applied, however, to the fungi of the genus *Agaricus*, but most medical writers and the N. F. limit it to the fungus from *Polyporus officinalis* Fries (*Boletus laricis* Jacquin; *B. purgans* Persoon), which is found upon the old trunks of the European larch and upon *Larix sibirica* Ledebour, of Asia. The same species is found on various coniferous trees in some of the western United States and British Columbia. It is of various sizes, from that of the fist to that of a child's head, or even larger, hard and spongy, externally brownish or reddish; but, as found in commerce, it is deprived of its exterior coat, and consists of a light, white, spongy, somewhat farinaceous, friable mass, which, though capable of being rubbed into powder upon a sieve, is not easily pulverized in the ordinary mode, as it flattens under the pestle. That which is most esteemed is said to be brought from Siberia; but it is probably produced wherever the European larch grows. It is described in the N. F. as in "light, fibrous, somewhat spongy pieces of irregular shape; grayish-white to pale brown externally; yellowish and resinous internally; fracture tough, fibrous; friable but difficult to powder. The powdered drug, examined under the microscope, shows numerous non-septate, narrow, mycelial threads and many cubical crystals of calcium oxalate from 0.01 to 0.02 mm. in diameter. It yields to boiling alcohol not less than 50 per cent. of a resinous extract. Agaric yields not more than 2 per cent. of a white ash, rich in phosphates." N. F. Wm. M. McPheeters (*St. L. M. S. J.*, x, 421) found a specimen brought from the Rocky Mountains decidedly cathartic in dose of twenty-four grains (1.6 Gm.).

Agaric has a sweetish, very bitter taste. It owes its medicinal virtues to *Agaric acid* (N. N. R., 1916), which is also called *laricic* and *agaricinic acid*. This is a tribasic acid, $C_{19}H_{36}OH(COOH)_3 + 1\frac{1}{2}H_2O$, occurring as an odorless, tasteless, micro-crystalline powder, melting at 141.5° C. (286.5° F.). According to J. Schmieler, agaric contains a small amount of soft resin, $C_{15}H_{20}O_4$, extracted with petroleum benzine, and from 4 to 6 per cent. of a fatty body, which is made up of

- (1) *agaricol*, $C_{10}H_{16}O$, fusing at 223° C. (433.4° F.);
- (2) *phytosterin*, $C_{26}H_{44}O$;

- (3) solid hydrocarbons, $C_{23}H_{46}$ and $C_{29}H_{54}$;
- (4) cetyl alcohol, $C_{16}H_{33}.OH$;
- (5) a liquid aromatic alcohol, $C_9H_{18}O$;
- (6) a fatty acid, $C_{14}H_{24}O_2$; and
- (7) ricinoleic acid, $C_{18}H_{34}O_3$. (Schmidt, *Lehrbuch der Pharm. Chem.*, ii, 3te Auf., 1528.) J. D. Eiedel has produced two phenetidides of agaric acid, for which antipyretic and anhidrotic properties are claimed. (Ph. Ztg., xlvii.) Sodium, Lithium and Bismuth agaricinate have been prepared and introduced into medicine.

According to Hoffmeister (*A. E. P. P.*, 1889, xxv, p. 189), in a moderate dose, agaric acid has no effect upon the system, except to paralyze the nerves of the sweat glands. When given in very large doses, it produced primary excitation of the medulla, followed by paralysis, increasing at first the blood pressure and the respiratory rate, which was followed by diminishing activity in both. The large doses also acted as an irritant to the stomach and intestine, causing vomiting and purging. The depressant action shown on the sweat glands was not shared by the other glands of the body. McCartney (*J. P. Ex. T.*, 1917, x, 83) offers the remarkable theory that its antihydrolic action is due to spasm of the muscular layer of the skin. The most important use of agaric is in the treatment of the *colliquative sweats* of wasting conditions, such as *phthisis*. Its value in these conditions has been abundantly confirmed by clinical experience. Aside from the solanaceous drugs, it is probably the most reliable remedy that we possess for this purpose. Rosenbaum has found the *fluid extract of agaric* (*Med.Klin.*, 1906) of service in various catarrhal conditions of the alimentary tract, even in *intestinal tuberculosis*.

Under the name of *agaricin* are marketed preparations containing the active *agaric acid*, with larger or smaller amount of impurities. The dose of the pure principle is from one-sixth to one-half of a grain (0.01-0.03 Gm.).

Thoerner obtained from *Agaricus atramentosus* crystalline, dark-brown scales, which he believed to be *dioxykinon*. (*Ber. d. Chem. Ges.*, 1878, 533.) According to T. L. Phipson, *Agaricus ruber* contains a rose-red coloring matter, *ruberin*, which appears bright-blue by transmitted light; being soluble in water, it is washed out of the head of the fungus by a heavy fall of rain. Ether extracts from the fungus a yellowish-white alkaloid, agarythrine, which has a bitter, afterwards burning taste, somewhat like aconitine; its chloride is soluble, but the sulphate insoluble in water, the latter dissolving in alcohol; it dissolves in nitric acid with red color, and is colored red by chlorinated lime and afterwards bleached. On agitating the solution of the alkaloid with ether, it is oxidized by the air to a red coloring matter, which is probably the cause of the red color of the surface of the fungus. (*Chem. News*, 1882, 199.) An agaric growing on the *Larix leptolepis*, and used in Japan as a sacred medicine under the name of *Toboshi* or *Eburiko*, has been found by Y. Inoko to contain agaric acid. (*Sei-I-Kwai*, April, 1891.)

Fungus chirurgorum. Boletus chirurgorum, Wundschwamm, G.—*Surgeon's agaric* is the product of *Polyporus fomentarius* (L.) Fries, which is found upon the oak and beech trees of Europe. It is shaped somewhat like the horse's foot, with a diameter of

from six to ten inches. It is soft like velvet when young, but afterwards becomes hard and ligneous. It usually rests immediately upon the bark of the tree, without any supporting footstalk. On the upper surface it is smooth, but marked with circular ridges of different colors, more or less brown or blackish; on the under surface, it is whitish or yellowish, and full of small pores; internally it is fibrous, tough, and of a tawny-brown color. It is composed of short tubular fibers compactly arranged in layers, one of which is added every year. The best is that which grows on the oak, and the season for collecting the fungus is August or September. It has neither taste nor odor. Among its constituents, according to Bouillon-Lagrange, are extractive, resin in very small proportion, nitrogenous matter also in small quantity, potassium chloride, and calcium sulphate, and in its ashes are found iron, and calcium and magnesium phosphate. It is prepared for use by removing the exterior rind or bark, cutting the inner part into thin slices, and beating these with a hammer until they become soft, pliable, and easily torn by the fingers. In this state it was formerly much used by surgeons for arresting hemorrhage, being applied with pressure. *P. ignarius* (L.) Fries and *P. marginatus* Fries yield similar products.

When prepared polyporus (so-called agaric) is steeped in a solution of nitre, and afterwards dried, it constitutes spunk, punk, or tinder, the amadou of the French, which occurs in flat pieces, of a consistence somewhat like that of very soft, rotten buckskin leather, of a brownish-yellow color, capable of absorbing liquids, and inflammable by the slightest spark. It is said to be prepared also from various other species of *Polyporus*, as *P. unguis*, *P. ribis*, etc.

Agave. *Agave americana*, L. *American Agave*. *American Aloe*. *Maguay*. (Fam. *Amaryllidaceae*.) —An evergreen succulent plant, indigenous to Florida, Mexico, and other parts of tropical America, and largely cultivated, chiefly for hedges, in the south of Europe, especially in Spain. Although the *Agave americana* is the best known form, botanists have described fifty species of the genus, which are indigenous to South America and the southern portions of North America, and many of which contribute to the economic products produced in that country from the agave plant. The number of these products is very great. *Sisal grass* or *sisal hemp* and *Tampico hemp*, also known as *Pita hemp* or *Pita fiber*, are the most important of the various fibers obtained from the agave leaves, though a number of other forms are locally known in Mexico. From a number of species of *Agave*, are produced in Mexico, large quantities of fermented liquors, known as *pulque*, and distilled liquors known as *mescal* or *tequila*. All of the pulque agaves have thick leaves. When they are about to bloom the central bud is cut out, leaving a large cavity into which the sap (*aguamiel* or *honey water*) exudes, rapidly. At first clear green, yellowish or whitish, this sap soon by fermentation becomes milky and acquires a cider-like taste or, if the process is allowed to go on, is rapidly converted into vinegar. *Pulque* is said to contain about 7 per cent. of alcohol, and is very largely used as a beverage by the Mexicans, but its odor and taste are disagreeable to unaccustomed palates. The juice has in it an optically inactive reducing sugar, agavose, $C_{12}H_{22}O_{11}$. The leaves and roots and stocks of the agave contain saponin and are used in Mexico in the place of soap. The fresh juice is said to be laxative, diuretic, and emmenagogue, and in doses of two fluidounces (60 mls) useful in scurvy. The leaves are said to be used as counter-

irritants, and Lenoble has found in them an acrid volatile oil. (*J. P. C.*, xv.) *Agave Gum* has been compared to gum arabic, but differs in containing a much larger proportion of lime, and in being only partially soluble in water, the soluble portions resembling pure gum, but the larger insoluble portions having all the characteristics of bassorin.

Agave virginica, L., which grows in our Southern States, is known in South Carolina by the name of *rattlesnake'smaster*, has a very bitter root, which is used, in the form of tincture, in colic.

Agelaea. *Agelaea Lamarckii* Planch.—Under the name of *Cephan-Mahi*, *Soandrou*, *Vahemainti*, this African plant is used as an anti-blenorrhagic. According to Rochebrune (*Toxicologie Africaine*), it contains a poisonous glucoside, *agelaetoxine*.

Ageratum. *Ageratum conyzoides* L. (Fam. *Compositae*), a Brazilian plant commonly known in cultivation as *ageratum*, is said by Barker Smith (*C. D.*, May 15, 1876) to be used as an emmenagogue.

Agrimonia. *Agrimonia Eupatoria*, L. *Common Agrimony*. *Herba Agrimonia*; *Aigremoine*, *Eupatoire des Grecs*, Fr. *Odermoening*, *Leterklette*, G. (Fam. *Roseaceae*.)—This species of agrimony is a perennial herb, indigenous to Europe, and while somewhat resembling one or more species of *Agrimonia* growing in the United States, it differs, according to Britton, markedly in foliage and fruit from any of our species. Its stem, which rises from one to three feet in height, is hairy, furnished with interruptedly pinnate leaves, and terminated by a long simple spike of yellow flowers. Both the herb and root have been employed. A volatile oil may be obtained from the plant by distillation. Agrimony is a mild astringent and alterative. It also contains a bitter principle. Dose, one drachm (3.9 Gm.) or more. (See 16th ed., U. S. D.)

Ailanthus. *Ailanthus glandulosa* Desf. *Tree of Heaven*. *Chinese Sumach*. *Tree of the gods*. *Ailanto*, *Gotterbaum*, G.—This well-known shade-tree, belonging to the Fam. *Simarubaceae* in its general aspect and the character of its foliage, appears like a gigantic sumach, and was at one time considered to be a *Rhus*. In France it is cultivated for the sake of its leaves, upon which the Chinese silkworm is fed, and is known by the name of *Japan varnish* (*verniss de Japan*), from its having been mistaken for the true Japan varnish tree, which is a species of Sumach. (*P. J.*, vii, 370.) The powdered bark is of a greenish-yellow color, possesses a strong, narcotic, nauseating odor, in the fresh condition, and has a strongly bitter taste. When chewed, it is said to produce a general uneasiness, a sense of increasing weakness, vertigo, cold sweats, with shivering and a sensation of nausea. It has been found to contain lignin, chlorophyll, a yellow coloring principle, a gelatinous substance (pectin), quassiin, an odorous resin, traces of a volatile oil, a nitrogenous fatty matter, and several salts. F. H. Davis detected traces of a crystallizable organic acid, but no alkaloid or glucoside. (*A. J. P.*, 1885, 600.) By the action of alcohol, there is obtained from the bark an oleoresin which has the consistence of tar, a very dark greenish-brown color, and in a high degree the odor and taste of the bark. Hetet found the bark to produce in dogs copious stools and the discharge of worms. The resin purged, but rarely acted as an anthelmintic. The powdered bark has been used successfully

against the *tapeworm*. In China the bark is very popular as a remedy in *dysentery* and other *bowel complaints*. (A. J. P., 1874, 276; P. J., vii, 372.) Dose, from seven to thirty grains (0.45-2.0 Gm.). The oleoresin produces the same effect in a somewhat smaller dose, and keeps better than the bark, which loses its powers with age. (J. P. C., March, 1859, 163.)

In India the bark of the *Ailanthus excelsa* Roxb. is used as a bitter tonic. It occurs in rough, dirty-green pieces. Narayan Daji found in it a bitter uncrystallizable principle and a bitter nitrogenous acid, *ailanthic acid*, to which he attributes medicinal virtues. (P. J., Aug., 1870, Oct., 1876, June, 1877.) This acid is not used medicinally in this country.

Ajowan. *Ajava. Ajwan.*—The ripe fruit of *Carum copticum* Benth. et Hook. (*Carum Ajowan* Benth. et Hook., *Ptychotis Ajowan* D. C.), an annual of the Fam. *Umbelliferae*. It is cultivated in India, Egypt, Persia and Afghanistan. The fruits resemble those of parsley, but are distinguished by their odor. They yield 3 to 4 per cent. of volatile oil which contains from 45 to 55 per cent. of thymol. This oil is official in the B. P. (see *Oleum Ajowan*). The fruits also contain from 25 to 32 per cent. of a fixed oil and from 15 to 17 per cent. of protein, making them a very good cattle food. They are used in the form of an extract and water, viz.: *Extractum Ptychotis Liquidum* P.I. and *Aqua Ptychotis* P.I. The water known as *Omum water* is used in India in the treatment of *cholera*. The dose of the *Fluidextract of ajowan* is ten to thirty minims (0.6-2.0 mils).

Ajuga.—Of this genus *A. chamaepitys* (L.), or *Ground Pine*; *A. reptans*, L., *Mountain Bugle*, or *Common Bugle*; and *A. pyramidalis*, L., all of them European species, the last naturalized in America, have been used in medicine, and are probably mild astringents and tonics. The ground pine is said to contain a volatile oil, and has been used to some extent in *amenorrhea* and in various forms of *rheumatism*, in doses of from one to two drachms (3.9-7.7 Gm.). *Ajuga Iva*, L., of Sardinia, is said to be a depressomotor, an active bactericide, and an antiperiodic. (A. J. B., xxxiv.)

Akazga. *Boundou. Quai. Ikaga. Icaya.*—An ordeal poison, largely used in a district on the west coast of Africa, extending far into the interior, north and south of the equator. The precise botanical character of the plant is unknown, but it is thought to belong to one of the *Loganiaceae*. Thomas E. Eraser found in the plant an alkaloid, *akagine*. The alcoholic extract or the alkaloid acts on the system similarly to *nuxvomica*. (For further description, see *U. S. D.*, 19th ed., p. 1373 and also *A. J. P.*, March, 1867.)

Alchemilla. *Alchemilla vulgaris*, L. *Lady's Mantle*. (Fam. *Rosaceae*)—This astringent, bitterish perennial European herb was formerly employed in diarrhea. By the ancients it was highly esteemed; extraordinary powers were ascribed to it by the alchemists. (P. J., 1885, 791.)

Aletris. *N. F. IV. Unicorn Root. Star Grass. Aletris farinosa* L. *Blazing Star. Mealy Starwort. Colic Root. Ague Root. Aletris farineux. Unicorn Root true, Fr. Mehligé*

Aletris, G. (Fam, *Liliaceae*).—It is described in the N. F. as “the dried rhizome and roots of *Aletris farinosa* Linne (Fam. *Liliaceae*). Rhizome horizontal or slightly oblique, nearly cylindrical or laterally compressed above, from 2 to 4 cm. in length and from 5 to 12 mm. in diameter; externally grayish-brown, upper portion with circular stem scars from 3 to 7 mm. in diameter and with numerous leaf bases, the sides and lower portion with numerous tough, wiry, whitish or reddish-brown roots which are more or less flexuose and provided with short branches; fracture short: internally light brown, cortex from 1 to 2 mm. in thickness, central cylinder with numerous twisted and branching fibre-vascular bundles. Odor slight, acetous; taste sweetish, somewhat bitter. Examined microscopically, the greater part of the drug is found to consist of parenchyma cells filled with spherical or ellipsoidal starch grains from 0.008 to 0.016 mm. in diameter. Some of the parenchyma cells contain raphides, the latter being from 0.025 to 0.045 mm. in length. The tracheae are reticulate or provided with simple pores and around these are several layers of lignified cells with thick walls and simple, large oblique pores. The endo-dermis is composed of several layers of thick-walled and closely-lamellated cells of a deep yellow color and the cortex is readily separated. Aletris yields not more than 16 per cent. of ash.” *N. F.* An indigenous perennial plant, the leaves of which spring immediately from the rhizome, and spread on the ground in the form of a star. This drug is often contaminated with other drugs collected by mistake for it, being most frequently confused with *Helonias* species. The bitterness is extracted by alcohol, and the tincture becomes turbid upon the addition of water. The decoction is moderately bitter, but much less so than the tincture. It affords no precipitate with the salts of iron. (Bigelow.) In small doses of about ten grains (0.65 Gm.), it appears to be a simple, bitter tonic. In very large doses, it is said to be cathartic and emetic. It has been employed, with asserted benefit, in *colic*, *dropsy* and *chronic rheumatism*. *Aletrin*, a resinoid, is prepared by exhausting the drug with alcohol and evaporating the percolate to dryness, treating with water, and drying the residue; it is asserted to be a uterine stimulant in doses of from one to two grains (0.065-0.13 Gm.). *Dose*, of aletris, thirty grains (1.9 Gm.).

Algarobilla, the pod of *Caesalpinia brevifolia*, (Clos.) Benth. (Fam. *Leguminosae*), a drug containing over 60 per cent. of tannin and a quantity of ellagic acid, is obtained from Chili. (Gehe's Report, *N. R.*, 1878, 332; *J. Chem. S.*, 1891, 918.)

Alisma. *Alisma Plantago-aquatica*, L. *Water Plantain*. *Plantain d'eau*. *Pain de grenouilles*, Fr. *Froschloffel*, *Wasserwegerich*, G. (Fam. *Alismaceae*).—A perennial herbaceous plant, common to Asia, Europe, and the United States. The root has, when fresh, an odor like that of Florentine orris, but loses it when dried. Its taste is acrid and nauseous. It contains a pungent volatile oil and an acrid resin, to which all its virtues must be ascribed. The Calmucks in Russia are said to use it for food. The leaves are rubefacient, and will sometimes even blister. They have been recommended in gravel and cystitis. *Dose*, a drachm (3.9 Gm.).

Alkanet, *Anchusae Radix*. *Alkanna Root*, *Alkanet Root*, *Orcanette*, Fr. *Spanish Bugloss*. *Alkannawurzel*, G.—This is the root of *Alkanna tinctoria* L., or *dyers' alkanet*, an herbaceous perennial plant, of the Fam. *Boraginaceae*, growing in the Grecian Archipelago and the south of Europe, where it is cultivated. See E. M.

Holmes, P. J., 1897, p. 61. For an account of Syrian alkanet and allied plants, see *Proc. A. Ph. A.*, 1896, 565. Alkanet, as found in commerce, is in pieces 7 to 10 cm. long, and from 5 to 15 mm. thick, somewhat twisted, consisting of a dark-red, easily separable bark, and an internal ligneous portion, which is reddish externally, whitish near the center, and composed of numerous distinct, slender, cohering fibers. As it comes to us it is usually much decayed internally, very light, and of a loose, almost spongy texture. The fresh root has a faint odor, and a bitterish, astringent taste; but when dried it is nearly inodorous and insipid. Its coloring principle, which abounds mostly in the cortical part, is soluble in alcohol, ether, and the oils, to which it imparts a deep red color, but is insoluble in water. It may be obtained by first exhausting the root with water, and then treating it with a weak solution of potassium or sodium carbonate, from which the coloring principle may be precipitated by an acid. According to Pelletier, by whom it was discovered, it possesses acid properties, forming with the alkalies and earths neutral compounds, which are of a blue color, and soluble in alcohol and ether. Its weak acid character resembles that of alizarin, to which it is chemically related, as when distilled with zinc dust it yields *methyl-anthracene*. It has also received the names of *anchusin* and *alkannin*. The awhusin has been extracted and studied by C. J. S. Thompson. (*A. J. P.*, 1886, 409.) He finds it to vary in amount between 5.25 and 6.02 per cent. It is red, resin-like, insoluble in water, soluble in oils, alcohol, chloroform, and ether, and with a rich deep blue color in alkali hydroxides, the color changing again to crimson on addition of an acid. According to A. Gawalowski, the red coloring matter of alkanet root consists of two distinct bodies, the one turning blue, the other green by the action of alkalies. The first of these, *alkannic acid*, is extracted by ether and alcohol. The second, *anchusic acid*, is obtained by extraction with benzene. Both form characteristic colored salts. (*Ph. Ztg.*, 1902, 817.) Alkanet is somewhat astringent, and was formerly used in several diseases; but it is now employed exclusively for coloring oils, ointments, and plasters, which are beautifully reddened by one-fortieth of their weight of the root. The best way to use it with this object in view is to suspend the alkanet, after tying it in a piece of flannel, in the melted fat. A fine color is obtained by previously washing the alkanet with water and then thoroughly drying it before suspending it in the fat or oil. It is said also to be used in the preparation of spurious port wine. The *Oleum Hypericum*, formerly much used under that title or the name Red Oil, consisted of fixed oil colored with alkanet.

Allamanda,—*Allamanda cathartica*, L., is a shrub of the Fam. *Apocynaceae*, growing in Porto Rio, the extract of whose bark is said to be an excellent hydragogue cathartic, in *doses* of from one to two grains (0.065-0.13 Gm.).

Alliaria. *Alliaria officinalis* Andr. [*Sisymbrium Alliaria*, Scop. *Erysimum Alliaria*, L. *Alliaria Alliaria* (L.) Brit.] *Hedge Garlic*.—A perennial European herb, a native also of Northern Asia, and naturalized from Canada to Virginia, having an alliaceous odor when rubbed, and a bitterish, somewhat acrid taste. When eaten it communicates its odor to the breath. Wertheim obtained from the root a volatile oil, apparently identical with that of mustard. (*Ann. Ch. Ph.*, liii, 52.) The herb and seeds are esteemed diuretic, diaphoretic, and expectorant, and are used as external applications in *gangrenous affections*, and to *promote suppuration*.

Alnus. *Alder*.—Of this genus of small trees or bushes, *A. glutinosa* (L.) Medic., or *European Alder*, *Black Alder*; *A. rugosa* (Du Roi) K. Koch (*A. serrulata* Willd.), or *American Alder*; *A. incana* (L.) Willd., or *Tag Alder*, are tonic and astringent, and have been used in intermittent fever, the bark being the part employed. *A. glutinosa* has been used for dyeing and also for tanning. According to Eitner, the bark contains from 16 to 20 per cent. of tannic acid. The tannic acid, however, appears to differ from that of galls and oak bark, as, according to Stenhouse, it does not yield glucose when acted on by sulphuric acid. (*P. J.*, Dec., 1861.) F. Dreykorn and E. Eeichardt, however, state that it is resolved by sulphuric acid into *alnine red* and sugar. (*A. J. P.*, xlii, 403.)

ALOE. U. S., Br. ALOES

"The inspissated juice of the leaves of *Aloe Perryi* Baker, yielding *Socotrine Aloes*; or *Aloe vera* Linne yielding *Curacao Aloes*; or of *Aloe ferox* Miller, yielding *Cape Aloes* (Pam. *Liliaceae*)." *U. S.* "Aloes is the juice that flows from the transversely cut leaves of *Aloe chinensis*, Baker, *Aloe Perryi*, Baker, and probably other species of *Aloe*, evaporated to dryness. Known in commerce as *Curacao aloes*, *Socotrine aloes*, or *Zanzibar aloes*." *Br.*

Aloe Barbadosis; *Aloe Socotrina*; *Aloes socotrin*, ou *sucotrin*, *Fr.*; *Aloes hepaticque des Barbades*, *Fr.*; *Socotora* oder *Socotrinische Aloe*, *G.*; *Barbados Aloe*, *G.*; *Musebber*, *Ar.*; *Acibar Sucotrin*, *Sp.*

The 1890 edition of the *U. S. Pharmacopoeia* agreed with the *British* in recognizing as distinct varieties *Barbados* and *Socotrine aloes*; but both standards now recognize only the general title of *Aloe*.

Most plants belonging to the genus *Aloe* are capable of yielding a bitter juice from which may be prepared an aloes, and there is little doubt that in many cases a commercial aloes exported from one country is the product of several species.

1. *A. Perryi*, J. G. Baker, *Tr. Linn. Soc.*, xxviii. The true *Socotrine aloes* plant was first described from specimens sent to Kew Gardens by Wykeham Perry, and was subsequently found by Balfour, of Edinburgh, growing abundantly upon the island of Socotra, especially in the limestone tracts, from the sea level to an altitude of 3000 feet; along with it, but much less abundant, was a dwarf species with spotted leaves. It resembles in its general habit the *Barbados aloes*, but differs in its shorter leaves, and especially in its flowers, which are arranged in

looser racemes on longer pedicels and have the tube much longer than the segments.

The proper aloetic juice was formerly thought to exist in longitudinal vessels beneath the epidermis of the leaves, and readily flows out when these are cut transversely; but, according to E. Robiquet, who made elaborate researches in relation to this drug, these vessels are air ducts, and the juice flows in the intercellular passages between them. The liquid obtained by expression from the parenchyma is mucilaginous, and possessed of little medicinal virtue. After condensation by artificial or natural heat the aloe juice is poured into gourds, more commonly boxes, or into monkey skins, allowed to harden and sent into commerce.

2. *A. vera* L.—This species, which is the source of Curacao Aloes, has a very short, woody stem, and lanceolate embracing leaves, which are first spreading, then ascending, of a glaucous green color, somewhat mottled with darker spots, flat on the upper surface, convex beneath, and armed with hard reddish spines, distant from each other, and perpendicular to the margin. *A. vera* is a native of Southeastern Europe, Northern Africa, and Madagascar. It is cultivated in Italy, Sicily, Malta, and especially in the West Indies, where it contributes largely to furnish the Barbados aloes.

3. *Aloe chinensis* Baker.—This species was introduced from China into the Dutch Colonies of Curacao by W. Anderson, in 1817. It was described by Haworth from flowerless specimens as a probable variety of *A. barbadensis*. It is apparently, however, a distinct species and is so recognized in the British Pharmacopoeia. The leaves of *A. chinensis* are not more than half the length of those in *A. barbadensis*, and are more or less copiously spotted on the dorsal surface as in *A. abyssinica*. The flowers have a strong and decidedly unpleasant odor; and occur in loose racemes, the stamens being much shorter than in *A. barbadensis*. Holmes suggests that *A. chinensis* may be a native of Africa, Arabia or India. Engler considers that *A. chinensis* is merely a form related to *A. vera*. (Baker, in *J. L. S.*) xviii, p. 161; Holmes, *P. J.*, xxi, p. 205.)

4. *A. ferox* Miller yields Cape Aloes. It has a simple stem ten to fifteen feet long, four to six inches in diameter; furnished at the top with a dense rosette containing thirty to fifty leaves, which are lanceolate, one and one-half to two feet long, very rigid, with copious prickles on back and face, the margin armed with brown-tipped deltoid or cuspidate

prickles one-eighth to one-sixth of an inch long.

According to L. Pappe, Cape aloes of poor quality is obtained from *A. africana* and *A. plicatilis*, of Miller; while in Lindley's *Flora Medica*, *A. purpurascens* Haworth, *A. arborescens* Mill., *A. Commelyni* Willd., and *A. multiformis* are all said to contribute to commercial Cape aloes. Curacao Aloes is apparently produced by the following species: *A. vera* (L.) Webb, *A. vulgaris* Lam., *A. spicata* L., and *A. socotrina* Lam., all of which have been introduced into the island (see *P. J.*, Jan., Sept., 1890), although E. M. Holmes believes it to be at least in part the product of *A. chinensis* Baker.

Commercial History and Varieties.—Three chief varieties of aloes have been known in comparatively recent commerce: Socotrine, Barbados or Curacao, and Cape.

SOCOTRINE ALOES.—This variety appears to have been the original aloes, having been produced in the island of Socotra at least as early as the time of Alexander the Great, 333 B.C., who is said to have sent a commission to investigate its manufacture. Very little, however, of the true Socotrine aloes at the present time comes into the Western markets, the aloes which reaches European commerce from Bombay, Muscat, Aden, and Zanzibar having various botanical and geographical origins. This form of aloes under the title of "Aloes Socotrina" alone is official in the Spanish Pharmacopoeia. It is said to be derived from *Aloe vera* Mill., *A. spicata* Thumb., *A. ferox* L., *A. arborescens* Mill., and *A. lingua-formis* L., and other species of aloes.

It is stated that the production of aloes in Arabia was formerly a government monopoly, but that at present it is entirely free to the inhabitants. The leaves, which are cut at any time of year, are allowed to drain into a goat's or sheep's skin, and the gathered juice permitted to evaporate spontaneously. In the course of about one month, when it has become thick and viscid, it is known by the Arabic name of *Jayef Gesheeshah*; several weeks subsequently, when it has become hard, it is called *Jayef Kasahul*. Due to its exposure throughout the long process of desiccation, all the varieties of Socotrine aloes contain much foreign matter, which, according to E. R. Squibb, amounts to from 7 to 22 per cent. of the bulk.

The best Socotrine aloes occurs in pieces varying from a dark ruby-red

to a yellowish or reddish-brown, more or less semi-transparent, with a glossy surface and a smooth or ragged but not conchoidal fracture, and yielding a bright golden-yellow powder. Its odor is peculiar, almost fragrant, especially developed by breathing upon the aloes, and its bitter, disagreeable taste has a somewhat aromatic tang. The poorest variety of Socotrine aloes, *Mocha aloes* of the East, is soft, dark, and malodorous. Much of the drug supplied American dealers in recent years has consisted of this variety. Even the finest Socotrine aloes may consist of an orange or yellow colored distinctly fragrant, semi-liquid mass, while the variety known as Zanzibar aloes usually occurs in liver-brown masses, with a dull, waxy fracture, a characteristic odor and a nauseous, bitter taste. The variability of Socotrine aloes probably depends upon not only different methods of preparation but a different origin. Both Zanzibar and true Socotrine Aloes " are opaque even in small splinters, exhibit when examined under the microscope numerous minute crystals embedded in a transparent mass, and impart to *nitric acid* a reddish or yellowish-brown color." *Br.*, 1900.

CURACAO or BONAIRE ALOES.—This aloes, which is produced in the Dutch West Indian Islands, chiefly in the island of Aruba, appears not to have entered commerce extensively before the early part of the 19th century, but at present constitutes a very large proportion of commercial aloes. It occurs chiefly in three forms; first, an opaque, brittle aloes, showing abundant crystals under the microscope, and sold in gourds usually as Barbados aloes; second, aloes having an appearance like the first variety but sold in cases; third, glossy Curacao or Capey Curacao aloes, which occurs in cases and is glossy and transparent.

It is affirmed that the difference in these varieties of Curacao aloes depends upon the extent of the evaporation by artificial heat, the aloes being dark colored and opaque when poured into the gourds while still soft; glossy and transparent when allowed to evaporate to dryness over the fire. It is said that the juice is obtained by allowing the leaves to drain into V-shaped troughs, and that it is never evaporated spontaneously.

According to P. van der Wielden, shining Curacao aloes dissolves completely in nitric acid with the production of a red color, while the dull Curacao aloes, giving the same color reaction, fails to entirely dissolve. Kremel gives a method to distinguish Curacao aloes from other kinds by adding to it a little cupric sulphate solution, then some saturated

solution of common salt, which makes the color an intense carmine. The reaction is due to *cuproaloin*. (C. D., 1895, 759.) Curacao aloes is sometimes found in the markets which has been deprived of its aloin; this fraudulent product is then sold as Cape aloes; the odor of the Curacao variety still remains.

BARBADOS ALOES.—This aloes appears to have been brought to London as early as 1693, and to have reached its greatest commercial abundance in the year 1843, when 4227 gourds of it are said to have been exported from Barbados, a gourd containing from twenty to sixty pounds. Occasionally small quantities of Barbados aloes are on the American markets. Most of the Barbados aloes was produced from *A. vera*, although *A. socotrina*, *A. purpurascens*, and *A. arborescens* are said to have been cultivated.

The method of obtaining Barbados aloes seems to have varied at different periods of time, and possibly in different portions of the island. According to various authors the lower ends of the freshly cut leaves were put into wooden V-shaped troughs, and the exuding juice collected and dried in the sun or boiled in copper pans; again, a decoction of the chopped-up leaves was boiled to the proper consistency; in either case, when the liquor had become so thick that it hardened on cooling, it was poured into calabashes or gourds.

Barbados aloes, as formerly supplied, varied in color from very dark blackish-brown through reddish-brown and liver-colored to orange-brown. It yielded a dull olive-yellow powder, of a disagreeable, even nauseous odor, and it was described in the British Pharmacopoeia as follows: "Fracture either dull and waxy, in which case small splinters are opaque; or smooth and glassy, in which case the splinters are transparent; the opaque variety examined under the microscope exhibits numerous minute crystals embedded in a transparent mass." *Br.*, 1898.

"Mixed with nitric acid, it acquires a red color. Barbados Aloes is not colored, or acquires only a light bluish-green tint, on being mixed with sulphuric acid and blowing the vapor of nitric acid over the mixture (difference from *Natal aloes*)" *U.S.*, 1890.

According to Marais, Barbados aloes could be distinguished by the fact that its solution in distilled water, 1 to 100,000 parts, yielded on the

addition of gold chloride or of tincture of iodine a fine rose color, all other varieties of aloes producing with the reagents named either a feeble color of slow development, or no change of color whatever.

CAPE ALOES.—The general method of collecting Cape aloes is to allow the excised leaves to drain into a sheep's skin, which has been so placed in a hole in the ground as to force the juice to collect in the center. Later this juice is evaporated by artificial heat, and when sufficiently concentrated, poured into boxes or skins. Cape aloes differs from Socotrine aloes, especially in its brilliant conchoidal fracture and peculiar odor, which is strong, but neither nauseous nor aromatic. When freshly broken it has a very dark olive or greenish color approaching to black, presents a smooth, bright, almost glassy surface, and if held up to the light appears translucent at its edges. The small fragments also are semi-transparent, and have a tinge of yellow or red mixed with the deep olive of the opaque mass. The same tinge is sometimes observable in the larger pieces. The powder is of a fine greenish-yellow color, and, being generally more or less sprinkled over the surface of the pieces as they are kept in the shops, gives them a somewhat yellowish appearance. Cape aloes, when quite hard, is very brittle and readily powdered; but in very hot weather it is apt to become somewhat soft and tenacious, and the interior of the pieces is occasionally more or less so even in winter. This variety alone is official in the Swiss, German, and Austrian Pharmacopoeias.

Uganda or crown aloes is a brand of Cape aloes produced by manufacturers who buy the aloe juice from the collectors, allow it to undergo a slight fermentation, and dry it in the sun in wooden troughs. It is sent into commerce in bags containing coarse or fine powder, or chips, and in bricks wrapped in red paper; it has a very bitter, aromatic taste and a strongly aromatic odor. The bricks are of a hepatic brown color, with a resinous fracture, which has a bronzy-gold luster by reflected light. Splinters are translucent, but not garnet-red. With nitric acid it forms a brown solution, gradually changing through dull brownish-yellow to a deep green color.

Natal aloes is a variety coming from Natal, on the southeast coast of Africa, which occurs in irregular pieces, with a fracture much less shining than that of Cape aloes and a totally different color, having a greenish slate hue. It yields a greenish-brown powder, which has the odor of Cape aloes. It is less soluble than Cape aloes, and has a peculiar

composition, which will be adverted to under the chemistry of the drug.

Besides the chief varieties of aloes, others are, or have been, known in the market. *Hepatic aloes*, as well as *fetid*, *caballine* or *horse aloes*, have no proper claim to be considered distinct varieties, being simply inferior aloes of various origins, the first liver-colored, the second blackish and fetid and full of impurities. *Jafferabad aloes*, supposed to be the same as *Mocha aloes* (*A. J. P.*, 1881, 175), has been shown to be the product of *A. abyssinica* Lam., and is said by Shenstone to contain b-barbaloin. (*A. J. P.*, 1883, 92.) Aloes made in India from the *A. vera* is known as *Musambra aloes*. It appears to be a very inferior variety, and rarely, if ever, reaches Europe. (*P. J.*, Aug., 1889.) Occasionally aloes is found on the market in which the aloin has been removed. Noyes has reported the presence of pea flour in the powdered drug.

It is evident that the labels under which aloes are largely sold often have little or no connection with the place of production, or with the variety of aloes in the package. This fact has probably come about through the indifference of retail druggists to the variety of the aloes which they are using, an indifference largely due to their common habit of buying aloes in powder. Wilbert (*A. J. P.*, 1903) proposed that aloes should be classified as follows:

Aloes A.—Containing barbaloin; responds to Borntrager's test for emodin, but does not give a distinct red color with nitric acid, or with Klunge's test.

Aloes B.—Containing isobarbaloin with barbaloin ; responds to Borntrager's test for emodin, and also has a deep red color with strong nitric acid, or with Klunge's test.

Properties.—The commercial aloes are sometimes divided into two groups:

1. Those which are shiny and amorphous, as Cape aloes, and
2. Those which are of a dull color and crystalline. To this latter group most of the other aloes belong. They are also grouped geographically as follows.

1. South African aloes, including Cape and Natal.
2. East African aloes, including Socotrine, the brown and black Zanzibar aloes and Madagascar aloes.

3. The West Indian aloes which includes the Curacao, Barbados and Jamaica varieties.

4. The East Indian aloes which includes Jafferabad and Musumbra aloes. The official description is limited to the three principal varieties, viz., Socotrine, Curacao and Cape aloes and is as follows:

"Socotrine Aloes.—In yellowish-brown to blackish-brown, opaque or smooth and glistening masses; fractured surface somewhat conchoidal; sometimes soft or semi-liquid; odor aromatic or saffron-like, never fetid or putrid; taste nauseous, bitter. Not less than 50 per cent. of Socotrine Aloes is soluble in cold water, the solution being of a yellowish color. The powder is dark brown; when mounted in expressed oil of almond and examined under the microscope, it shows yellowish- to reddish-brown, irregular or angular fragments. On adding nitric acid, it yields a yellowish- to reddish-brown solution.

"Curacao Aloes.—In orange to blackish-brown, opaque masses; fractured surface uneven, waxy, somewhat resinous; odor characteristic but not aromatic as in Socotrine Aloes. Not less than 60 per cent. of Curacao Aloes is soluble in cold water, the solution being of a purplish-red color. The powder is deep reddish-brown; when mounted in expressed oil of almond and examined under the microscope, it shows numerous blackish-brown, irregular, more or less opaque and angular fragments. Upon the addition of nitric acid yields immediately a deep red liquid.

"Cape Aloes.—In reddish-brown or olive-black masses, usually covered with a yellowish powder, or in thin, transparent fragments of a reddish-brown color; fracture smooth and glassy; odor characteristic. Not less than 60 per cent. of Cape Aloes is soluble in cold water, the solution being of a pale yellow color. The powder is greenish-yellow, changing to light brown on aging; when mounted in expressed oil of almond and examined under the microscope, it shows numerous, distinctly angular, bright yellow fragments. Upon the addition of nitric acid, it yields a liquid that is colored reddish-brown, changing to purplish-brown and finally greenish.

The tests which follow apply to Socotrine, Curacao, and Cape Aloes. Aloes contains not more than 10 per cent. of moisture. Add 50 mils of alcohol to 1 Gm. of Aloes, gently heat the mixture and then cool it; a nearly clear solution is obtained (gum and inorganic impurities)*

Intimately mix 1 Gm. of Aloes with 10 mils of hot water and dilute 1 mil of this mixture with 100 mils of water; a green fluorescence is produced upon the addition of an aqueous solution of sodium borate (1 in 20). Dilute 1 mil of the original aqueous mixture of Aloes with 100 mils of water, and shake it with 10 mils of benzene; upon separating the benzene solution and adding to it 5 mils of ammonia water, a permanent deep rose color is produced in the lower layer. Aloes yields not more than 4 per cent. of ash." *U. S.*

The 1914 British Pharmacopoeia gives the following description: "In hard masses, varying in color from yellowish-brown to dark or chocolate-brown. Fractured surface dull, waxy and uniform (Curacao and Zanzibar aloes), or uneven and somewhat porous (Socotrine aloes). Small splinters examined under the microscope exhibit minute crystals embedded in a transparent mass. Characteristic odor; taste nauseous and bitter. The solution obtained by dissolving 0.1 gramme of Aloes in 10 millilitres of boiling *water* and adding 0.5 gramme of *purified borax* acquires a green fluorescence. *Nitric acid* dropped on a little crushed Aloes acquires a reddish-brown color (Socotrine and Zanzibar aloes), or a crimson color (Curacao aloes). Almost entirely soluble in alcohol (60 per cent.). Loss on drying at 100° C. (212° F.) not more than 10 per cent. Ash not more than 5 per cent." *Br.*

Chemical Properties.—Several distinguished chemists have investigated the nature and composition of aloes. Braconnot found a bitter principle, which he named *resino-amer* (resinous bitter), and another substance in smaller proportion, which he designated by the name of *flea-colored principle*. These results were essentially confirmed by Trommsdorff, Bouillon-La-grange, and Vogel. Robiquet obtained a product from aloes which he called *aloetin*. (For details, reader is referred to 14th ed., U. S. Dispensatory.)

ALOINS.—The bitter substances noticed above, viz., the *resino-amer* of Braconnot, and the *aloetin* of Robiquet, probably contain the active principle of aloes, but combined with impurities which render it unsusceptible of crystallization. It has been assumed that there exists not one compound, but a set of three closely related compounds, to which the general name of aloins is now given. The first of these, found exclusively in Barbados, aloes, and discovered by T. and H. Smith, is called *barbaloin*; the second, discovered by Fliickiger in Natal aloes, is called *nataloin*; the third, found by Histed and Fluckiger in Socotrine

aloes, is called *socaloin*.

The three aloins, *barbaloin*, *nataloin*, and *socaloin*, are easily distinguished by the following reaction, first noticed by Histed. A drop of nitric acid on a porcelain slab gives, with a few particles of barbaloin or nataloin, a vivid crimson (rapidly fading in the case of barbaloin, but permanent with nataloin unless heat be applied), but produces little effect with socaloin. To distinguish barbaloin from nataloin, test each by adding a minute quantity to a drop or two of sulphuric acid, then allowing the vapor from a rod touched with nitric acid to pass over the surface. Barbaloin (and socaloin) will undergo no change, but nataloin will assume a fine blue. (*Pharmacographia*, 2d ed., p. 688.) E. von Sommaruga and Egger consider that the three aloins form a homologous series possessing the formulas: barbaloin, $C_{17}H_{20}O_7$; nataloin, $C_{16}H_{18}O_7$; socaloin, $C_{15}H_{16}O_7$, and that they are all derived from *anthracene*, $C_{14}H_{10}$. Tilden subsequently assigned a different composition to the aloins: barbaloin and socaloin, each $C_{16}H_{18}O_7$; for nataloin, the formula $C_{25}H_{28}O_{11}$. He further states that barbaloin and socaloin differ in physical and chemical properties on account of the variation in the molecules of water which are associated with them. Leger assigns to nataloin the formula $C_{23}H_{26}O_{10}$. The British Pharmacopoeia (1898) assigns to barbaloin the formula $C_{16}H_{16}O_7, 3H_2O$. Two bases only are recognized now, *barbaloin* (or simply aloin) and *isobarbaloin*. According to Leger (*P. J.*, 1902, 21) *Cape aloes* contains from 5 to 6 per cent. of aloin (barbaloin) without any admixture of the isomeric isobarbaloin. The Barbadoes aloes of English commerce never gave more than 5 per cent. of barbaloin with but minute traces of isobarbaloin, which, however, is always met with in the so-called Barbados aloes of French commerce. *Curacao aloes* is rich in aloin, containing 10 per cent., of which half is barbaloin and the other half isobarbaloin. *Jafferabad aloes* is very rich in aloin, yielding 20 per cent., chiefly in the form of isobarbaloin. *Socotrine aloes* does not contain more than 4 per cent. of aloin, almost wholly barbaloin with a very little isobarbaloin. Since barbaloin is found in almost all varieties, the significance of the prefix "barb" is misleading. The only aloes in which it does not occur is that of Natal.

Hugo Borntrager asserted that one part of aloes in 5000 can be detected in the following manner. A little of the suspected liquid is shaken with

about twice its bulk of benzin, which is allowed to separate, decanted, and shaken with a few drops of stronger water of ammonia. On separation the ammonia will be of a clear red color. With solids a tincture should first be made. According to R. H. Groves (*P. J.*, 3d ser., si, 1045), this test will never succeed with a less concentration than 1 part in 250, and with some aloes 1 in 100, and is due to the tannin-like substance of aloes; he also states that extreme care is necessary to have the benzin solution perfectly clear. (*P. J.*, 1885, p. 633. For Hager's quantitative method for determining the percentage of aloin in aloes, see *A. J. P.*, 1885, p. 237.

R. A. Cripps and T. S. Dymond have given the testing of aloes a lengthy investigation, and they recommend the following method. Place 1 grain of the substance in a glass mortar standing on white paper, now add 16 drops of strong sulphuric acid and triturate until dissolved, then add 4 drops of nitric acid, sp. gr. 1.42, and then 1 ounce of distilled water. If aloes be present, a color varying from deep orange to crimson will be produced, according to the kind of aloes that has been used; the color is deepened by the addition of ammonia. The table below is taken from the paper of Bainbridge and Morrow. (*P. J.*, Jan., 1890.) Under the heading of Kew Specimens are given the results obtained with juice of aloes plants grown in Kew Gardens.

Commercial Specimens.	HNO ₃ .	H ₂ SO ₄ and vapor of HNO ₃ .	Cripps and Dymond test.	C. and D. test with NH ₄ HO.	Bromine Test.	FeCl ₃ .
Hepatic aloes . .	Reddish-grown.	Nil.	Orange-red.	Intense brownish-red.	Nil.	All varieties of aloes give an olive-green coloration with the above reagent.
True Socotrine . .	Reddish-brown.	Nil.	Orange-red.	Intense brownish-red.	Nil.	
Commercial Socotrine	Faint crimson.	Nil.	Crimson.	Deep claret.	Nil.	
Cape	Permanent green after standing a few minutes.	Nil.	Orange-red.	Pale claret.	Nil.	
Curacao	Evanescent crimson.	Nil.	Crimson.	Intense claret.	Nil.	
Natal	Permanent crimson.	Deep blue.	Deep crimson.	Intense brownish-red.	Nil.	
Barbadoes	Crimson soon fading.	Slight bluish-green occasionally.	Crimson.	Deep claret.	Nil.	
Kew SPECIMENS.						
<i>Aloe ferox</i>	Evanescent crimson.	Green.	Pale yellow.	Red.	Violet.	
<i>-socotrina</i>	Permanent crimson.	Deep blue.	Crimson.	Intense brownish red.	Deep purplish-red.	
<i>-vera</i>	Nil.	Slight green.			Nil.	
<i>-Perryi</i>	Nil.	Nil.			Nil.	
<i>-purpurascens</i>	Crimson fading to light red.	Nil.			Violet.	
<i>-platylepis</i>	Nil.	Nil.			Nil.	
<i>-arborescens, var. frutescens</i>	Nil.	Nil.			Nil.	
<i>-africana</i>	Evanescent red, changing after a few minutes to green.	Nil.	Orange-red.	Pale claret.	Nil.	
<i>-chinensis</i>	Nil.	Nil.			Nil.	

Tschirch, of Berne, has published (*B. P. G.*) 1898, viii, Heft 6) an important communication, in which he showed that *emodin*, $C_{15}H_{10}O_5$, or *trioxymethylantraquinone*, is the purgative principle of the aloins. He succeeded in obtaining emodin in orange-red crystals which melt at $216^{\circ} C.$ ($420.8^{\circ} F.$). Emodin was found in the aloins obtained from Cape, Barbadoes, and Socotrine Aloes; it is extracted by treating barbaloin with ether, which dissolves out the emodin. Tschirch found that if a liquid extract of aloes be deprived of its resin and aloin, an additional quantity of emodin could be obtained by boiling the liquid extract with diluted sulphuric acid, thus pointing to the fact that emodin may be produced through hydrolysis. He also showed that emodin could be obtained from purgative drugs of the same class as aloes: rhubarb, rumes, frangula, cas-cara, senna, rhamnus catharticus, morinda bark, and parmelia.

Aloes yields its active matter to cold water, and when good is almost wholly dissolved by boiling water; but the inert portion, or apotheme of Berzelius, is deposited as the solution cools. It is also soluble in alcohol, rectified or diluted. Long boiling impairs its purgative properties by oxidizing the aloin and rendering it insoluble. The alkalies, their carbonates, and soap alter in some measure its chemical nature, and render it of easier solution. It is inflammable, swelling up and decrepitating when it burns, and giving out a thick smoke which has the odor of the drug.

Those substances only are incompatible with aloes which alter or precipitate the soluble matter, as the insoluble portion is without action upon the system. Among these is the infusion of galls, which we have found, probably through its tannic acid, to afford a copious precipitate with an aqueous solution of aloes. It is said that such a mixture will keep a long time, even for a period of several months, without moldiness or putrescence, though it becomes ropy.

A method for the detection of aloes in mixtures containing other cathartic drugs, such as rhubarb, caseara, etc., has been described by Mossley (*Chem. and Drug.*, 1913, 915). The method depends upon the precipitation of the oxymethyl anthraquinones, which usually interfere in such identification tests, and the subsequent detection of aloes by the addition of bromine T.S., which precipitates aloin, and the green fluorescence produced with aloes by borax.

Uses.—Aloes was known to the ancients, being cultivated in the island of Socotra as far back as the time of Alexander the Great, and is mentioned in the works of Dioscorides and of Celsus. Its cathartic action is due to a stimulation of peristalsis, especially in the larger bowel, probably the result of a local irritant effect upon the mucous membrane, although there is some evidence that it exercises a specific stimulant effect upon unstriated muscles. As its action is largely limited to the colon it is not to be recommended in those conditions in which it is desirable to clean out the whole alimentary canal, and as its effect is largely the result of local irritation it should be avoided in inflammatory conditions of the intestines. In chronic constipation, however, especially when dependent upon an atonic condition of the lower bowel, it is one of the most useful laxatives that we possess. Many believe that it possesses a direct tonic action, not only evacuating the bowel of its contents but encouraging a restoration toward normal conditions. The presence of bile in the bowel seems in some way to be essential for the best effects of this drug, and in those cases in which this secretion is lacking it is well to exhibit some preparation of bile in conjunction with the aloes. Soap also appears to enhance the cathartic action of this drug. It was formerly almost universally believed that aloes possessed emmenagogue properties and it was accordingly largely used in the treatment of various forms of *amenorrhoea*. It is, however, extremely doubtful whether it exercises any action upon the pelvic organs which is not attributable to its cathartic effects.

Crude aloes is rarely used in human medicine, but may be given in doses of from two to ten grains (0.13-0.65 Gm.).

Off. Prep.—Extractum Colocynthis Compositum, U. S. (); Pilulae Aloes, U. S. (*Br.*); Pilulas Rhei Compositae, U. S. (*Br.*); Tinctura Aloes, U. S.; Tinctura Benzoini Composita, U. S. (*Br.*); Decoctum Aloes Compositum, *Br.*; Extractum Aloes, *Br.*; Pilula Aloes et Asafetidae, *Br.*; Pilula Aloes et Ferri, *Br.*; Pilula Aloes et Myrrhae, *Br.*; Pilula Colocynthis Composita, *Br.* (*N. F.*); Extractum Aloes, *N. F.*; Pilulae ad Prandium, *N. F.*; Pilulae Aloes et Asafoetidae, *N. F.*; Pilulae Aloes et Ferri, *N. F.*; Pilulae Aloes et Mastiches, *N. F.*; Pilulae Aloes et Myrrhae, *N. F.*; Pilulae Aloes et Podophylli Compositae, *N. F.*; Pilulae Aloes, Hydrargyri et Scammonii Compositae, *N. F.*; Pilulae Antiperiodicas (from Extract), *N. F.*; Pilulae Colocynthis et Hyoscyami, *N. F.*; Pilulae Ferri, Quininae, Aloes et Nucis Vomicae, *N. F.*; Pilulae Laxativae Post Partum, *N. F.*; Pulvis Aloes et Canellae, *N. F.*; Tinctura Aloes et

Myrrhae, *N. F.*; Tinctura Antiperiodica (from Extract), *N. F.*; Tinctura Zedoariae Amara, *N. F.*

ALSTONIA. Br. ALSTONIA

"Alstonia is the dried bark of *Alstonia scholaris*, E. Br., and also of *Alstonia constricta*, F. Muell." *Br.*

Dita Bark; Australian Fever Bark; Bitter Bark.

Under Alstonia the British Pharmacopoeia recognizes the dried barks of *Alstonia scholaris* (L.) R. Br. (*Echites scholaris* L.), of India and the Philippine Islands, and *Alstonia constricta* F. Muell., of Australia, two apocynaceous trees whose barks are quite dissimilar in appearance, and, as far as our present knowledge goes, contain different alkaloids. These barks are respectively described as follows:

"Bark of *Alstonia scholaris* usually in irregular fragments, three to twelve millimetres thick; texture somewhat spongy, fracture short and coarse; external layer unevenly rough and fissured, brownish-grey with occasional blackish spots; internal layer bright buff. Transverse section shows numerous small medullary rays in inner layer. Almost odorless; taste bitter. Bark of *Alstonia constricta* usually in curved pieces or quills about sixty millimetres wide, and twelve millimetres thick. Periderm from two and a half to six millimetres thick, rusty brown, strongly rugose, with large deeply fissured reticulations. Bark internally cinnamon-brown, with strong, coarse longitudinal striae. Transverse section shows dark-brown periderm covering the inner orange-brown tissues, in which numerous small shining particles can be seen with a lens. Fracture short and granular in outer layers, fibrous in inner. Slight aromatic odor; taste very bitter." *Br.*

From the bark of *Alstonia scholaris* M. Gruppe extracted an uncrystallizable, hygroscopic, bitter principle, *ditaine*. (*J. P. C.*, 4e ser., xviii, 225; xix, 84; *P. J.*, Aug., 1875.) Harnaek (*Ber. d. Chem. Ges.*, 1878) first obtained ditaine in pure crystallized form, and gave it the formula $C_{20}H_{30}N_2O_4$. O. Hesse (*P. J.*, Oct. 23, 1880) finds in dita the following principles: three alkaloids: *ditamine*, $O_{16}H_9O_2N$, the relative amount of which he estimates at 0.04 per cent.; *echitamine*, $C_{22}H_{28}O_4N_2 + H_2O$ (identical, according to Hesse, with Harnack's ditaine); and

echitenine, $C_{20}H_{27}O_4N$. Of these, the second is the strongest base, and resembles ammonia in its chemical characters; Hesse considers it with one molecule of water to form the hydroxide of a strong basic radical, *echitammonium*, $C_{22}H_{29}O_4N_2$. The solutions of *echitammonium hydroxide* are so strongly basic that they precipitate the hydroxides of copper, iron, aluminum, and lead, and decompose sodium and potassium chlorides, liberating the corresponding hydroxides. Hesse considers *echitammonium* the most strongly basic of all the alkaloids. Hesse also obtained by extraction with petroleum benzin *echicaoutchin*, *echiretin*, *echicerin*, *echitin*, and *echitein*, of which the three last mentioned are crystalline.

From *Alstonia constricta*, F. V. Miiller and A. Rummel obtained *alstonine*. Oberlin and Schlagdenhauffen found in 1879 another alkaloid, *alstonicine*. Hesse subsequently analyzed the bark and found *alstonine*, the *chlorogenine* of a former investigation, which has the composition $C_{21}H_{20}O_4N_2$, *prophyrine*, $C_{21}H_{25}O_2N_3$, and *alstonidine*. The alkaloids and their salts in acidulated solutions show decided blue fluorescence.

Uses.—This drug has been used for many years in Australia and the Philippine Islands in the treatment of malarial and other fevers, as well as a simple bitter. The alkaloid ditaine has been scientifically studied by Harnach (*A. E. P. P.*, 1877, xvii, p. 126), who finds that it has a paralyzing effect upon the endings of the motor nerve similar to that produced by curara. In large dose it also paralyzes the cardio-inhibitory nerves and lowers blood pressure. There is nothing in this study, which is, as far as we know, the only scientific investigation of the drug which has been made, to explain any action in malaria. Nevertheless some of the clinical reports, especially from the eclectic physicians, have been extremely laudatory, vaunting it even as a substitute for quinine.

Dose, two to four grains (0.13-0.25 Gm.).

Off. Prep.—*Infusum Alstonia*; *Br.*; *Tinctura Alstoniffi*, *Br.*

ALTHAEA. U. S. ALTHAEA [Marshmallow root]

" The root of *Althaea officinalis* Linne (Fam. *Malvaceae*) deprived of the brown, corky layer and small roots, and carefully dried. Preserve *Althaea* in tightly-closed containers, adding a few drops of chloroform or

carbon tetrachloride from time to time, to prevent attack by insects." *U.S.*

Radix Hibisci, Radix Bismalvae; Wymote, White Mallow, Mortification root; Racine de Guimauve, Guimauve, *Fr.*; Radix Althaeae, P. G.; Altheewurzel, Althee, Eibischwurzel; Eibisch, *G.*; Altea, Malvavischio, *It.*; Altea, Raiz de Malvavisco, *Sp.*

Althaea officinalis is an herbaceous perennial, with a perpendicular branching root and erect woolly stems, from two to four feet or more in height, branched and leafy towards the summit. The leaves are described under *Folio Althaea*, p. 120. The flowers are terminal and axillary, with short peduncles, each bearing one, two, or three flowers. The corolla has five spreading, obcordate petals, of a pale rose color. The fruit consists of numerous capsules united in a compact circular form, each containing a single seed. The plant grows throughout Europe, inhabiting salt marshes, the banks of rivers, and other moist places. It is found also in this country, from New England to New York and westward to Michigan and Arkansas. It is largely cultivated in Europe for medicinal use, particularly in Germany, Belgium and France.

The roots should be collected in autumn from plants at least two years old. They are usually prepared for the market by removing the outer layers. The commercial drug sometimes consists of the unpeeled root, which is sliced transversely and diagonally.

Properties.—*Althaea* is usually cut into small pieces about 5 mm. in diameter, of a uniform grayish-white color and otherwise having the characters of entire roots; occasionally entire, slenderly tapering, attaining a length of 30 cm. and a thickness of 2 cm., externally whitish, longitudinally furrowed, frequently spirally twisted and covered with the somewhat loosened bast-fibers; fracture of bark fibrous, of wood short and granular; internally yellowish-white; bark 1 to 2 mm. thick, porous, due to mucilage cells, and separated from the slightly radiating wood by a distinct, grayish cambium zone; odor slight; taste sweetish, mucilaginous. The powder is whitish; starch grains numerous, from 0.003 to 0.02 mm. in diameter, usually with a long cleft at the point of origin of growth; sclerenchymatous fibers in groups, the walls being quite thick and more or less lignified; tracheae with scalariform thickenings or with bordered pores; calcium oxalate crystals few, in rosette aggregates from 0.02 mm. to 0.03 mm. in diameter. Add 1 Gm. of *Althaea* to 10 mls of cold water, allow it to stand with occasional stirring during

thirty minutes, and filter through cotton; a pale yellow-colored mucilage is obtained, which is neutral to litmus and is colored a deep yellow on the addition of a few drops of potassium hydroxide T.S. The mucilage does not have a sour or ammoniacal odor. Althasa yields not more than 8 per cent. of ash." *U. S.*

The abundant mucilage is situated chiefly in special cells, and can be seen to be in layers when alcohol is added. Kraemer (*A. J. P.*, 1898, p. 285) proposed the use of an alcoholic solution of methylene blue for the differentiation of the mucilage. It, with starch and saccharine matter, is taken out by boiling water. The mucilage, without the starch, is extracted by cold water, which thus becomes ropy. A principle was discovered in the root by Bacon, which has been ascertained to be identical with asparagin, $C_4H_8N_2O_3 + H_2O$. Boutron-Charland and Pelouze found it to belong to that class of organic principles which are convertible by strong acids, and other agencies, into ammonia and organic acids, and which are designated by the termination amide, being compounds of acid radicals with the group NH_a . When such an amide is acted upon by acids, it is decomposed, the acid radical taking OH to form the free acid and the amide group taking H to form ammonia. Thus asparagin, which in this view should be called *asparamide*, is converted into ammonia and *aspartic acid*, $C_4H_7NO_4$, and one molecule of the resulting ammonium aspartate corresponds with one molecule of asparamide and one of water. (*J. P. C.*, xix, 208.) Asparagin, being now recognized as a derivative of succinic acid, is called *amido-succinamide*, and the aspartic acid is called *amido-succinic acid*. It is found in various other plants besides the marshmallow, as in the shoots of asparagus, in vetches grown in the dark, in all the varieties of the potato, and in the roots of the comfrey and licorice plant.

According to Pira, asparagin has acid properties. It has no therapeutic value. Betaine (trimethyl-glycocol) has been obtained from *Althaea* by Orlow. (*Ph. Z. R.*, 1898.)

The roots of other Malvaceae are sometimes substituted for that of marshmallow, without disadvantage, as they possess similar properties. Among these are *Althaea rosea* Cav., or *hollyhock*, and *Malva Alcea* L. The dark purple flowers of a variety of *A. rosea* have been proposed as a test for acids and alkalies. A strong infusion of these flowers imparts to slips of white filtering paper a permanent purplish-blue color, which is reddened by acids, and rendered bluish-green by alkalies.

ALTHAEA or MARSHMALLOW LEAVES, under the title of *Folia Althaea*, are official in the Swiss, German and Austrian Pharmacopoeias and as *Althaea Folia* in the National Formulary. The leaves are collected in June or July, while the plant is in flower, and dried. They are described in the N. F. as "the dried leaves of *Althaea officinalis* Linne (Fam. *Malvaceae*), without the presence of more than 5 per cent. of stems or other foreign matter." *N. F.* As seen in commerce they are "gray-green or yellowish gray-green and densely and finely tomentose throughout ; petioles one-sixth to one-fifth as long as the blades; blades varying from 5 to 15 cm. in length and from 3 to 10 cm. in breadth, cordate or rhomboidal-ovate in outline, rounded or occasionally nearly truncate at the base, acute at the summit; margin doubly serrate-dentate, the principal teeth from one to three pairs, the lowest almost large enough to be regarded as lobes, the secondary very irregular, triangulate, acute, broader than long, the sinuses acute; two to four occasionally six principal veins originating with the midrib in the petiole, prominent underneath, terete; branches of the midrib arising at a wide angle, nearly straight, each terminating in a marginal tooth. Leaf thin, but appearing thick because of its hairy covering. Odor slight, scarcely characteristic; taste mucilaginous. The powdered drug is grayish to grayish-green and, when examined under the microscope, exhibits numerous unicellular, non-lignified stellate branching hairs, up to 0.6 mm. in length, usually occurring in clusters of two to six; few, short stalked, multicellular glandular hairs; calcium oxalate in rosette aggregates up to 0.025 mm. in diameter; fragments of the epidermal tissue with stomata, the latter about 0.025 mm. in length; few lamellated mucilage cells; usually a few pollen grains, spherical, spiny, up to 0.1 mm. in diameter. *Althaea* Leaves yield not more than 16 per cent. of ash." *N. F.*

Uses.—The virtues of marshmallow are exclusively those of a demulcent. The decoction of the root is much used in Europe in irritation and inflammation of the mucous membranes. A syrup of althaea is official in the German Pharmacopoeia, and was introduced into the U. S. Pharmacopoeias of 1880 and 1890 (see *U. S. D.*, 18th edition, p. 1327). Owing to its tendency to ferment rapidly it was not retained in the U. S. P. VIII or IX, but is found in the N. F. IV. (See *Syrupus Althaeae*.) The roots themselves, as well as the leaves and flowers, boiled and bruised, are sometimes employed as a poultice. In France the powdered root is much used in the preparation of pills and electuaries. It enters, as an

ingredient, into one mass and two pills of the U. S. P.

Off. Prep.—Massa Hydrargyri, *U. S.*; Pilulas Ferri Carbonatis, *U. S.*; Pilulae Phosphori, *U. S.*, Species Pectorales, *N. F.*; Syrupus Althaeae, *N. F.*

Amapa Milk.—The milky sap of the bitter bark of *Plumeria Fallax* (Fam. *Apocynaceae*), a Brazilian tree, has come into general use as a vermifuge and antimalarial, having been used and known by the natives of Brazil and South America from time immemorial. It is also used externally in the treatment of *cancerous sores*. *Dose*, for children, one minim for each year of age.

Ambrosia. *Ambrosia trifida*, L. *Ragweed, Roman Wormwood, Hog-weed, Bitter-weed, Ambrosie*, Fr. *Traubenkraut*, G. (Fam. *Compositae*.) —This and another indigenous annual, *A. artemisiifolia* L., are deemed by the eclectics astringent and stimulant, and are given in low forms of *fever*. L. W. Schwab has found in *A. artemisiifolia* a bitter glucoside (*A. J. P.*, 1890), and Schimmel & Co. have obtained from it about 0.15 per cent. of a green volatile oil (sp. gr. 0.876). (*Schim. Rep.*, 1904, p. 96.) The pollen of this plant is also said to be one of the causes of hay fever. It is estimated that there are about 90,000,000 pollen grains in a gramme of ragweed pollen.

AMYGDALA AMARA. Br. BITTER ALMOND

“Bitter Almond is the ripe seed of *Prunus Amygdalus*, Stokes, var. *amara*, Baill.” *Br.*

Semen Amygdali Ama-rum; Amandes ameres, *Fr. Cod.*; Amygdalae Amarae, *P. G.*; Bittere Mandein, *G.*; Mandorle amare, *It.*; Almendra amarga, *It.*

Bitter almond was not made official in the U. S. P. IX.

The almond tree resembles that of the cherry. The leaves are elliptical, petiolate, minutely serrated, and are of a bright green color. The flowers are large, of a pale red color varying to white, with very short peduncles, and petals longer than the calyx, and usually stand in pairs upon the branches. The fruit is a drupe with the outer covering thin, tough, dry, and marked with a longitudinal furrow, where it opens when fully ripe. Within this covering is a rough shell, containing the kernel or almond.

There are several varieties of this species of *Amygdalus*, differing chiefly in the size and shape of the fruit, the thickness of the shell, and the

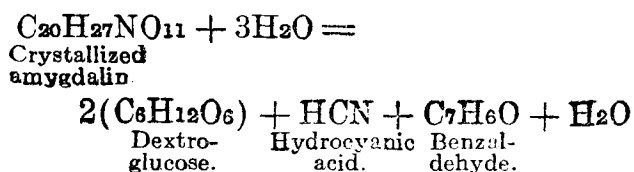
taste of the kernel. The two most important are the var. *dulcis* and the var. *amara*, the former bearing sweet, the latter bitter almonds. Both of these varieties have been known since ancient times. The var. *dulcis* yields the hard and paper-shelled variety. The latter, owing to the thin endocarp, is particularly suitable for table use. Another variety grows wild in Turkestan and has a nearly smooth endocarp or "stone." The almond tree is a native of sub-tropical China, Middle Asia and probably also Turkestan. It is now cultivated not only in the Orient, but in the Mediterranean countries of Southern Europe and Northern Africa, and also in Southern England, Scandinavia and California. Bitter almonds are chiefly imported from Morocco and Sicily.

Bitter Almonds.—These are smaller than the sweet almonds, and are "ovate or oblong-lanceolate, 20 to 30 Mm. long; seed-coat thin, brown, finely downy; embryo straight, white, and with two plano-convex cotyledons; taste bitter and oily; when triturated with water Bitter Almond yields a milk-white emulsion which emits an odor of hydrocyanic acid." *U. S. VIII.*

"Resembles the Sweet Almond in general appearance, but is distinguished by being shorter and proportionally broader, by its bitter taste, and by the characteristic odor resembling that of prussic acid given off by its aqueous emulsion." *Br.*

They have the bitter taste of the peach kernel, and, though when dry, inodorous or nearly so, have, when triturated with water, the fragrance of the peach blossom. They contain nearly the same ingredients as sweet almonds, and like them form a milky emulsion with water. It was formerly supposed that they also contained hydrocyanic acid and volatile oil, to which their peculiar taste and odor and their peculiar operation upon the system were ascribed. It was, however, ascertained by Robiquet and Boutron that these principles do not pre-exist in the almond, but result from the reaction of water; and Wohler and Liebig proved, what was suspected by Robiquet, that they are formed out of a peculiar substance denominated *amygdalin*, which is the characteristic constituent of bitter almonds. This substance, which was discovered by Robiquet and Boutron in 1830, is white, crystallizable, inodorous, of a sweetish bitter taste, unalterable in the air, freely soluble in water and hot alcohol, very slightly soluble in cold alcohol, and insoluble in ether. It is decomposed by the action of diluted acids or in the presence of water by the nitrogenous ferments, like *emulsin*, which accompany it in

the bitter almond. The reaction is as follows:



It is recognized as belonging to the glucoside class, compounds which, when decomposed by diluted acids, alkalies, or ferments, yield glucose and some other characteristic decomposition product. They may be considered as esters of glucose analogous to the esters of glycerin which exist in the fats under the name of *glycerides*. Liebig and Wohler give the following process for obtaining amygdalin, in which the object of the fermentation is to destroy the sugar with which it is associated. Bitter almonds, previously deprived of their fixed oil by pressure, are to be boiled in successive portions of alcohol till exhausted. From the liquors thus obtained all the alcohol is to be drawn off by distillation, care being taken, near the end of the process, not to expose the syrupy residue to too great a heat. This residue is then to be diluted with water, mixed with good yeast, and placed in a warm situation. After the fermentation which ensues has ceased, the liquor is to be filtered, evaporated to the consistence of syrup, and mixed with alcohol. The amygdalin is thus precipitated in connection with a portion of gum, from which it may be separated by solution in boiling alcohol, which will deposit it upon cooling. If pure, it will form a perfectly transparent solution with water. Any oil which it may contain may be separated by washing with ether. One pound of almonds yields at least 120 grains of amygdalin. (Ann. Pharm., xxii, 329.) Amygdalin appears to be extensively diffused in plants, having been noticed not only in the different genera of the Rosaceae, as *Amygdalus*, *Cerasus*, and *Prunus*, but also by Wieke in various Pomaceae, as *Pyrus Malus*, *Sorbus Aucuparia*, *Sorbus hybrida*, *Sorbus torminalis*, *Amelanchier vulgaris*, *Cotoneaster vulgaris*, and *Crataegus Oxyacantha*. (Ann. Ch. Ph., lxxix, 79.) It may be advantageously procured from peach kernels, which have been found to yield 80 grains for each avoirdupois pound, or more than 1 per cent. (A. J. P., xxvii, 227.) According to the researches of Johannen, the emulsin is contained in the radicle and plumule, and in the vascular bundles of the cotyledons, while the parenchyma of the cotyledons contains the amygdalin. (P. J., March, 1888.)

Amygdalin, mixed with emulsion of sweet almonds, gives rise, among other products, to the volatile oil of bitter almond and hydrocyanic

acid,—the emulsin in the sweet almonds acting the part of a ferment, by causing a reaction between the amygdalin and water; and the same result is obtained when pure emulsin is added to a solution of amygdalin. It appears, then, that the volatile oil and hydrocyanic acid developed in bitter almonds when moistened result from the mutual reaction of amygdalin, water, and emulsin. Certain substances have the effect of preventing this reaction, as, for example, alcohol and acetic acid. It is asserted that emulsin procured from other seeds, as those of the poppy, hemp, and mustard, is capable of producing the same reaction between water and amygdalin, though in a less degree. (*Ann. Pharm.*, xxviii, 290.) Amygdalin appears not to be poisonous when taken pure in the stomach, unless there be emulsin in the food in the stomach.

Bitter almonds yield their fixed oil by pressure, and at the present time this oil is an article of commerce, and is frequently sold as expressed oil of almond, this being now officially permitted. It is usually produced from North African bitter almonds; the volatile oil, impregnated with hydrocyanic acid, may be obtained from the residue by distillation with water. (See *Oleum Amygdalae Amarae*.)

Uses.—Bitter almonds are used solely for their flavoring powers. For medicinal purposes the oil is preferable. (See *Oleum Amygdalae Amarae*.) It has been ascertained that bitter almond paste, and other substances which yield the same volatile oil, such as bruised cherry-laurel leaves, peach leaves, etc., have the property of destroying the odor of musk, camphor, most of the volatile oils, creosote, cod liver oil, the balsams, etc.; and Mahier, a French pharmacist, has employed them successfully to free mortars and bottles from the odor of asafetida and other substances of disagreeable odor. All that is necessary is first to remove any oily substance by means of an alkali, and then to apply the paste or bruised leaves.

Bitter almonds, on account of the hydrocyanic acid developed in them, have sometimes proved poisonous.

AMYGDALA DULCIS. U. S., Br.
SWEET ALMOND Amygd. Dulc.

“The ripe seeds of *Prunus Amygdalus dulcis* De Candolle (Fam. Rosaceae). Preserve Sweet Almond in tightly-closed containers, adding a

few drops of chloroform or carbon tetrachloride from time to time to prevent attack by insects." *U. S.* "Sweet Almond is the ripe seed of *Prunus Amygdalus*, Stokes, var. *dulcis*, Baill. Known in commerce as the Jordan almond." *Br.*

Semen Amygdali Dulce; Amandes douces, *Fr. Cod.*; Amygdalae Dulces, *P. G.*; Susse Mandein, *G.*; Mandorle doici, *It.*; Almendra dulce, *Sp.*

We are supplied with sweet almonds chiefly from Spain, Italy, France, and Southern California. They are separated into the soft-shelled and hard-shelled, the former of which come from Marseilles and Bordeaux, the latter from Malaga. From the latter port they are sometimes brought to us without the shell. In British commerce, the two chief varieties are the *Jordan* and *Valencia* almonds, the former imported from Malaga, the latter from Valencia. The former are longer, narrower, more pointed, and more highly esteemed than the latter.

Properties.—The shape and appearance of almonds are too well known to require description. Each kernel consists of two white cotyledons, enclosed in a thin, yellowish-brown, bitter skin, which is easily separable after immersion in boiling water. Deprived of this covering, they are called *blanched almonds*. On exposure to the air they are apt to become rancid; but, if thoroughly dried and kept in well-closed glass vessels, they may be preserved unaltered for many years.

Sweet almonds, when blanched, are without odor, and have a sweet, very pleasant taste, which has rendered them a favorite article of diet in all countries where they are readily attainable. They are, however, generally considered difficult of digestion. They are officially described as: "Ovate or oblong lanceolate, 17 to 25 mm. in length, 10 to 13 mm. in breadth and 4 to 7 mm. in thickness; seed-coat light brown with numerous parallel veins, thin and easily removed on soaking the seed in water; embryo straight, white, and with two plano-convex cotyledons; taste bland, sweet. Triturate Sweet Almond with water; a milk-white emulsion is produced which is not acid to litmus, and has no odor of benzaldehyde or hydrocyanic acid (*bitter almond*). The powder is creamy-white, exhibiting numerous very small oil globules, 0.001 mm. or less in diameter, and larger oil globules and crystalloids, the latter sometimes with adhering globoids; fragments of parenchyma of endosperm, containing oil-globules and aleurone grains; also occasional fragments of seed-coat with characteristic, more or less scattered, large,

elliptical, thin-walled, strongly lignified epidermal cells and narrow, closely spiral tracheae. Starch grains are absent. Sweet Almond yields not more than 4 per cent. of ash." *U. S.* "About two and a half centimetres or somewhat more in length, nearly oblong in outline, more or less compressed, pointed at one extremity and rounded at the other. Testa cinnamon-brown, thin and scaly. Seed exalbuminous, containing two large planoconvex oily cotyledons. Taste bland; when triturated with *water* forms a white emulsion with no marked odor." *Br.* Shelled almonds are sometimes substituted by the kernels of the peach, plum and apricot. The stone cells in the epidermal layer of the almond are much larger than in the kernels of the substitutes. For microscopic distinctions see Win-ton and Moeller, "*The Microscopy of Vegetable Foods.*" Almond cake a by-product in the manufacture of almond oil is largely used in the preparation of a class of detergent powders known as "almond meal." It is also used as a diabetic food and sometimes as an adulterant of ground spices and powdered drugs. By the analysis of Boullay, it appears that almonds contain 54 parts of fixed oil, 24 of protein, 6 of uncrystallizable sugar, 3 of gum, 9 of fibrous matter, 3.5 of water, and 0.5 of acetic acid, comprising loss. The protein is somewhat peculiar, consisting of *amandin* and *emulsin*, the latter being an enzyme. It may be obtained separate by treating the emulsion of almonds with ether, allowing the mixture, after frequent agitation, to stand until a clear fluid separates at the bottom of the vessel, drawing this off by a siphon, adding alcohol to it so as to precipitate the emulsin, then washing the precipitate with fresh alcohol, and drying it under the receiver of an air pump. In this state it is a white powder, inodorous and tasteless, soluble in water, and insoluble in ether and alcohol. Its solution has an acid reaction, and, if heated to 100° C. (212° F.), becomes opaque and milky, and gradually deposits a snow-white precipitate, amounting to about 10 per cent. of the protein employed. The distinguishing characteristic of the emulsin is that of producing certain changes noticed previously in amygdalin, which property it loses when its solution is boiled, although not by exposure in the solid state to a heat of 100° C. (212° F.). It consists of nitrogen, carbon, hydrogen, and oxygen, with a minute proportion of sulphur, and is probably identical with the *synaptase* of Robiquet. L. Portes has reported *asparagin* in sweet almonds. (*N. R.*, January, 1877.) The fixed oil is described under the head of *Oleum Amygdalae Expressum*, to which the reader is referred. Sweet almonds, when rubbed with water, form a milky emulsion, free from the odor of hydrocyanic acid, the insoluble matters being suspended by the agency of the albuminous,

mucilaginous, and saccharine principles.

Uses.—Sweet almonds have no other influence on the system than that of a nutrient and demulcent. The emulsion formed by triturating them with water is a pleasant vehicle. From their nutritive properties, and the absence of starch in their composition, they are much used in the diet of diabetics, as originally recommended by Pavy. (*Guy's Hosp. Rep.*, 1862, p. 213.) Almond meal or almond press cake is used for cosmetic purposes as an addition to the bath or to the water used in washing the face and hands. Much of the so-called almond meal used for this purpose is factitious or adulterated.

Off. Prep.—Emulsum Amygdalae, *U. S.*; Mistura Amygdalae, *Br.*; Pulvis Amygdalae Compositus, *Br.*

Anacahuite Wood.—In the year 1860 considerable quantities of this wood were imported from Mexico, into Germany, as a supposed remedy in phthisis, but it failed to sustain its first reputation. It is the product of *Cordia Boissieri* DC. (See *P. J.*, Dec., 1862, 272, with figure.)

Anacardium. *Anacardium occidentale* L. *West Indian Cashew-nut. Acajou a Pommés*, Fr. *Caschunuss*, G.—A small and elegant tree of the Fam. *Anacardiaceae*, growing in the West Indies and other parts of tropical America. A gum exudes from the bark, which bears some resemblance to gum arabic, but is only in part soluble in water, and consists of true gum and bassorin. It is the *gomme d'acajou* of the French writers. Peckoldt describes *cashew gum* as occurring in hard, fragile pieces which are more or less transparent, yellowish-brown, and stalactite-shaped, and is as soluble in water as acacia. (*Zeit. Oest. Apoth. Ver.*, 1893, 501.) The fruit is a fleshy, pear-shaped receptacle, supporting at its summit a hard, shining, ash-colored, kidney-shaped nut, an inch or more in length and three-quarters of an inch broad, consisting of a pericarp having large balsam canals and of a sweet oily kernel which is now an article of commerce, as a food sold either in the raw state or roasted and salted. The receptacle is red or yellow, and of agreeable subacid flavor with some astringency. It is edible, and affords a juice which has been recommended in uterine complaints and dropsy. This juice is converted by fermentation into a vinous liquor, which yields by distillation a spirit used in making punch, and said to be powerfully diuretic. The black juice contained between their outer and inner shell of the nuts is extremely acrid and corrosive, producing, when applied to the skin, severe inflammation, followed by blisters or des-quamation. Staedeler found in it two peculiar principles—*anacardic acid* and a yellow, oleaginous liquid, *cardol*. (See *J. P. C.*, 3e ser., xiii, 459.) The juice is used in the West Indies for the cure of *corns*, *warts*, *ringworms*, and obstinate *ulcers*, and even of *elephantiasis*. It is said to be sometimes applied to the face by women, in order to remove the cuticle, and produce a fresher and more youthful aspect. In a case of external poisoning which came under observation, in a lady who was exposed to the fumes of the roasting nuts, the face was so much swollen that for some time

not a feature was discernible. (*N. J. Med. Rep.*, 1855, 187.) In the case of a boy the tongue, face, neck, hands, forearms, scrotum, etc., were red and enormously swollen, and very painful. The tincture of iodine was found useful as a local application. The black juice of the nut and a milky juice which flows from the tree after incision are used for almost indelibly marking linen. The *Oriental Cashew-nut* or *Anacardium Orientale* is the fruit of *Semecarpus Anacardium*, L., a tree quite common in Southern Asia. It contains principles similar to the West Indian Cashew, and is also said to contain an alkaloid, *chuchunine*.

Anagallis. *Anagallis arvensis*, L. *Scarlet Pimpernel. Red Chickweed. Weather-glass. Mouronrouge*, Fr. *Gauchheil, RotheMiere*, G. (Fam. *Primulaceae*.)—An annual plant, growing in Europe and the United States. It has little odor, but a bitterish, somewhat acrid taste. The ancients esteemed it a counter-poison, and Orfila found three drachms of its extract to cause fatal gastroenteritis in a dog. It has been recommended as a local application to old and ill-conditional *ulcers*, and has been used as a folk-remedy in *visceral obstructions, consumption, dropsy*, etc. J. A. Heintzelman obtained from it a volatile oil of a strong, peculiar odor, a pungent and somewhat acrid taste, and the sp. gr. 0.987. Four drops (0.25 mil) of it produced intense headache and nausea, lasting for twenty-four hours, with pains throughout the body. According to Dacomo and Tommasoli, anagallis contains an active ferment, which rapidly digests raw meat. (*Rassegna di Sci. Med.*, 1892, No. 4.) *A. caerulea* (Schreb.) Ledeb., having blue petals, is a variety of *A. arvensis*, and shares its medicinal properties.

Anagyris. *Anagyris foetida*, L. (Fam. *Leguminosae*.)—Hardy and Gallois have separated from *Anagyris foetida* an alkaloid, *anagyrine*. Parthiel and Spasski found that the crude alkaloid could be separated into *cytisine*, $C_{11}H_{14}N_2O$ and *anagyrine*, $C_{15}H_{22}N_2O$; the latter is not obtainable in crystalline form; it forms a brittle, resinous-like mass easily reducible to a yellowish powder, but rapidly absorbs moisture and becomes sticky. It volatilizes at $245^{\circ} C.$ ($473^{\circ} F.$). (*Arch. d. Pharm.*, 244, No. 1, 1906, 20.) It forms, however, a crystalline hydrobromide.

Anagyrine hydrobromide, which has the formula $C_{14}H_{18}N_2O_2HBr$, occurs in colorless or faintly yellow crystals and soluble in water. Anagyrine, according to Loewi (*A. I. P.*, vol. vii, p. 66), is physiologically related to lobeline, acting primarily upon the nerve endings as a paralyzant and later upon nerve centers, but having no direct influence upon the muscles. It lessens the cardiac frequency and decreases the force of the systole in the frog, but is said in the mammal to have very little influence upon the blood pressure, death occurring through respiratory paralysis.

Anchietea. *Anchietea salutaris* St. Hil. *Cipo Suma. Cipo Carneiro. Pirageia*. (Fam. *Violaceae*.)—The bark of the root of this Brazilian plant contains *anchietine*, an alkaloid isolated by Peckoldt. (*Ber. d. Chem. Ges.*, 1897, p. 98.) It is used in Brazil in treating *scrofula, erysipelas*, and *eczema*. Given in doses of two drachms (7.7 Gm.), it acts as an aperient, while three drachm (11.6 Gm.) doses produce vomiting.

Anchusa. *Anchusa officinalis*, L. *Bugloss. Ox-tongue*. (Fam. *Boraginaceae*.)—The root, leaves, and flowers of this European biennial plant were at one time recognized

by the U. S. Pharmacopoeia, but probably are practically devoid of medicinal properties. In France the *Anchusa italica*, which is there known as *buglosse*, is substituted for *A. officinalis* and is still in popular use as a diaphoretic and diuretic.

Andrographis. Br. Add. 1900. *Andrographis paniculata* Nees. (Fam. *Acanthaceae*.) —Under the name of *Kiryat* this plant is stated to be used to some extent in India as a bitter tonic, having similar properties to chiretta. It appears scarcely to enter commerce at all, although exposed in the shops of the herbalists. (See *B. P. C.*, p. 122.) The Br. Add., 1900, recognized the *infusion* (*Infusum Andrographidis*, one ounce to a pint), *dose*, one-half to one fluidounce (15-30 mils); the *concentrated liquor* (*Liquor Andrographidis Concentratus*), *dose*, one-half to one fluidrachm (1.8-3.75 mils); and the *tincture* (*Tinctura Andrographidis*), *dose*, one-half to one fluidrachm (1.8-3.75 mils).

Andromeda. *Oxydendrum arboreum* (L.) DC., (*Andromeda arboreum* L.), *Sour Wood*, or *Sorrel-tree*, grows in the valleys of the Alleghanies, from Pennsylvania to Florida and west from Indiana to Louisiana. The decoction of the leaves was at one time used as a pleasantly acidulous drink in fevers. The powder of the leaves and buds of *Leucothoe racemosa* (L.) A. Gray (*Andromeda racemosa* L.) is said to be a powerful errhine.

J. F. Eykman, of Japan, found a poisonous glucoside, *asebotoxin*, in *Andromeda* (*Pieris japonica*). (*N. R.*, 1882, 290.) In 1883, Plugge separated from *Andromeda japonica* a colorless, crystallizable, poisonous principle, *andrometoxin*. Subsequently he found that various ericaceous plants contain it. (*A. Pharm.*, xxvi; also *A. J. P.*, 1889.) It exists in *Azalea indica* and *Rhododendron maximum* L., and has been found by De Zaayer (*Chem. Ztg*; July, 1887) in *Rhododendron ponticum*, and in *Kalmia angustifolia* L., and *K. latifolia* L.; also in *Monotropa uniflora* L., by A. J. M. Lasche (*Ph. Rund.*, Sept., 1889). It occurs in acicular crystals, melting at from 228° to 229° C. (442° - 444° F.), soluble in alcohol, amyl alcohol, chloroform, ether, benzene, much more soluble in cold than in boiling water, yielding solutions of an alkaline reaction, but not precipitated by ordinary alkaloidal reagents nor by solutions of metallic salts. For further tests, see reference; also *P. J.*, vol. xviii, 171. The *poisonous honey* of Xenophon, derived from the flowers of *Rhododendron ponticum*, probably owed its toxic properties to andrometoxin. (See also *Ph. Z. R.*, 1883, xxii.) The oil of *Andromeda Leschenaultii*, of India, was found by J. Broughton to be methyl salicylate. (*P. J.*, Oct., 1871.)

ANETHI FRUCTUS. Br. DILL FRUIT

"Dill Fruit is the dried ripe fruit of *Peucedanum graveolens*, Benth. and Hook. f." *Br.*

Garden Dill, Dilly, Anet; Aneth, *Fr. Cod*; Fenouil puant, *Fr.*; Dill, *G.*; Eneldo, *Sp.*

Peucedanum graveolens (*Anethum graveolens* L.), or garden dill,

resembles the fennel plant, but is smaller. It is an annual plant, three or four feet high, with a long spindle-shaped root; an erect, striated, jointed, branching stem; and bipinnate or tripinnate, glaucous leaves, which stand on sheathing footstalks and have linear and pointed leaflets. The flowers are yellow, and in large, flat, terminal umbels, destitute of involucre. The plant is a native of Spain, Portugal, and the south of France, and is found growing wild in various parts of Africa and Asia. It is cultivated in all the countries of Europe, and has been introduced into our gardens. The whole plant is aromatic, the leaves are used as a flavor for soups, sauces and pickles. For a paper by J. C. Umney describing the commercial varieties, see *Year Book of Pharmacy*, 1898, 374. The seeds, as the fruit is commonly called, are the only part used. They are " composed of two mericarps usually separate and freed from the pedicel; each broadly oval, about four millimetres long, and two to three millimetres broad; brown; very strongly compressed dorsally; dorsal ridges inconspicuous, but the lateral ridges prolonged into paler brown wings. In transverse section, six- vittae in each mericarp. Odor and taste agreeably aromatic." *Br.* These properties depend on a volatile oil, which is present in the fruits to the extent of 2.8 to 4 per cent. (See *Oleum Anethi*.) The bruised fruits impart their virtues to alcohol and to boiling water.

Uses.—Dill seeds have the properties common to the aromatics, but are very seldom used in this country. They may be given in powder or infusion.

Dose, of the fruit, from fifteen grains to a drachm (1-3.9 Gm.); of the oil, two or three minims (0.12-0.2 mil).

Off. Prep.—Aqua Anethi, Br.

Angelica.—Two species of this genus are used in medicine, the *Angelica Archangelica* L. (*Garden Angelica*), a native of Europe, and the *A. atropurpurea* (*Masterwort*), which grows throughout the eastern United States. *Garden angelica* has a long, thick, fleshy, biennial root, furnished with many rootlets, and sending up annually a, hollow, jointed, round, channelled, smooth purplish stem, which rises five feet or more in height, and divides into numerous brancha. The plant is a native of the north of Europe, and is found in the high mountainous regions in the southern section of that continent, as in Switzerland and among the Pyrenees. It is often cultivated. The whole plant is aromatic, but the root only is official in the Swiss, Austrian, and German Pharmacopoeias, while the fruit is official in the N. F. IV. The root should be dug up in the autumn of the first year, as it is then least liable to become mouldy and worm eaten. It is spindle-shaped, 4 to 6 cm. thick at the crown, and beset with long

descending rootlets. The fresh root has a yellowish-gray epidermis, a fleshy yellow parenchyma, and when wounded yields a honey-colored juice, having all the aromatic properties of the plant. The dried root is grayish-brown and much wrinkled externally, whitish and spongy within, and breaks with a starchy fracture, exhibiting shining resinous masses. It is very apt to be attacked by insects. The drug and the powder should be conserved by the addition of a few drops of chloroform or carbon tetrachloride. The odor is strong and fragrant, and the taste at first sweetish, afterwards warm, aromatic, bitterish, and somewhat musky. These properties are extracted by alcohol, and less perfectly by water. The constituents of the root are *angelic acid*, $C_5H_8O_2$, a monatomic acid of the acrylic series, valeric acid, $C_5H_{10}O_2$, resin, bitter principle, tannin, pectin, malic acid, sugar starch and a volatile oil consisting largely of phellandrene. For further information concerning the constituents of this drug, see *U. S. D.*, 19th ed., p. 1386. *Schim. Rep.*, 1902, 15; 1911, 21; 1913, 26.

Angelicas Fructus, *N. F. IV, Angelica Seed*, is described by the N. F. as "the ripe fruit of *Angelica Archangelica* Linne (Fam. *Umbelliferae*) and of other species of *Angelica*, without the presence of more than 3 per cent. of foreign matter. Cremocarps oval, externally of a pale yellowish-brown color, from 4 to 8 mm. in length, 3 to 6 mm. in breadth and from 1 to 2 mm. in thickness, the base faintly notched, the summit bearing five minute calyx-teeth and the remains of the style; the two mericarps joined by their broad faces, or separate; each mericarp nearly flat upon one surface, which bears a central longitudinal groove and has sharp, slightly upturned margins, convex upon the other surface which is traversed longitudinally upon the back by three strong ribs, separated from one another by narrow grooves and from the margin by much broader grooves; pericarp soft, rather tough and corky, and enclosing a single seed, showing on cross section six large oil-tubes. Odor characteristic and agreeable; taste aromatic, pungent, and sweetish. *Angelica Fruit* yields not more than 8 per cent. of ash."

Garden angelica is an aromatic tonic. The Laplanders, in whose country it nourishes, esteem it highly as a condiment and medicine. In Europe the stems are frequently made into a preserve. The dose of the root or seeds is from thirty grains to a drachm (2-3.9 Gm.).

The N. F. IV recognizes under the name of *Angelica Radix (Angelica Root)* "the rhizome and roots of *Angelica atropurpurea* Linne (Fam. *Umbelliferae*) and of other species of *Angelica*, without the presence of more than 5 per cent. of stem bases and leaves or other foreign matter. Preserve *Angelica Root* in air-tight containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects. Rhizomes short and thick, from 5 to 10 cm. in length, sometimes split, frequently crowned with the bases of stem and leaves; the roots are numerous, from 10 to 20 cm. in length and from 5 to 7 mm. in thickness at the base and gradually tapering to about 1 mm.; frequently twisted or braided together, externally dark gray-brown to reddish- or purplish-brown and with conspicuous, rather deep furrows; when dry breaking with a smooth fracture. On cross section, the rhizome shows a distinct pith, which is absent in the root, and both exhibit a spongy bark

nearly or quite as wide as the woody zone; in the bark are radial rows of brownish canals containing oleoresin. The wood rays are finely porous and narrower than the medullary rays. The bark is rich in starch. Odor strongly aromatic; taste sweetish, pungent, aromatic, and then bitter. The powdered drug is yellowish-brown and, when examined under the microscope, exhibits numerous, mostly simple, irregularly spherical starch grains, up to 0.008 mm. in diameter, sometimes with the cleft at the center and occasionally two- or more compound; tracheae or fragments of tracheae, with reticulate markings or large simple pores up to 0.075 mm. in width; brownish oil canals or fragments thereof, up to 0.23 mm. in diameter, sometimes with adjoining epithelial cells; fragments of parenchyma tissue with some of the cells filled with starch; fragments of large brownish cork cells; sclerenchymatous fibers with thin walls and often with oblique markings; yellowish oil globules. Angelica Root yields not more than 8 per cent. of ash." It has a strong odor and a warm aromatic taste. The juice of the recent root is acrid, and is said to be poisonous; but the acidity is dissipated by drying. The medicinal virtues of the plant are similar to those of the garden angelica of Europe, for which it has been proposed as a substitute. It is, however, inferior to the European angelica. Its uses are similar to those of the root.

Angrecum. *Angrecum fragans* Thouars.—This is an orchidaceous plant, indigenous to the Isle of Reunion and to Mauritius, where the leaves have been long used, under the name of *faham*, for the same purposes as tea leaves. For description, see *P. J.*; 1881, 913. They have a somewhat pungent aromatic taste, and a strong and highly agreeable odor, scenting the whole apartment with a delicious perfume. Given in infusion, they appear to have an effect on the system somewhat similar to that of Chinese tea, and they have been introduced into Paris as a rival of that popular beverage. The drink is made by putting the leaves and stalks, in the proportion of fifteen grains (1 Gm.) to a teacupful, into cold water, boiling for about ten minutes, and then pouring into a closed vessel, and sweetening it when used. (*A. J. P.*, 1866, 441.)

Anhalonium.—Under the name of *Pellote* are used in Mexico for narcotic purposes, certain cacti whose tops have entered commerce under the name of *MescalButtons*. These were formerly believed to belong to the genus *Anhalonium*, but at present are referred to species of *Mammalaria* and of the genus *Echinocactus*, which is characterized by a flexible epidermis, its freedom from spines and tubercles and its segments not assuming the form of a projecting or leaf-like organ. (See Schumann in Engler and Prantl's *Pflanzenfamilien*, and *Reports of Missouri Botanical Gardens*, 1898.) In a mass of such cactus tops sent to the Pharmaceutical Institute of Leipzig from Mexico as *pellote*, experts have recognized the products of *Mammalaria fissuratus*, *M. retusus*, *Echinocactus Williamsii* Lem., and *E. Lewenii* Henn. Moreover, from *A. jourdanianum*, L., Lewin obtained traces of an alkaloid (*A. E. P. P.*, xxxiv). There is little doubt but that various allied species of cactus are represented in the commercial drug. The most important of these plants are *E. Lewenii* and *E. Williamsii*, which inhabit the valley of the Rio Grande in Mexico, and are furnished with stems reaching about half an inch above the surface of the ground, surmounted by a top composed mainly of the blunt leaves of the plant, bent around a tuft, of from half an inch to an inch in diameter, composed of short, yellow-white filaments or hairs.

It is this top which constitutes the mescal button, which is from an inch to an inch and a half in diameter, one-fourth of an inch in thickness, with a convex under surface, a texture which is brittle and hard when dry, but becomes soft when moistened, a very bitter disagreeable taste, and an odor when moist which is peculiar and disagreeable, and is especially marked in the powdered drug. According to C. H. Thompson, the buttons of *E. Lewinii* and *E. Williamsii* are readily distinguished by the fact that the surface of *E. Lewinii*, is traversed by thirteen shallow narrow furrows giving the appearance of there being as many irregular or much broken ribs or obtuse ridges, while in *E. Williamsii* the furrows and ridges are eight in number atod regular.

In 1888, L. Lewin separated from *E. Lewinii* an alkaloid, *anhalonine*, which has the formula $C_{12}H_{15}NO_3$, and crystallizes in small white prisms, soluble in ether, alcohol, and chloroform. Subsequently, Heffter (*Ber. d. Chem. Oes.*, 1896) separated from *E. Lewinii*, besides anhalonine, three alkaloids: *mescaline*, $C_{17}H_{17}NO_3$, in white needles melting at $151^{\circ} C.$ ($303.8^{\circ} F.$) ; *anhalonidine*, $C_{12}H_{15}NO_3$, fusing at $160^{\circ} C.$ ($320^{\circ} F.$), and *lophophorine*, $C_{13}H_{17}O_3$. (See also *A. E. P. P.*, 1898, xl.)

Kander (*A. Pharm.*, 1899, vol. ccxxxvii) has found that in commercial mescal buttons, besides the alkaloids already mentioned, are two other bases, *pellotine* and *anhalanine*, so that Merck has offered as commercial products the following salts: *Anhaloninae Hydrochloridum* cryst., *Anhalonidinae Hydrochloridum* cryst., *Lophophorinae Hydro-chloridum* cryst., *Mescalinae Sulphas* cryst., *Pellotinae Hydrochloridum* cryst. According to the researches of Heffter, *pellotine*, $C_{13}H_{19}NO_3$, is contained exclusively in *L. Williamsii*, but as this cactus is present in most, if not all, of the commercial buttons, it was naturally found by Kander in analyzing the commercial drug. However, the correctness of the conclusion of Heffter is challenged by Merck's chemists, who, in the analysis of *L. Williamsii*, found the same quantity of the same alkaloids as is present in the true mescal button. For a description of these alkaloids see *M. R.*, 1898 and 1900. E. White (*J. P.*, xxv) obtained *mescaline*, 1.16 per cent.; *anhalonidine*, 1.16 per cent.; *anhalonine*, 0.46 per cent.; *lophophorine*, 0.14 per cent. *Anhaline*, $C_{10}H_{17}NO$, is an alkaloid crystallizing in colorless stellate prisms, which has been extracted from *L. fissuratum*.

From time immemorial the Kiowa Indians of the Rio Grande have used the mescal buttons for the purpose of producing intoxication during their religious ceremonies. Attention was first called to the peculiar cerebral action of the drug by D. W. Prentiss and Francis P. Morgan (*T. G.*, 1895), who found that from two hundred and fifteen to two hundred and thirty grains (14-15 Gm.) (four to five buttons) will produce a peculiar cerebral excitement attended with an extraordinary visual disturbance, characterized by an incessant flow of visions of infinite beauty, grandeur, and variety, of both color and form, often followed after a time by the seeing of monsters, grotesque faces, and gruesome shapes. During the intoxication there are dilatation of the pupil, muscular relaxation, and some slowing of the pulse. Loss of sense of time, partial anesthesia, weakened heart's action, great muscular relaxation, wakefulness, and in some cases nausea and vomiting also have been noted, but no distinct alteration of the respiration. These results have been confirmed by several observers.

A. Mogilewa (*A. E. P. P.*, xlix, 137) found that mescaline, anhalonidine, anhalonine, lophophorine, and pelletine acted similarly in lessening the frequency and force of the isolated frog heart, varying simply in quantitative power. The most thorough research upon the anhalonium alkaloids is that of W. E. Dixon [*J. P.*, xxv) whose report is somewhat marred by the fact that he does not state in his experiments which one of the alkaloids was employed; he simply affirmed that anhalonine and anhalonidine are identical in physiological activity, that lophophorine differs only in being more toxic, and that mescaline has a physiological action almost indistinguishable from that of its associated alkaloids. He finds that "the alkaloid" is not locally anesthetic; that increased salivation is one of the most characteristic symptoms of its action; that in therapeutic doses, in man at least, it produces constipation, but that in toxic dose it causes diarrhea and bloody stools; that its main circulatory effect is upon the cardiac muscle and contained ganglia, causing slowing of the heart and a rise of arterial pressure; that it kills by action on the respiratory centers so that in man the most serious result of an overdose is rapid, shallow breathing, with a sense of suffocation; that upon the nervous system it acts most powerfully, producing in the frog, and to a lesser degree in the mammal, increasing loss of muscular power with heightened reflexes, believed to be due to spinal stimulation. The motor nerves appear to be depressed, since they are paralyzed when the drug is applied locally to them. In experiments upon two human subjects, there was wide dilatation of the pupils, with uncertainty of gait like that of alcoholic intoxication, tremors, and heightened reflexes, although sensation was distinctly blunted. The psychical symptoms caused by the largest doses resemble somewhat those from *cannabis indica*. The *dose* of the alkaloid used by Dixon was three and eight-tenths grains (0.25 Gm.).

In Heffter's experiments *pellotine* was found to be physiologically feeble, one-thirteenth grain (0.005 Gm.) causing only temporary stiffness in the legs of the frog, two-thirteenths grain (0.01 Gm.) producing stiffness, heightened reflexes, strychnine-like tetanus, lasting from three to four days, ending in recovery. In man, from seven-tenths to nine-tenths of a grain (0.045-0.058 Gm.) produced only temporary sleeplessness with sense of weariness. Pilcz (*W. K. W.*, ix, 1896) has used *pellotine* as a calmative in fifty-eight cases of insanity in doses of from one-third to one grain (0.021-0.065 Gm.). About half the cases were markedly affected, sleep coming on in from half an hour to an hour and a half after the hypodermic injection and continuing through the night. No disagreeable results and no collapse occurred, although Langstein is said to have seen collapse following the dose of seven-tenths of a grain (0.045 Gm.).

The value of mescal buttons as a remedial agent is doubtful; it has been employed to a slight extent in various forms of *neurasthenia* and *hysteria*, and is asserted by S. F. Landry (*T. G.*; 1888) to be especially valuable in cases of *asthma*. It has also been alleged to be useful in *neuralgic* and *rheumatic affections*. Prentiss and Morgan give the dose of the crude drug as from seven to fifteen grains (0.45-1.0 Gm.); of the fluidextract, from ten to fifteen minims (0.6-0.9 mils) ; of the 10 per cent. tincture, from one to two teaspoon-fills (3.75-7.5 mils).

ANISUM. U.S. (Br.) ANISE Anis. [Aniseed]

"The dried ripe fruit of *Pimpinella Anisum* Linne (Fam. *Umbelliferae*) without the presence or admixture of more than 3 per cent. of foreign seeds or other vegetable matter." *U. S.* " Anise Fruit is the dried ripe fruit of *Pimpinella Anisum*, Linn." *Br.*

Anisi Fructus, *Br.*; Fructus (Semen) Anisi, s. Anisi vulgaris; Aniseed, Anny, Aneys, Annyle; Anis, Anis vert, Graines d'Anis, *Fr.*; Fructus Anisi, *P. G.*; Anissame, Anis, *G.*; Anice, Anace, Semi d'Aniso, *It.*; Anis (Fruto de), Simiente de Anis, *Sp.*; Anison, *Ar.*

Pimpinella Anisum is an annual plant, about a foot in height, with an erect, smooth and branching stem. The leaves are petiolate, the lower roundish-cordate, lobed, incised-serrate, the middle pinnate-lobed with cuneate or lanceolate lobes, the upper trifid, or undivided, linear. The flowers are white, and in terminal compound umbels, destitute of involucre.

The anise plant is a native of Egypt and the Levant, but has been introduced into Southern Europe and is cultivated in all warm climates, especially Germany, Russia, Italy, Spain, France, Turkey, India, Japan and Chili. It is also cultivated occasionally in the gardens of this country. The Spanish is smaller than the German or French, and is usually preferred; the Russian fruit is very short. It is said also to be extensively cultivated in India and South America, although we are not aware that the product ever comes into American commerce. It is estimated that over a million pounds of anise are imported annually.

It is one of the oldest aromatics, having been used by the old Egyptians, and is spoken of by Theophrastus and cultivated in the imperial German farms of Charlemagne. In 1305 Edward I granted a patent giving the right to levy tolls upon it at the Bridge of London for the purpose of repairing the bridge.

Anise seeds (botanically, fruit) are officially described as follows: "Cremocarp broadly ovoid or pyriform, laterally compressed, from 3 to 6 mm. in length and from 2 to 3 mm. in breadth; mericarps usually cohering and attached to a slender pedicel from 2 to 12 mm. in length; summit with a ring-like disk and 2 projecting, diverging styles; externally grayish or greenish-gray, seldom grayish-brown, slightly pubescent; each with five light brown filiform ridges and in cross-section with from 15 to 45 vittae. Odor and taste agreeable and aromatic. Under

the microscope transverse sections of Anise show an epidermal layer with numerous papillae and short, one-celled, non-glandular hairs having very thick papillose walls; primary ribs each with a small fibrovascular bundle, surrounded by a few sclerenchymatous fibers; vittae or oil-tubes from 15 to 45 in number, extending as a more or less interrupted circle in the tissues of the mesoearp on the dorsal side of each mericarp; 2 large vittae on the commissural surface, each separated from the other tissues of the mericarp by a large cavity due to shrinkage of the seed-coat; inner epidermis of pericarp consisting of a layer of narrow, tangentially elongated cells closely united with the 1-layered seed-coat, the inner walls of which are yellowish-brown and considerably thickened; endosperm of polygonal, thick-walled cells filled with spherical or ellipsoidal aleurone grains, each containing a small rosette aggregate of calcium oxalate; the aleurone grains surrounded with an oily protoplasm, the oil of which is liberated upon mounting sections in hydrated chloral T.S., in the form of small globules; epidermal layer near the middle of the commissural surface composed of 2 or 3 rows of cells with thick porous walls, and beneath which occur small groups of thick-walled cells resembling stone cells. The powder is yellowish-brown; consisting of numerous irregular fragments of pericarp showing portions of the yellowish vittae, fragments with tracheae and sclerenchymatous fibers of carpo-phore; cells of endosperm filled with aleurone grains about 0.006 mm. in diameter, each usually enclosing a rosette aggregate crystal of calcium oxalate about 0.002 mm. in diameter; non-glandular hairs 1-celled, from 0.025 to 0.2 mm, in length, either straight or curved and with numerous, slight, centrifugal projections on the outer surface. Heat 1 Gm. of the whole drug or powdered drug with 10 mls of potassium hydroxide T.S.; no mouse-like odor develops (fruits of *Conium maculatum* Linne). Anise yields not more than 9 per cent. of ash." *U. S.*

"Ovoid, somewhat compressed laterally; about five millimetres long and two millimetres broad. Mericarps usually united and attached to the pedicel. Rough from the presence of short, bristly hairs. Greenish-grey or greyish-brown; primary ridges pale, slender and entire. In transverse section, numerous vittae in each mericarp; commissural surface of the endosperm not deeply grooved. Agreeably aromatic odor; taste aromatic and sweet. Ash not more than 11 per cent." *Br.*

Their odor and taste, which depend upon a peculiar volatile oil existing to the extent of from 1.5 to 3.5 per cent., are imparted sparingly to

boiling water, but freely to alcohol. (See *Oleum Anisi*.) The endosperm of the fruit contains a bland fixed oil. By expression, a greenish oil is obtained, which is a mixture of the two. The fruits are sometimes adulterated with fine gravel and small fragments of an argillaceous earth which resembles them in color. This accounts for the fact that the amount of ash may run as high as 30 per cent., greatly exceeding the official requirements. Their aromatic qualities are occasionally impaired by a slight fermentation, which they are apt to undergo in the mass, when collected before maturity. Russian anise is sometimes admixed with as much as 30 per cent. of coriander. Anise is also contaminated with weed seeds and stems of the anise plant.

The Italian anise not infrequently is admixed with from 2 to 10 per cent. or even 50 per cent. of the fruits of conium. A case of poisoning is on record from the accidental admixture of the fruits of *Conium maculatum*, which latter may be distinguished by their crenate or notched ridges and the absence of oil tubes; by their mericarps being smooth, grooved upon the face, and having crenate or notched ridges with wrinkles between them. The conium fruits are, moreover, broader in proportion to their length, and are generally separated into half fruits (or single mericarps), while those of anise are whole (double mericarps).

Star aniseed, the *Cardamomum Siberienae* or *Annis de Siberie* of the seventeenth century and the *badiane* of the French writers, is the product of *Illicium verum* Hook. f., Gaertn., and is fully described under the heading *Illicium*. They contain about 4 per cent. of a volatile oil very closely resembling that of anise. There are no known chemical differences between these oils, although dealers distinguish them by their odor and taste.

Ruschenberger, U. S. N., has shown that oil of anise has a remarkable power of masking the odor of potassium sulphide; a drop of the oil having entirely deprived of offensive odor a drachm of lard with which five grains of the sulphide had been incorporated. (*Am. J. M. S.*, N. S., xlviii, 419.)

Uses.—Anise, a grateful aromatic carminative, may be used in flatulent colic, and as a corrigent of griping or unpleasant medicines.

Dose, eight to fifteen grains (0.5-1.0 Gm.); of the oil, which should

always be preferred, three to eight minims (0.2-0.5 mil).

Off. Prep.—Aqua Anisi, *U. S.* (from Oil of Anise), *Br.*; Species Laxativae, *N. F.*; Species Pectorales, *N. F.*; Tinctura Rhei Dulcis, *N. F.*

Anisodus. *Anisodus luridus* Link and Otto. (*Scopolia lurida* Dun.)—This is a Himalayan solanaceous plant in which Siebert has found atropine and hyoscyamme. (*A. Pharm.*, Feb., 1890; *P. J.*, March, 1890.)

Annatto. *Orleana. Annotta. Arnotta. Terre de la. Nouvelle-Orleans, Fr. Orellana, Orlean, G.*— The coloring substance called *annatto*, *arnotta* or *roucou*, is the reddish pulp surrounding the seeds in the fruit of *Bixa orellana* L. (Fam. *Bixaceae*), a middle-sized tree native to Northern South America, but widely cultivated in tropical Asia and Africa. The pulp is separated by bruising the fruit, mixing it with water, then straining through a sieve, and allowing the liquid to settle. The mass which remains is dried and formed into flat cakes or cylindrical rolls. Another mode is to bruise the seeds, mix them with water, and allow the mixture to ferment. The coloring matter is deposited during the fermentation, after which it is removed and dried. In commerce there are two kinds of annatto, the Spanish or Brazilian, and the French, the former coming in baskets from Brazil, the latter in casks from French Guiana. The French, which is also called *flag annatto*, has a disagreeable odor, probably from having been prepared by the fermenting process in which urine is sometimes used; but is superior, as a dye stuff, to the Spanish, which is without any disagreeable odor. Annatto is of a brownish-red color, usually rather soft, but hard and brittle when dry, of a dull fracture, of a sweetish peculiar odor, and a disagreeable, saline, bitterish taste. It is inflammable, but does not melt with heat. It softens in water, to which it imparts a yellow color, but does not dissolve. Alcohol, ether, the oils, and alkaline solutions dissolve the greater part of it. The South American Indians are said to produce directly from the annatto seeds, without fermentation, a color similar to and almost as brilliant as carmine. (*P. J.*, April, 1903.) For a proximate analysis of the leaves see *Ap. Ztg.*, 1899, p. 35. It contains a peculiar coloring principle, to which Preisser, its discoverer, gave the name of *bixin*. This has the formula $C_{28}H_{34}O_5$, and when pure is a dark, red, somewhat crystalline substance. According to Van Hasselt, *bixin* has the composition $C_{29}H_{34}O_5$, but Heiduschka and Eiffart believe that the correct formula is $C_{29}H_{34}O_5$. (*A. Pharm.*, 1911, No. 1, 39.) It is accompanied by a yellow coloring matter, *orellin*. A coloring matter found in the root of *Escobedia scabrifolia*, a plant growing in tropical America, is used by the Mexicans in coloring fats and butter yellow. (*S. W. P.*, 1912, No. 18, 260.) The chief uses to which annatto is applied are for dyeing silk and cotton orange-yellow, and for coloring cheese and butter. The color, however, which it imparts to cloth is fugitive. It has been given internally as a medicine; but is not now used, and probably exercises little influence upon the system. In pharmacy it is employed to color ointments and plasters, and has occasionally been substituted for saffron. It is frequently adulterated with red ochre, powdered bricks, colcothar, farinaceous substances, chalk, calcium sulphate, turmeric, etc. The mineral substances, if present, will be left behind when the annatto is burned. *Tincture of annatto* is made by extracting 100 parts of annatto with 100 parts of

water containing 1 $\frac{1}{2}$ per cent. of potassium carbonate, and evaporating to 60 parts, mixing with 12 parts of alcohol and filtering.

Anona.—The seeds of *A. squamosa*, L., Sugar Apple or Sweet Sop of the West and East Indies, are said to be poisonous and to be used to kill lice, while the bark is a drastic cathartic. The seeds of *A. muricata*, L., *A. palustris*, L., and *A. spinescens*, Mart., are employed to poison fish and to exterminate destructive insects. (*Ph. Rev.*, Oct., 1896.)

ANTHEMIDIS FLORES. Br.
**CHAMOMILE FLOWERS [Chamomile, English Chamomile,
Roman Chamomile]**

"Chamomile Flowers are the expanded flower-heads of *Anthemis nobilis*, Linn., collected from cultivated plants, and dried." *Br.*

Anthemis, *U. S. VIII*; Flores Chamomillae Romanae, *P. G.*; Roman, Low, Garden, White or English Chamomile, Chamomile Flowers, Camil, Camovyne, Whig-plant; Camomille Romaine, *Fr.*; Romische Kamille, *G.*; Camomilla Romana, Camomilla Ingleses, *It.*; Manzanilla (Flor de), Manzanilla Romana, *Sp.*

Chamomile flowers were formerly recognized by the U. S. Pharmacopoeia. They still receive official recognition in the British, Austrian and Swiss Pharmacopoeias.

Several species of anthemis have been employed in medicine. *A. nobilis*, which is the subject of the present article, is by far the most important. *A. Cotula* L., *Dog Fennel*, or *mayweed*, was formerly recognized by the U. S. Pharmacopoeia. *A. arvensis* L. (*corn chamomile*), a native of Europe, naturalized in this country, bears flowers which have an acrid bitter taste and possess medicinal properties analogous though much inferior to those of common chamomile. They may be distinguished by their want of odor. *A. tinctoria* L. is occasionally employed as a tonic and vermifuge in Europe. *Matricaria suaveolens* is said to yield the chamomile of the Indian bazaars.

Anthemis nobilis is an herbaceous plant with a perennial root. The stems are from six inches to a foot long, round, slender, downy, trailing, and divided into branches, which turn upward at their extremities. The leaves are bipinnate, the leaflets small, thread-like, somewhat pubescent, acute, and generally divided into three segments. The

flowers are solitary, with a yellow convex disk, and white rays. The involucre is of a hemispherical form, and composed of several small imbricated hairy scales. The receptacle is convex, prominent, and furnished with rigid bristle-like paleae. The ray florets are numerous, narrow and terminated with three small teeth. The whole herb has a peculiar fragrant odor, and a bitter aromatic taste.

This plant is a native of Europe, and grows wild in all the temperate parts of that continent. It is also largely cultivated for medicinal purposes. In France, Germany, and Italy, it is generally known by the name of *Roman chamomile*. By cultivation the yellow disk florets are often converted into the white ray florets. Thus altered, the flowers are said to be *double*, while those which remain unchanged are called *single*; but, as the conversion may be more or less complete, it generally happens that with each of the varieties there are intermingled some flowers of the other kind, or in different stages of the change. The double flowers are generally preferred; though, as the sensible properties are found in the greatest degree in the disk florets, the single flower heads are the more powerful. It is rather, however, in aromatic flavor than in bitterness that the radial florets are surpassed by those of the disk. If not well and quickly dried, the flowers lose their beautiful white color, and are less efficient. The flowers which are largest, most double, and whitest should be preferred. They are thus described: "Flower-heads hemispherical, from about twelve to twenty millimetres in diameter, white or pale buff in color. Involucre composed of several rows of oblong bracts with membranous margins; receptacle solid, conical, and densely covered with concave, blunt, narrow, scaly bracts; florets mostly ligulate and white, the ligula possessing four veins and terminating in three teeth. Strong aromatic odor; taste bitter." *Br.*

The seeds yield by expression a fixed oil, which is said to be applied in Europe to various economical uses.

Though not a native of America, chamomile grows wild in some parts of this country, and is occasionally cultivated in our gardens for family use, the whole herb being employed. The medicine, as found in commerce, consists chiefly of the double flowers, and is imported from Germany and England. From the former country the flowers of *Matricaria Chamomilla* are also occasionally imported, under the name of chamomile. (See *Matricaria*.) In Europe the flowers of *A. arvensis* L., corn chamomile, are sometimes substituted for the official drug. In

France corn chamomile flowers are sold in commerce indiscriminately with those of *Anthemis nobilis*, of *Chrysanthemum Parthenium* Bernli. (*Pyrethrum Parthenium* iSmith), or of *Anthemis parthenoides* De Cand. (*Matricaria parthenoides* Desf.). (J. P. C., May, 1859, p. 347.) For the peculiar character by which these two flowers may be distinguished from the chamomile, see *Pyrethrum parthenium*..

Properties.—Chamomile flowers, as usually found in commerce, are large, almost spherical, of a dull white color, a fragrant odor, and a warmish, bitter, aromatic taste. When fresh, their odor is much stronger, and was fancied by the ancients to resemble that of the apple. Hence the name *chamaemelum*; and it is somewhat singular that the Spanish name *manzanilla* (a little apple) has a similar derivation. The flowers impart their odor and taste to water and alcohol, the former of which, at the boiling' temperature, extracts only one-fourth of their weight. The investigations of several chemists made in 1878-1879, in Fittig's laboratory at Strassburg, have shown the *oil of chamomile* to contain the following constituents: a fraction distilling at 147° to 148° C. (296.6°-298.4° F.) consisting of *isobutylic esters* and hydrocarbons; *isobutyl angelicate* at 177° C. (350.5° F.); *isoamyl angelicate* at 200° to 201° C. (392°-394° F.); *isoamyl tiglicate* at 204° to 205° C. (399°-401° F.) (both of these esters answering to the formula $C_5H_{11}, C_5H_7O_2$). In the residual portion, hexylic alcohol, C_6H_{13}, OH , and an alcohol of the formula $C_{10}H_{16}O$ isomeric with camphor, to which the name of *anthemol* has been given (see *Chem. Cb.*, 1903 (1), 1226), are met with, both probably occurring in the form of esters. By decomposing the angelicates and the tiglicate with potassium hydroxide, *angelic acid*, $C_5H_8O_2$, and *tiglinic acid* (or *methyl-crotonic*), isomeric with the former, are obtained to the extent of about 30 or more per cent. of the crude oil. In the oil examined by Fittig, angelic acid prevailed; from another specimen E. Schmitt (1879) obtained but very little of it, tiglinic acid prevailing. Naudin (*Bull. Soc. Chim.*, 1884, 41, 483) extracted also a solid paraffin, $C_{18}H_{36}$, to which the name of *anthemene* was given; Klopp obtained another body, anthesterin, from chamomile. (*P. J.*, 1903, 458.) Umney states that pure oil of chamomile has the sp. gr. 0.905 to 0.912 at 15° C. (59° F.) (*P. J.*, 1895, p. 949). The oil from *Anthemis Cotula* closely resembles that from *A. nobilis*, see *A. J. P.*, 1885, pp. 376, 381. E. Amerman (*A. J. P.*, 1889, p. 69) obtained a wax which was nearly white, bitter, and crystalline, melting at about 130° C. (266° F.), and a crystalline substance distinctly acid and of a glucosidal nature.

There was no evidence of the presence of an alkaloid. (See *Oleum Anthemidis*, Br., and *Extractum Anthemidis*, Br. Pharm., 1898.)

Uses.—Chamomile is a mild tonic, in small doses acceptable and corroborant to the stomach, in large doses capable of acting as an emetic. In cold infusion it is often advantageously used in cases of *enfeebled digestion* in convalescence, of *general debility*, with languid appetite, which often attends convalescence from infectious fevers. The flowers are sometimes applied externally in the form of fomentation, in cases of irritation or inflammation of the abdominal viscera, and as a gentle incitant in flabby, ill-conditioned *ulcers*. The infusion is usually preferred. The decoction or extract cannot exert the full influence of the medicine, as the volatile oil is driven off.

Dose, of the powder as a tonic, from half a drachm to a drachm (2.0-3.9 Gm.) three or four times a day, or more frequently.

Anthriscus. *Anthriscus cerefolium* (L.) Hoffm. (*Chaerophyllum sativum* Lam. *Scandix cerefolium*, L.), *Chervil*.—An annual European plant of the Fam. *Umbelliferae*, cultivated in gardens as a pot-herb, and naturalized in Eastern and Southern Pennsylvania. It has a strong agreeable odor, and a pungent, slightly bitterish taste. It contains a volatile oil of very feeble medicinal power, but it has been used as an emmenagogue and diuretic.

Aphloia theaeformis Benn. (Fam. *Bixaceae*).— This plant is a native of Madagascar and is claimed to possess marked alterative properties and beneficial effects upon hemoglobin. It is administered as an infusion of the leaves, 30 Gm. of the plant being used to make 1 liter of infusion.

Apocynum. *N. F. IV (U. S. P. VIII). Canadian Hemp. Black Indian, Hemp. Dogbane. Chanvre du Canada, Fr. Canadische Banfwurzel, G.*—"The dried rhizome and roots of *Apocynum cannabinum* Linne (Fam. *Apocynaceae*), without the presence of more than 5 per cent. of stems or other foreign matter." *N. F. IV.* Although latterly apocynum has fallen into disuse, some physicians have insisted that the *A. cannabinum* is a valuable remedy and that its unfavorable reputation has arisen from the use of other species. The drug of commerce in recent years has consisted of several species of *Apocynum*. A number of physicians in the United States have come to the conclusion that the absorption of *Apocynum* in the gastro-intestinal tract is uncertain and irregular, which led to its being deleted from the Pharmacopoeia. It has been admitted into the N. F.

There are several indigenous species of this genus of very similar general aspect, the rhizome and roots of two of them being collected, viz.: *Apocynum cannabinum*, L., and *A. androsaemifolium*, L. Both plants abound in a milky juice, and have a tough, fibrous bark, which, by maceration, affords a substitute for hemp; hence the common

name. It is used by the Indians of California for making all manner of cordage and for weaving.

In *A. cannabinum* the stems and branches are upright or ascending, terminated by erect and close, many-flowered cymes, which are usually shorter than the nearly sessile leaves, and the corolla has nearly erect lobes, with the tube not longer than the lanceolate divisions of the calyx. In *A. androsaemifolium* the branches are divergently forked, the leaves are slender petioled, the cymes loose and spreading, the open bell-shaped corolla with revolute lobes and a tube much longer than the ovate-pointed divisions of the calyx. *A. cannabinum*, of which there are a number of well recognized varieties, grows in gravelly or sandy soil mostly near streams, while *A. androsaemifolium* grows in dry thickets and open woods. According to E. A. Manheimer, the root of the latter is distinguished from *A. cannabinum* by the thick-walled stone cells, which are arranged in an interrupted circle near the middle of the bark. (*A. J. P.*, Nov., 1881. See also *A. J. P.*, 1888.) Holm has contributed an article on the structure of *A. cannabinum*. [*Merck's Rep.*, 1910, p. 277.)

It is described in the N. F. as: "Cylindrical, somewhat branched, of varying length, from 3 to 10 mm. in thickness; externally reddish-brown to grayish-brown, longitudinally wrinkled and occasionally with transverse fissures having vertical sides extending through the bark; fracture short; internally, bark light brown, from 1.5 to 3 mm. in thickness, wood faintly radiate and with large tracheae, a small pith occurring in pieces of the rhizome. Almost inodorous; taste starchy, afterwards becoming bitter and somewhat acrid. Under the microscope sections of *Apocynum* show numerous laticiferous vessels in both the bark and pith. The stems of *Apocynum* have a comparatively thin fibrous bark, a light brown porous wood and a large, hollow pith. The powder is light brown, starch grains numerous, from 0.003 to 0.015 mm. in diameter, spherical, ellipsoidal, ovate, pyri-form, or more or less irregular, sometimes more or less altered, swollen, and with a hyaline central cleft; numerous fragments of strongly lignified wood fibers, associated with tracheae mostly having bordered pores, occasionally with spiral thickenings; fragments of cork layer few, the walls being of a reddish-brown color; an occasional fragment with laticiferous tissues; stone cells few or absent (*Apocynum androsaemifolium* Linne). *Apocynum* yields not more than 5 per cent. of ash." *N. F. IV.* The fresh root, when wounded, emits a milky juice, which concretes into a substance resembling caoutchouc. The stems of *Apocynum* have a comparatively thin, fibrous bark, a light brown porous wood and a large, hollow pith. In the dried state, the rhizome and roots are brittle and readily pulverized, affording a powder which is light brown, containing numerous starch grains which are from 0.003 to 0.015 mm. in diameter, spherical, ellipsoidal, ovate, pyriform, or more or less irregular, sometimes more or less altered, swollen, and with a hyaline central cleft. It also contains numerous fragments of strongly lignified wood fibers which are associated with tracheae having bordered pores or occasionally with spiral thickenings, a few fragments of cork, the walls being of a reddish-brown color, and an occasional fragment with laticiferous tissues. Stone cells are not present in *A. cannabinum*, but are common in *A. androsaemifolium*.

The nature of the active principle of apocynum is as yet somewhat uncertain. Finnemore, in 1908, obtained from the *A. cannabinum* a crystalline substance to

which the name of cynotoxin was applied. The following year Moore (*J. Chem. Soc.*, 1909, xcv) separated from the *A. androsaemifolium* a glucoside having the formula $C_{14}H_{18}O_3$, to which he applied the name of *apocynamarin*. These two principles which appear to be identical, possess the characteristic physiological effects of the crude drug. Taub and Fickewirth (*A. G. P.*, cliii, p. 239) believe that neither of these principles is chemically pure and that the activity of the plant is due to an intensely bitter principle which is not of glucosidal nature and to which they apply the name of *cymarin*. This latter substance has been studied pharmacologically by Impens and has also been used practically by Allard (*D. M. W.*, 1913, xxxix, p. 783) and others, and appears to exert the characteristic effects of the drug. Cymarin is given in oral single dose of one two-hundredth of a grain (0.003 Gm.) ; daily dose, one-sixtieth to one-thirtieth of a grain (0.001-0.002 Gm.) intravenous or intramuscular dose, one one-hundred and twenty-eighth to one sixty-fourth of a grain (0.0005-0.001 Gm.).

Von Oefele (*Journ. Pharm. Elsass-Lothr.*, 1891, 325) described *apocyneteine*, an alkaloid obtained from *A. venetum*; it is said to be a cardiac sedative.

Apocynum belongs physiologically to the digitalis group of cardiac tonics. Like digitalis it slows the pulse by stimulating cardiac inhibition, increases the vigor and tone of the heart muscle, and in overdose causes systolic spasm of the frog's heart, increases vasomotor tone and the activity of the kidney. It differs from digitalis only in the relative degree of its different effects. It appears to be the most powerful of the whole group in its effect upon inhibition, the slowing of the pulse being so extreme that despite marked constriction of the blood vessels the pressure is often lowered instead of elevated. According to Dale and Laidlaw [*Proceedings of the Royal Society of Medicine*, Dec., 1909), its action upon the vasomotor system is also relatively strong. It appears to be more irritant to mucous membranes than either digitalis or strophanthus, and therefore is prone to cause nausea and catharsis. Perhaps this local stimulant effect is also the explanation of its very powerful diuretic action, although Dale and Laidlaw believe that the effect upon the kidneys is due chiefly to a relative dilatation of the renal arteries.

Apocynum is useful in medicine as a diuretic and as a cardiac tonic. For the former purpose it is especially of service in *dropsies* due to heart failure, but has been also highly recommended in the *ascites of hepatic cirrhosis*; indeed, so powerful are its hydragogue properties that it has been dubbed the "vegetable trocar." As a tonic to the heart it is useful in the same classes of chronic *heartdisease* in which digitalis is of service. The N. F., however, adds the following caution: "It has been stated that the absorption of Apocynum in the gastro-intestinal tract is uncertain and irregular. To avoid an accumulation of the drug or toxic action, the physician should carefully guard the dosage and determine in each case the tolerance of the patient." Its irritant action upon the intestinal tract also militates strongly against its clinical usefulness; many patients are quite unable to take the drug because of the occurrence of emesis or purgation. *Dose*, five to fifteen grains (0.32-1.0 Gm.).

Aplopappus. *Aplopappus (Haplopappus) Baylahuen* Remy.—This composite herb is a native of Chili, where it is said to be relied upon as a stimulant in *flatulent*

dyspepsia, and chronic *inflammation* with *hemorrhage* of the lower bowels. It has been analyzed by H. H. Rushy (*A. J. P.*, 1890, 488), and later by H. Kahn (*A. J. P.*, 1891, 377). The former found a volatile oil, a fatty oil which had the specific odor of the plant, a brown acid resin of sharp taste, and tannin. The latter determined the percentage of volatile oil as 6.65, and of resin as 21.15. He also considers that this resin is a mixture of four different resins. G. Baille asserts (*B. G. T.*, Feb., 1889) that the remedy is valuable not only in *dysentery*, but in *genito-urinarycatarrhs*, and also as a stimulating expectorant. *Dose*, one-half to one tablespoonful (7.5-15 mils) of a strong decoction, one part to five, may be given every two hours; or the fluid-extract, from five to twenty minims (0.3-1.3 mils). It has also been used in tincture form as an application to slowly healing zoounds and ulcers.

AQUA AMYGDALAE AMARAE. U. S.

BITTER ALMOND WATER Aq. Amygd. Amar.

Eau d'Amandes ameres, *Fr.*; Aqua Amygdalarum Amararum, *P. G.*; Bittermandelwasser, *G.*; Acqua distillata di mandorle amare, *It.*; Agua de almendras amargas, *Sp.*

"Oil of Bitter Almond, *one mil* [or 16 minims] ; Distilled Water, recently boiled, *nine hundred and ninety-nine mils* [or 33 fluidounces, 6 fluidrachms, 14 minims], to make *one thousand mils* [or 33 fluidounces, 6¹/₂ fluidrachms]. Dissolve the oil of bitter almond in the recently boiled distilled water by agitation, and filter. Note: Bitter Almond Water contains a mere trace of hydrocyanic acid and differs from the preparation of the same name, recommended by the International Protocol, 1906, which contains 0.1 per cent. of hydrocyanic acid." *U. S.*

Owing to the almost universal employment at this time of artificial oil of bitter almond (or benzaldehyde), which is free from hydrocyanic acid (such oil being much cheaper than that made from bitter almond), the bitter almond water of pharmacy cannot be relied upon as a medicinal agent, but is used mainly as a pleasant vehicle, but the requirements of the T. J. S. P. IX are that the oil of bitter almond shall contain not less than 85 per cent. of benzaldehyde, and not less than 2 per cent. nor more than 4 per cent. of hydrocyanic acid, hence the use of benzaldehyde (see *Benzaldehyde*) is no longer permissible and care must be exercised not to prescribe a larger dose of the water to begin with than two teaspoonfuls (7.5 mils). Its principal use in this country is as a vehicle, many physicians prescribing it not for its medicinal virtues, but on account of its agreeable taste and powers of masking the taste of saline substances. The process for *Aqua amygdalarum amararum* of the

German Pharmacopoeia directs that 12 parts of bruised bitter almonds shall be expressed without heat, so as to remove as much fixed oil as possible; the press-cake is powdered, mixed thoroughly with 20 parts of water, and 9 parts distilled off into a receiver containing 3 parts of alcohol; the distillate is assayed to determine the percentage of hydrocyanic acid, and then diluted with a mixture of 1 part of alcohol and 3 parts of water, so that 1000 parts of the final product shall contain 1. part of hydrocyanic acid.

Under the name of *chloral hydrocyanate* a substance has been introduced for making cherry-laurel or bitter almond water extemporaneously. It occurs in white, translucent, rhombic prisms, soluble in water, alcohol, and ether. It has the odor of hydrocyanic acid and chloral, and is said to be a very stable compound. A solution of 6.5 grains of the salt in 1000 grains of distilled water corresponds with the official bitter almond water of the German Pharmacopoeia, which is 1 to 1000. (*Merck's Bulletin.*)

Dose, one fluidrachm (3.75 mils).

AQUA ANETHI. Br.

DILL WATER

Eau d'Aneth, *Fr.*; Dillwasser, *G.*

"Dill Fruit, 100 *grammes*; Water, 2000 *millilitres*. Distil one thousand millilitres. In preparing this and other similar aqueous liquids by distillation, only good natural potable water must be employed, as directed for 'Distilled Water' " *Br.*

"This Water may be prepared by triturating the oil of dill with twice its weight of calcium phosphate and five hundred times its volume of distilled water and filtering the mixture. In tropical and subtropical parts of the Empire this Water may be used in place of the corresponding Water of the text of the British Pharmacopoeia." *Br.*

This water, which is frequently prescribed in Great Britain, is occasionally used here; it closely resembles caraway water, over which it has no advantages. It is used only as a vehicle.

AQUA ANISI. U. S., Br.

ANISE WATER Aq. Anisi

Eau d'Anis, *Fr.*; Aniswasser, *G.*; Acqua distillata di anice, *It.*; Agua de anis, *Sp.*

"Oil of Anise, *two mils* [or 32 minims]; Purified Talc, *fifteen grammes* [or 231 grains]; Distilled Water, recently boiled, *a sufficient quantity*, to make *one thousand mils* [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Triturate the Oil of Anise with the Purified Talc, add the recently boiled Distilled Water gradually with continued trituration, filter, and pass the filtrate through the filter repeatedly until the Anise Water is perfectly clear." *U. S.* See also *Aquae Aromaticae*.

"Anise Fruit, 100 *grammes*; Water, 2000 *millilitres*. Distil one thousand millilitres." *Br.*

"This water may be prepared by triturating the oil of anise with twice its weight of calcium phosphate and five hundred times its volume of distilled water and filtering the mixture. In tropical and subtropical parts of the Empire this Water may be used in place of the corresponding Water of the text of the British Pharmacopoeia." *Br.*

Anise water is rarely made by distillation, although the product thus secured has a more delicate flavor than the U. S. preparation. It is used solely as a vehicle.

AQUA AURANTII FLORUM. U. S. (Br.)

ORANGE FLOWER WATER Aq. Aurant. Flor.

Aqua Aurantii Floris, *Br.*, Aqua Florum Naphae; Eau distillee (Hydrolat) de Fleura d'Oranger, *Fr. Cod.*; Eau de Naphe, *Fr.*; Orangenbluthenwasser, *G.*; Acqua distillata di arancio. *It.*; Agua destilada de azahar, *Sp.*

"Stronger Orange Flower Water, Distilled Water, recently boiled, each, *one volume*. Mix them immediately before use. Orange Flower Water complies with the tests for identity and purity given under *Aqua Aurantii Florum Fortior*." *U. S.* "Orange-flower Water is the orange-

flower water of commerce, prepared by distillation from the flowers of the Bitter Orange tree, *Citrus Aurantium*, var. *Bigaradia*, Hook., f., diluted, immediately before use, with twice its volume of Distilled Water." Br.

The U. S. Pharmacopoeia, 1890, and the U. S. P. VIII and IX introduced "Stronger Orange Flower Water," providing for its dilution with an equal volume of distilled water to make "orange flower water." This plan enables American pharmacists to employ the imported "triple" water, as it is known in commerce. This retains its fragrance longer than a weaker water; moreover, economy is effected through saving customs duty and freight, and a fresh, delicate water can be dispensed.

" Colorless or with a slight yellowish tint; odor very fragrant. Yields no reactions for lead or copper. The orange-flower water of commerce is a saturated solution of the volatile oil of the fresh flowers." Br.

This preparation is also considered by the British Pharmacopoeia as an object of importation. According to this authority, it is obtained from the flowers of the bitter orange tree; this is concurred in by our own official standard. In Italy and France, where it is largely made, the flowers of the bitter orange have long been preferred, as yielding the most fragrant product. It may be prepared in the most southern districts of our country from the fresh flowers; and these may be brought to the North for the same purpose, if previously incorporated with one-third or one-fourth of their weight of common salt. The proper method is to arrange the flowers and salt in successive layers in jars of stoneware or glass. They may also be preserved by means of glycerin. Notwithstanding, however, the facility of preparing this water here, it is generally imported from the south of France, whence it usually comes in cans of tinned copper.

L. Malenfant observed that fresh orange flowers, mixed with cold water, yield, on distillation over the naked fire, a milky water, possessing a somewhat empyreumatic odor and a strong, somewhat acrid taste. Kept for twelve or eighteen months in glass vessels covered with parchment, it loses its empyreuma, and after filtering has an agreeable odor and taste. If the flowers be mixed with boiling water and immediately distilled, the water is limpid, and gradually separates some thick oil of a brownish color; the water has the odor and taste of the flowers, but complicated with an odor of the still, which it loses after long keeping; it

seems to alter less rapidly than that obtained by the former process. Distilled by steam, limpid water of a pure odor and taste it at once obtained, free from empyreuma; it may be at once used, and keeps better in the light than when obtained by the two former processes. (*A. J. P.*, June, 1874.) Hesse and Zeitsehel (*J. Pr. Chem.*, 1901, 525) found by exhausting with ether the orange flower water obtained in the distillation of the orange blossoms that the quantity of oil dissolved in the water represented about one-third of the total amount of oil from the blossoms. A distilled water of the leaves is also prepared, and sometimes a mixture of the leaves and flowers is employed. But this is a fraud, as the distilled water of the leaves never has the sweet perfume of that of the flowers. (*J. P. G.*, 4e ser., iii, 249.) Orange flower water is used exclusively on account of its agreeable odor as a flavoring agent.

Orange flower water is stored in large glass vessels or carboys in cool cellars by the manufacturers in Grasse, France, care being taken not to stopper them tightly, but simply cover the orifice with a piece of paper or coarse cloth.

Nitric, sulphuric, or hydrochloric acid produces a red coloration with orange flower water, particularly if the water be shaken with ether to take up the oil, and the acid added to the ethereal solution. (*P. J.*, 1878, 248.) It is used as a vehicle, and to flavor syrups and elixirs.

Off. Prep.—Syrupus Aurantii Florum, *U. S.*

AQUA AURANTII FLORUM FORTIOR. U. S. (Br.)

STRONGER ORANGE FLOWER WATER Aq. Aurant. Flor. Fort. [Triple Orange Flower Water]

"The saturated aqueous distillate prepared by distilling the fresh flowers of *Citrus Aurantium amara* Linne (Fam. *Rutaceae*) with water. Preserve it in bottles stoppered with a pledget of purified cotton and in a dark, cool place." *U. S.* The orange flower water of commerce is a saturated solution of the essential oil of the fresh flowers, and the British Pharmacopoeia uses this in several preparations, terming it "Orange-flower water of commerce, undiluted." (See *Aqua Aurantii Florum*)

Orange flower water is nearly colorless, though often of a pale yellowish tint. "Stronger Orange Flower Water is colorless and clear or only faintly

opalescent, and possesses a strong and pleasant odor and taste of orange blossoms, and must be free from empyreuma, mustiness, or mucoid growths. It is neutral or only slightly acid to litmus, and 100 mls, when evaporated to dryness on a water bath and the residue subsequently dried in an oven to constant weight at 100° C. (212° F.), yields not more than 0.001 Gm. of residue. It gives no reaction with hydrogen sulphide T.S. or with sodium sulphide T.S. (*metallic impurities*)." *U. S.* From being kept in tinned copper cans, it sometimes contains metallic impurity, which is said to be chiefly lead carbonate, derived from the lead used as a solder in making the cans. The means of detecting metallic impurity is also mentioned under the general observations on distilled water. Much color, offensive odor, or mouldiness indicates impurity derived from the flowers in distillation.

Off. Prep.—Aqua Aurantii Florum, *U. S.*; Syrupus Aurantii Floris, *Br.*; Elixir Amygdalae Compositum, *N. F.*; Elixir Aurantii Amari, *N. F.*; Elixir Glycyrrhizae Aquosum, *N. F.*

AQUA CARVI. Br.

CARAWAY WATER

Aqua Carvi; Eau Distillee de Carvi, Fr.; Kummelwasser, G.

"This Water may be prepared by triturating the oil of caraway with twice its weight of calcium phosphate and five hundred times its volume of distilled water and filtering the mixture. In tropical and subtropical parts of the Empire this Water may be used in place of the corresponding Water of the text of the British Pharmacopoeia." *Br.*

"Caraway Fruit, 100 *grammes*; Water, 2000 *millilitres*. Distil one *thousand millilitres*." *Br.*

Distilled Caraway Water has the flavor of the fruit or seeds, but is seldom used in the United States. The water made from the volatile oil (16 minims in a pint), in the same manner as is cinnamon water, is largely employed. It is used only as a vehicle.

AQUA CINNAMOMI. U. S., Br.

CINNAMON WATER Aq. Cinnam.

Eau distillee de Cannelle, *Fr. Cod.*; Aqua Cinnamomi, *P. G.*; Zimmtwaaser, *G.*; Acqua distillata di canella. *It.*; Agua destilada de canela, *Sp.*

"Oil of Cinnamon, *two mils* [or 32 minims]; Purified Talc, *fifteen grammes* [or 231 grains]; Distilled Water, recently boiled, *a sufficient quantity*, to make one *thousand mils* [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Triturate the Oil of Cinnamon with the Purified Talc, add the recently boiled Distilled Water gradually with continued trituration, filter, and pass the filtrate through the filter repeatedly until the Cinnamon Water is perfectly clear." U. S.

"Cinnamon Bark, bruised, 100 *grammes*; Water, 2000 *millilitres*. Distil one *thousand millilitres*." *Br.* "This Water may be prepared by triturating the oil of cinnamon with twice its weight of calcium phosphate and five hundred times its volume of distilled water and filtering the mixture. In tropical and subtropical parts of the Empire this Water may be used in place of the corresponding Water of the text of the British Pharmacopoeia." *Br.*

Of these processes, that of the U. S. Pharmacopoeia is the easier, though the second, the British, may yield a sweeter product. On standing, cinnamon water, made from oil of Ceylon cinnamon, is apt to precipitate, owing to the gradual oxidation and formation of cinnamic acid, which is comparatively insoluble in water: this can be prevented, according to E. Backhaus, by passing a stream of carbon dioxide through the fresh water for a few minutes. We have never seen the precipitation successfully prevented, notwithstanding the application of numerous so-called preventives; these usually delay the precipitation, but in a few weeks' time the cloudiness due to the formation of minute crystals of cinnamic acid invariably appears. When oil of cinnamon (*Oleum Cassia*) is used as directed in the U. S. P. IX process precipitation rarely occurs. E. Holmes recommends glycerin as an excellent intermedium between the oil of cinnamon and water. Ten drops of glycerin will effect the solution of a drop of the oil in a fluidounce of water.

Cinnamon water is much used as a vehicle for other less agreeable medicines, but should be given cautiously in inflammatory affections. For ordinary purposes the U. S. preparation is sufficiently strong when diluted with an equal measure of water.

Off. Prep.—Infusum Digitalis, *U. S.*; Mistura Cretae, *U. S., Br.*; Mistura Guaiaci, *Br. (N. F.)*; Mistura Olei Ricini, *Br.*; Mistura Spiritus Vini Gallici, *Br.*; Syrupus Aromaticus, *Br.*; Syrupus Cascarae Aromaticus, *Br.*; Syrupus Cinnamomi, *N. F.*; Syrupus' Ipecacuanha; et Opii, *N. F.*; Tinctura Ferri Pomata, *N. F.*; Tinctura Rhei Aquosa, *N. F.*

AQUA FOENICULI. U. S., Br.

FENNEL WATER Aq. Foenic.

Eau de Fenouil, *Fr.*; Aqua Foeniculi, *P. G.*; Fenchelwasser, *G.*; Acqua distillata di finocchio, *It.*; Agua de hinojo, *Sp.*

"Oil of Fennel, *two mils* [or 32 minims]; Purified Talc, *fifteen grammes* [or 231 grains]; Distilled Water, recently boiled, *a sufficient quantity*, to make *one thousand mils* [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Triturate the Oil of Fennel with the Purified Talc, add the recently boiled Distilled Water gradually with continued trituration, filter, and pass the filtrate through the filter repeatedly until the Fennel Water is perfectly clear." *U. S.*

"Fennel Fruit, 100 *grammes*; Water, 2000 *millilitres*. Distil one thousand *millilitres*." *Br.*

"This Water may be prepared by triturating the oil of fennel fruit with twice its weight of calcium phosphate and five hundred times its volume of distilled water and filtering the mixture. In tropical and subtropical parts of the Empire this Water may be used in place of the corresponding Water of the text of the British Pharmacopoeia." *Br.*

Uses.—Fennel water is a pleasant vehicle for other medicines, and useful when a mild aromatic is indicated. The distillation process of the British Pharmacopoeia, although more troublesome, furnishes a more delicate and agreeable water than does that of the U. S. Pharmacopoeia.

AQUA HAMAMELIDIS. U. S. (Br.)

HAMAMELIS WATER Aq. Hamam. [Witch Hazel Water Distilled Extract of Witch Hazel]

Liquor Hamamelidis, *Br.*; Solution of Hamamelis, Witch-hazel extract; Eau distillée de hamamelis, *Fr.*; Hamamelis-wasser, *G.*

"A saturated aqueous liquid obtained by distilling with steam or water the bark, twigs, smaller stems or the entire shrub of *Hamamelis virginiana* Linne (Fam. *Hamamelidaceae*) collected in the autumn, and adding *one hundred and fifty mils* [or 5 fluidounces, 35 minims] of alcohol to each *eight hundred and fifty mils* [or 28 fluidounces, 356 minims] of distillate. Preserve it in tightly-closed containers in a cool place." *U. S.* "Fresh Hamamelis Leaves, 1000 *grammes*; Distilled Water, 2000 *millilitres*; Alcohol (90 per cent.), 160 *millilitres*. Macerate for twenty-four hours; then distil one thousand *millilitres*." *Br.*

The U. S. P. VIII directed that this water be made from Hamamelis Bark, the Br. Pharm. (1914) directs fresh Hamamelis leaves; the U. S. P. IX uses the bark, twigs, smaller stems, or the entire shrub of Hamamelis.

Hamamelis Water or, as it is popularly called, "Distilled Extract of Witch Hazel," has been found on the market containing very little alcohol, formaldehyde being used as a preservative. Methyl alcohol has also been found in place of ethyl alcohol in many samples. The U. S. Pharmacopoeia IX describes Hamamelis Water as "a clear and colorless, or not more than faintly opalescent or slightly yellowish liquid having a characteristic odor and taste. It is neutral or only faintly acid to litmus. Specific gravity: 0.979 to 0.982 at 25° C. (77° F.). It must be free from mucoid or fungous growths and must not have an acetous odor. It gives no reaction with hydrogen sulphide T.S. or with sodium sulphide T.S. (*metallic impurities*). Evaporate 100 mils of Hamamelis Water to dryness on a water bath; not more than 0.025 Gm. of residue remains (*dissolved impurities*). It contains not less than 14 per cent. of absolute alcohol, by volume, when estimated as directed under Determination of alcohol in official preparations (see Part III, Test No. 14). Add 8 drops of an aqueous solution of resoreinol (1 in 200) to 5 mils of Hamamelis Water and then carefully pour this upon 5 mils of sulphuric acid, contained in a test tube, in such a manner that the two liquids do not

mix. After standing for three minutes a rose-red ring does not appear at the line of contact of the liquids nor does a distinct, white layer appear above this zone (*formaldehyde*). Ten mils of Hamamelis Water gives no reaction for methyl alcohol when tested as directed under Alcohol for the detection of methyl alcohol." *U. S.*

Uses.—This water was probably introduced into the British Pharmacopoeia and U. S. Pharmacopoeia IX on account of the large demand for it which has grown out of the wide advertisements of a certain proprietary medicine, and the universally recognized need in American families for an embrocation which appeals to the psychic influence of faith. As the tannic acid of hamamelis bark does not come over into the distillate the water is therapeutically a mixture of water and alcohol, the volatile oil being found in too minute a proportion to possess any therapeutic value.

AQUA LAUROCERASI. Br.

CHERRY LAUREL WATER

Eau distillee de Laurier-cerise, *Fr. Cod.*; Kirschchlorbeer-wasser, *G*; Agua destilada de laurel-cerezo, *Sp.*

"Cherry-Laurel Leaves, crushed, 800 *grammes*; Water, 2500 *millilitres*. Distil one thousand *millilitres*; shake the product; filter, if necessary; adjust the strength of the finished product either by adding hydrocyanic acid or Distilled Water, so that, when tested as described under 'Acidum Hydrocyanicum Dilutum' it contains 0.1 per cent. by weight of hydrocyanic acid, HCN." *Br.*

The International Protocol (1906) fixed the strength of Cherry-Laurel Water at 0.1 per cent. of hydrocyanic acid which corresponds with the strength of the Br. Pharm, 1898 and 1914.

It is greatly to be regretted that this uncertain, dangerous, and troublesome preparation should retain a place in European pharmacopoeias, inasmuch as it could easily be replaced by a flavored water containing a definite amount of a soluble cyanide. See *S. W. P.*, 1909, No. 10, 147, and 1909, No. 36, 542.

As the cherry-laurel is little cultivated in the United States, the water is

not official; but from several experiments by William Procter there is little or no room to doubt that a preparation identical in its effects might be made from the leaves of our common wild cherry, *Prunus serotina*. The imported cherry-laurel water, as found in commerce, is generally impaired by age, and not to be relied on.

Cherry-laurel leaves contain 65 per cent. of water, sufficient to provoke the reaction which results in the formation of a volatile oil and hydrocyanic acid. Water is very prone to hasten the conversion of the benzaldehyde, contained in the volatile oil, into benzoic acid by oxidation, and it has been found by C. Umney (*P. J.*, x, 467) and by Moore (*Ibid.*, 604) that the water distilled without previous maceration is somewhat stronger in hydrocyanic acid and decidedly stronger in oil (Umney) than the official product. The strength of cherry-laurel water was formerly very variable, but the present Pharmacopoeias require 0.1 per cent. of hydrocyanic acid. The proportion of hydrocyanic acid in the water diminishes with time. It has been ascertained by Deschamps that if a drop of sulphuric acid be added to a pint of the preparation it will keep unchanged for at least a year. It is best preserved by the entire exclusion of air and light. Lepage found that, preserved in full and perfectly air-tight bottles, both this and bitter almond water remained unchanged at the end of a year; while if freely exposed to the air, they lost all their hydrocyanic acid and essential oil in two or three months. (*J. P. C.*, xvi, 346.) For Deniges's method of assaying the water, see *Proc. A. Ph. A.*, 1894* 556.

Uses.—Cherry-laurel water is employed in, Europe as a sedative narcotic, identical in its properties with a diluted solution of hydrocyanic acid; but it is of uncertain strength, and should not be allowed to supersede the preparation of the acid now in use.

Dose, twenty minims to a fluidrachm (1.3-3.75 mls).

AQUA MENTHE PIPERITAE. U. S., Br.

PEPPERMINT WATER Aq. Menth. Pip.

Eau distillee de Menthe poivree, *Fr. Cod.*; Aqua Menthae Piperitae, *P. G.*; Pfefferminzwasser, *G.*; Acqua distillata di menta piperita. *It.*; Agua destilada de menta piperita, *Sp.*

“Oil of Peppermint, *two mls* [or 32 minims]; Purified Talc, *fifteen*

grammes [or 231 grains]; Distilled Water, recently boiled, *a sufficient quantity*, to make *one thousand mils* [or 33 fluidounces, 6¹/₂ fluidrachms]. Triturate the Oil of Peppermint with the Purified Talc, add the recently boiled Distilled Water gradually with continued trituration, filter, and pass the filtrate through the filter repeatedly until the Peppermint Water is perfectly clear." *U. S.* "Oil of Peppermint, 1 *millilitre*; Water, 1500 *millilitres*. Distil one thousand *millilitres*." *Br.*

"This Water may be prepared by triturating the oil of peppermint with twice its weight of calcium phosphate and five hundred times its volume of distilled water, and filtering the mixture. In tropical and subtropical parts of the Empire this Water may be used in place of the corresponding Water of the text of the British Pharmacopoeia." *Br.*

Uses.—Peppermint water is one of the most popular of the aqueous vehicles. It is especially useful as an ingredient in mouth washes because the menthol content produces a pleasant and cool sensation on mucous membranes.

Off. Prep.—Liquor Sodae et Menthae (Alternative with Spearmint), *N. F.*

AQUA MENTHE VIRIDIS. U. S., Br.

SPEARMINT WATER Aq. Menth. Vir.

Eau de Menthe verte, *Fr.*; Romisch-Minzwasser, *G.*; Agua de yerba buena, *Sp.*

"Oil of Spearmint, *two mils* [or 32 minims]; Purified Talc, *fifteen grammes* [or 231 grains]; Distilled Water, recently boiled, *a sufficient quantity*, to make *one thousand mils* [or 33 fluidounces, 6¹/₂ fluidrachms]. Triturate the Oil of Spearmint with the Purified Talc, add the recently boiled Distilled Water gradually with continued trituration, filter, and pass the filtrate through the filter repeatedly until the Spearmint Water is perfectly clear." *U. S.*

"Oil of Spearmint, 1 *millilitre*; Water, 1500 *millilitres*. Distil one thousand *millilitres*." *Br.*

"This Water may be prepared by triturating oil of spearmint with twice its weight of calcium phosphate and five hundred times its volume of

distilled water and filtering the mixture. In tropical and subtropical parts of the Empire this Water may be used in place of the corresponding Water of the text of the British Pharmacopoeia." *Br.*

There would seem to be no good reason for distilling the mint waters from their respective volatile oils, as directed in the British processes. If the fresh plants were available, a good source for a distilled water could be provided; but if a volatile oil must be used with its uncertainty of freshness always present, the quicker process of the U. S. P. is greatly preferable.

Uses.—Spearmint water is used solely as a vehicle. Its flavor to most persons is inferior to that of peppermint, and it lacks the characteristic cooling effect of the menthol which is found in peppermint.

Off. Prep.—Liquor Sodae et Menthae, *N. F.*

AQUA ROSAE. U. S., Br.

ROSE WATER Aq. Ros.

Eau distillée de Rose, *Fr. Cod.*; Aqua Rosse, *P. G.*; Roaen-wasser, *G.*; Acqua diatillata di Rose, *It.*; Agua destilada de rosas, *Sp.*

"Stronger Rose Water, Distilled Water, recently boiled, *one volume* [or 1 pint]. Mix them immediately before use." *U. S.* "Rose Water is the rose water of commerce, prepared by distillation from the flowers of *Rosa damascena*, Linn., diluted, immediately before use, with twice it; volume of Distilled Water. The rose water of commerce is a saturated solution of the volatile oil of the fresh rose flowers." *Br.*

"Rose Water complies with the tests for identity and purity described under *Aqua Rosae Fortior.*" *U. S.*

The British Pharmacopoeia of 1898 abandoned the former process of distilling the petals and followed the method adopted by the U. S. Pharmacopoeia of diluting the so-called triple rose water of commerce with distilled water. This, however, does not make rose water identical in strength in these authorities, the U. S. preparation being the stronger.

Although domestic rose water of fair quality may be made by distilling fresh rose petals, it does not possess the strength or delicacy of the by-product obtained from abroad, as officially described under *Aqua Rosae Fortior*; hence the above process of diluting this stronger rose water. The process of distilling the fresh petals of the hundred-leaved rose is sometimes practised. These are usually preferred in the recent state; but it is said that, when preserved by being incorporated with one-third of their weight of common salt, they retain their odor, and afford a water equally fragrant with that prepared from the fresh flowers. Indeed, Haselden prefers the salted roses, believing that the water prepared from them is less mucilaginous, less apt to become sour, and keeps its odor better than that prepared from the fresh flowers. (*P. J.*, xvi, 15.) It is not uncommon to employ the whole flower, including the calyx; but the product is less fragrant than when the petals only are used, as officially directed. A. Monthus states that the petals of the hundred-leaved rose are more odorous the nearer they are to the center of the flower, and, contrary to what is said in the text, thinks that the calyx should not be rejected in preparing the distilled water. He maintains that so far from injuring the product it in fact contributes to its preservation, and that the water obtained from the whole flower is less liable to that mucosity which is the commencement of decomposition. This effect he ascribes to the astringent matter of the calyx, coagulating the mucilaginous matter of the petals, and preventing it from passing over in the distillation. (*J. P. C.*, 1863, p. 497.) Rose water is sometimes made by distilling together water and the oil of rose. This is best performed by dropping 10 drops of oil of rose on a sponge and adjusting it in the upper part of a still in the body of which a gallon of water is placed; the steam from the boiling water will carry over portions of the oil, and the distillate will thus be impregnated. Alpers (*Am. Drug.*, 1896, 384) prepares rose water by dropping 10 drops of oil of rose into a liter of hot distilled water, agitating and filtering. Rauschenberger improves the flavor by adding a trace of oil of cloves; 2.5 Gm. of oil of rose, 0.25 Gm. of oil of cloves are added to sufficient alcohol to make 100 mls; then 10 mls of this solution is added to 1000 mls of boiling water and the liquid cooled and filtered.

Rose water when properly prepared, has the perfume of the rose in great perfection. It is most successfully made on a large scale. Like the other distilled waters, it is liable to spoil when kept; and the alcohol which is sometimes added to preserve it is incompatible with some of the purposes to which the water is applied, and is even said to render it sour

through acetous fermentation. It is best, therefore, to avoid this addition, and to substitute a second distillation. It may be kept in a bottle stoppered with a plug of absorbent cotton. This distilled water is chiefly employed, on account of its agreeable odor, in collyria and other lotions. It is wholly destitute of irritating properties, unless it contain alcohol.

Off. Prep.—Mistura Ferri Composita, *Br.*; Linimentum Terebinthinae Aceticum, *N. F.*; Mistura Ferri Composita, *N. F.*; Unguentum Aqua Rosae, *Br.*

AQUA ROSAE FORTIOR. U. S. (Br.)

STRONGER ROSE WATER Aq. Ros. Fort.

Rose Water of Commerce, *Br.*, [Triple Rose Water] Aqua Rosae, *U. S.* 1880; Starkeres Roenwasser, *G.*

"The saturated aqueous distillate prepared by distilling the fresh flowers of *Rosa centifolia* Linne (Fam. *Rosaceae*) with water. Preserve it in bottles stoppered with a pledget of purified cotton, in a cool, dark place." *U. S.*

This has been introduced for the purpose of making rose water. (See the preceding article.)

"Stronger Rose Water is colorless and clear, and possesses a strong and pleasant odor, and a taste of fresh rose blossoms, and must be free from empyreuma, mustiness, or mucoid growths. It is neutral or only slightly acid to litmus, and 100 mils, when evaporated to dryness on a water bath and the residue subsequently dried in an oven to constant weight at 100° C. (212° F.), yields not more than 0.001 Gm. of residue. It gives no reaction with hydrogen sulphide T.S. or with sodium sulphide T.S. (*metallic impurities*); *U.S.*

Off. Prep.—Aqua Rosae, *U. S.*, *Br.*; Unguentum Aquae Rosae, *U. S.*, *Br.*; Confectio Rosae, *N. F.*

Aquilegia. *Aquilegia vulgaris*, L. *Columbine*. —A perennial herbaceous plant of the Fam. *Ranunculaceae*, indigenous to Europe, but cultivated in our gardens. At one time considered diuretic and diaphoretic, columbine is not at present used in practical medicine. For further information concerning this drug, see *U. S. D.*, 19th ed., p. 1394.

Aralia. N. F. IV. *American Spikenard. Spignet.*—*Aralia* of the N. F. is "the dried rhizome and roots of *Aralia racemosa* Linne (Fam. *Araliaceae*), without the presence of more than 5 per cent. of adhering stem bases, or other foreign matter. Rhizome of oblique growth, about 12 cm. in length and 5 cm. in thickness, somewhat flattened, tortuous, externally pale brown, somewhat annulately roughened, frequently cut longitudinally, whitish internally; nodes approximate, each with a prominent stem scar about 3 cm. in breadth; fracture fibrous; roots numerous, of varying length, from 5 to 25 mm. in thickness, usually cut longitudinally and furrowed, sometimes with transverse ridges and corky patches; light brown or purplish-brown externally, whitish and spongy or porous internally; fracture of the cortex short, of the wood short and fibrous. Odor aromatic; taste mucilaginous, pungent and slightly acrid. A transverse section of the root shows a thick bark with several zones of secretion reservoirs containing oil, a well-developed cork with one or more hypodermal layers of lignified cells, and a more or less distinctly radiate wood. Examined microscopically, the powdered drug shows spherical or angular, single or two- or more compound starch grains, from 0.005 to 0.02 mm. in diameter, rosette aggregates of calcium oxalate from 0.03 to 0.07 mm. in diameter, tracheae with scalariform or reticulate thickenings and simple or bordered pores, characteristic lignified cells from the hypodermis about 0.04 to 0.1 mm. in length and about one-half as broad, their walls showing simple pores (distinction from *Aralia nudicaulis*). *Aralia* yields not more than 10 per cent. of ash."

Aralia nudicaulis L. *False Sarsaparilla. Wild Sarsaparilla. Shotbush. Small Spikenard. Wild Licorice. Racine d'aralie nue, Petitnard, Fr. Nackte Aralienwurzel, G.*—This plant is an indigenous perennial. It grows from Canada to the Carolinas, inhabiting shady and rocky woods, being common in rich soil. The rhizome is horizontal, creeping, sometimes several feet in length, and 5 to 15 mm. in thickness, more or less twisted, of a yellowish-brown color externally, of a fragrant odor, and a warm, aromatic, sweetish taste. Alpers and Murray (*Proc. A. Ph. A.*, 1897, 182) found in it 3.05 per cent. of resin, 0.33 per cent. of oil, tannin, an acid, albumen, mucilage, and cellulose.

The roots of *Aralia racemosa* and *A. nudicaulis* have been used especially in domestic practice for their gently stimulant diaphoretic and alterative action, chiefly in *rheumatic, syphilitic, and cutaneous affections*, in the same manner and dose as genuine Sarsaparilla. W. R. Monroe (*A. J. P.*, Oct., 1898) found in the rhizome of the *Aralia californica* S. Wats. a small amount of a pale yellow, very aromatic, volatile oil, but failed to detect saponin. Danzel found a glucoside *aralin* in the fresh leaves of *Aralia japonica*. (See *J. P. C.*, 1912, 530.)

Aralia spinosa, L. *Angelica-tree. Hercules club. Toothache-tree. Prickly Elder. Prickly Ash.*—The name "prickly ash" should be dropped, as it belongs properly to a species of *Xanthoxylum*. Angelica tree is an arborescent shrub which grows in Southeastern North America. The bark, root, and berries are used as alteratives.

Archidendron. *Archidendron Vaillantii*.—The bark and black beans of this leguminous plant of New South Wales are said to be an active paralyzant to the motor side of the spinal cord. (Bancroft, *Proc. Roy. Soc. N. S. W.*, 1886.)

Areca Nut. *Semen Arecae*. Betel Nut. Noix d'Arec, *Fr.* Arekanuse, Betelnuse, *G.*—The *Areca Catechu*, L., is an East India palm. The fruit, which is ovoid and from 2 to 3 cm. in diameter, and of an orange-yellow color, contains the nut embedded in a fibrous, fleshy envelope, and invested with a brittle shell which adheres to the exterior flesh. The kernel, the betel nut of commerce, is of a roundish-conical shape, rather larger than a chestnut, externally of a deep brown, diversified with a fawn color, so as to present a reticulate appearance, internally brownish-red with whitish veins, very hard, of a feeble odor when broken, and of an astringent, somewhat acrid taste. It abounds in tannin, and contains also gallic acid, a fixed oil, gum, a little volatile oil, lignin and various saline substances. It yields its astringency to water, and in some parts of Hindustan an extract is prepared from it having the appearance and properties of catechu. A red coloring matter known as *Areca red* is extracted, probably resulting from the decomposition of a tannin. It is insoluble in cold water and ether, soluble in boiling water and alkaline liquids, out of which it is precipitated by acids. E. Jahns (*Ber. d. Chem. Ges.*, 1888, 3404) has found three alkaloids in areca nut:

1. *Arecoline*, $C_8H_{13}NO_2$, identical with the *arekane* of Bombalon.
2. *Arecaine*, $C_7H_{11}NO_2 + H_2O$, which occurs in permanent, colorless crystals, soluble in water, insoluble in absolute alcohol, ether, chloroform, and benzene.
3. An alkaloid which exists in such small quantities that sufficient was not obtainable for close examination. On heating arecoline with strong hydrochloric acid to $150^\circ C.$ ($302^\circ F.$) it is decomposed into methyl chloride, CH_3Cl , and *arecaidine*, $C_7H_{11}NO_2$. This latter base forms colorless plates, stable in the air, fusing at from 223° to $224^\circ C.$ (433.4° - $435.2^\circ F.$), easily soluble in water, difficultly soluble in strong alcohol, and insoluble in ether and chloroform. Arecaidine has been shown to be *methyltetrahydronicotinic acid*, and has been made synthetically from nicotinic acid. The third alkaloid of Jahns is probably *guvacine*, $C_6H_9NO_2$, of which the methyl derivative is the base arecaidine before mentioned.

Immense quantities of areca nut are consumed in the East, mixed with the leaves of the Betel pepper (*Piper Betle*, L., *Chavica Betle* (L.) Miq.) and with lime, forming the masticatory so well known by the name of Betel. The red color which this mixture imparts to the saliva and the excrements is owing to the areca nut, which is also powerfully astringent, and, by its internal use, tends to counteract the relaxation of bowels to which the heat of the climate so strongly predisposes. (See *N. R.*, 1876, 71.) Arecoline resembles pilocarpine in its effects on the system. (Patz, *Z. E. P. T.*, 1910, vii.) According to Jahns (*B. G. T.*, 1889) arecaine is the active principle of the areca nut, and a powerful taenicide, and is an active poison with an action of the type of muscarine and pilocarpine. Locally applied, or when given internally, it contracts the pupils.

In India the areca nut has long been used as a vermifuge, the dose being a teaspoonful of the freshly grated nut, and its value against the tape worm has been confirmed by various European and American practitioners. The usual *dose* is from one to two drachms (3.9-7.7 Gm.). In this country the nut has also been used. for the making of a hard charcoal, employed as a basis of tooth-powder.

Argemone. *Argemone mexicana*, L. *Prickly Poppy*. *Argemone*, Fr. *Stachelmohn*, G.—An annual plant, belonging to the *Papaveraceae*, growing in our Southern and Western States, Mexico, the West Indies, Brazil and in many parts of Africa and Southern Asia. For an illustrated paper on the structure of the seed of this plant by Schlotterbeck and Eckler, see *Proc. A. Ph. A.*, 1906, 467. The whole plant abounds in a milky, acrid juice, which becomes yellow on exposure, and has been used as a local application in obstinate *cutaneous diseases*, especially that affection known in Upper India as *dhad*, and also in cases of *warts* and even *chancres*. The alleged presence of morphine in *Argemone mexicana* has been disproven by J. O. Schlotterbeck (*Proc. A. Ph. A.*, 1901, p. 247), who finds that the plant contains berberine, besides an alkaloid, *protopine* (*argemonine* of Peckoldt). The seeds of the plant have been used in *colic*, 8 grains (0.5 Gm.), given in emulsion, and repeated if necessary every half hour until three doses have been taken. (P. J., xiii, 642.) For further information concerning this drug, see *U. S. D.*, 19th ed., p. 1395.

Aristolochia.—There are several species of the genus *Aristolochia* which are found in the herbalists' stores of India but do not enter commerce. Of these *A. bracteata* Retz is employed as an emmenagogue. *Aristolochia* of the Br. Add. was the dried stem and root of *Aristolochia indica* L. As sold in commerce this drug consists chiefly of stems with attached roots and is employed for the cure of snake bite and to produce abortion. The possession by it of any distinct medicinal properties is very doubtful. Later investigation has shown *A. rotunda* L. to contain *aristolochine*, $C_{32}H_{22}N_2O_{13}$, which has been used in Europe as a general tonic in febrile debility. The Br. Add. recognized the concentrated liquor (1 in 2 of 20 per cent. alcohol) (*Liquor Aristolochiae Concentratus*, Br. Add.), dose, one-half to two fluidrachms (1.8-7.5 mls) ; the tincture (1 in 5 of 70 per cent. alcohol) (*Tinctura Aristolochiae*, Br. Add.), dose, one-half to one fluidrachm (1.8-3.75 mls). Among the other species of *Aristolochia*, which have been used medicinally *A. Clematitis* L., *A. longa* L., *A. rotunda* L., are still retained in official catalogues of the continent of Europe, where they are indigenous. *A. Pistolochia* L. of Southern Europe appears to have been the aristolochia of Pliny and is still used under the name of *Pistolochia*. The rhizome of *A. Clematitis* is very long, cylindrical, about 5 mm. in diameter, as a goose-quill or thicker, variously contorted, beset with the remains of the stems and roots, of a grayish-brown color, a strong, peculiar odor, and an acrid, bitter taste; that of *A. longa* L. is spindle-shaped, from 5 cm. to 3 dm. in length, about 2 cm. in thickness, fleshy, very brittle, grayish externally, brownish-yellow within, bitter, and of a strong, disagreeable odor when fresh; that of *A. rotunda* L. is tuberous, roundish, heavy, fleshy, brownish on the exterior, grayish-yellow internally, and similar to the preceding in odor and taste; that of *A. Pistolochia* L. consists of numerous slender yellowish or brownish rootlets, attached to a common head, and possessed of an agreeable aromatic odor, with a

taste bitter and somewhat acrid.

Many species of aristolochia, growing in the West Indies and Southern America, have been used medicinally. *A. cymbifera* Martius, known, in Brazil as *milhommen*, *jarra*, *jarrinha*, and in Mexico as *guaco*, is said to have medicinal properties similar to those of the official species, but Butte affirms that it is depressant to the sensory nerve centers and is useful in *neuralgia* and *pruritus*. In the Argentine Republic the root of *A. argentina* is used as a diuretic and diaphoretic, especially in *rheumatism*. In the East Indies *A. indica* L. is employed for similar purposes with the European and American species, and the Arabians are said by Forskhal to use the leaves of *A. sempervirens* as a counter-poison. *A. foetida* Kunth, of Mexico, or *Yerba del Indio*, is used as a local stimulant to foul ulcers. A number of species of aristolochia are employed as a remedy for snake-bites in various parts of the world, as *A. Serpentaria* L., in North America; *A. maxima* L. (the rhizome of which is called *Guaco* or *Contra Capitano*), in South America; *A. anguicida* L., in the Antilles; *A. brasiliensis* Mart. et Zucc.; *A. cymbifera* Mart. et Zucc.; *A. macroura* Gom.; *A. trilobata* L., etc. There is no sufficient reason for supposing that any one of them is effective.

Armeria. *Armeria vulgaris* Willd. (*Statice Armeria*, L.) Maiden Pink. (Fam. *Plumbaginaceae*).—This plant, found in Europe, Asia, and Western North America, is said to be an active diuretic. (*Ph. Post*, May, 1890.)

ARMORACIAE RADIX. Br.

HORSERADISH ROOT

"Horseradish Root is the fresh root of *Cochlearia Armoracia*, Linn., collected from cultivated plants." *Br.*

Armoracia, Br. 1864; Raifort sauvage, Moutarde des Moines, Radis de Cheval, Cran de Bretegece, G.; Meerrettig, G.; Rabano rusticano (Raiz de), g.

Cochlearia Armoracia L. (also known as *Roripa Armoracia* (L.) Hitch, and *Radicula Armoracia* (L.) Robinson) is a native of the marshy districts of Great Britain. It is cultivated very largely for its roots which are used as a condiment, being considered stimulating to the digestive organs. It has escaped from our gardens, growing in moist grounds, especially along streams. The root of this plant is perennial, sending up numerous very large radical leaves from the midst of which r-, round, smooth, erect, branching stem rises two or three feet in height. The radical leaves are lance-shaped, waved, scolloped on the edges, sometimes pinna-tifid, and stand upon strong footstalks. Those of the stem are much smaller, without footstalks, sometimes divided at the edges, sometimes almost entire. The flowers are numerous, white, pe-

dunled, and form thick terminal clusters.

The root, which is official in its fresh state, is long, conical at top, then nearly cylindrical for some inches, at last tapering, whitish externally, very white internally, fleshy, of a Strong pungent odor when scraped or bruised, and of a hot, biting, somewhat sweetish, and sometimes bitterish taste. "Nearly cylindrical, except at the crown, where it is somewhat enlarged, and marked with closely approximated semi-amplexicaul leaf-scars. Diameter from twelve to twenty-five millimetres, length commonly thirty centimetres or more; pale yellowish-white or brownish-white externally, whitish within. Inodorous when unbroken, but yielding a characteristic pungent odor when scraped or bruised; taste very pungent." *Br.* Its virtues are imparted to water and alcohol. They depend upon a volatile oil, which is dissipated by drying, the root becoming at first sweetish, and ultimately insipid and quite inert. Its acrimony is also destroyed by boiling. The oil may be obtained by distillation with water. It is colorless or pale yellow, heavier than water, very volatile, excessively pungent, acrid, and corrosive, exciting inflammation and even vesication when applied to the skin. Hubatka considers it as identical with the volatile oil of mustard. He combined it with ammonia and obtained crystals of *thiosinamin*, $\text{NH}_2.\text{CS.N}(\text{C}_3\text{H}_5)\text{H}$, which agreed with that produced from mustard oil. (*J. P. C.*; 3e ser., v, 42.) According to Gutret, only six parts of it are obtained from 10,000 of the root. Besides this principle, the fresh root contains, according to the same chemist, a bitter resin in minute quantity, sugar, extractive, gum, starch, albumen, acetic acid, calcium sulphate and acetate, water, and ligitin. A. Hilger found in the ashes of the root of horseradish the following: calcium, magnesium, potassium, a trace of sodium and iron in combination with sulphuric, hydrochloric, carbonic, phosphoric, and silicic acids. (*Chem. Cb.*, p. 597, 1878; *A. J. P.*, 1879, p. 21.) From observations made by F. L. Winekler, it may be inferred that *myronic acid* exists in the root combined with potassium, and that it is from the reaction between this potassium myronate, *myrosine*, an enzyme, also existing in the root, and water, that the volatile oil is produced, in the same manner as oil of mustard from mustard seed. (See *Sinapis*.) Horseradish when distilled with alcohol yields none of the oil. Buried in cool sand the root may be kept for some time without material injury.

It is said that if to the powder of the dried root which has become apparently inert, the emulsion of white mustard seed containing myrosin be added, it reacquires its original irritant properties; so that it

is the myrosin and not the potassium myronate which is injured by drying. Hence the powdered root may be added with advantage to mustard in preparing cataplasms, pediluvia, etc. (*J. P. C.*, xxvii, 268.)

The French Codex contains a formula for *compound syrup of Horseradish* under the name of *Sirop de Raifort Compose*. It was formerly called *Sirop Antiscorbutique*.

Uses.—Horseradish is highly stimulant, exciting the stomach when swallowed, and promoting the secretions, especially that of urine. Externally it is rubefacient. Its chief use is as a condiment to promote appetite and invigorate digestion.

Dose, fifteen to thirty grains (1-2 Gm.) or more, grated or cut into small pieces.

Off. Prep.—*Spiritus Armoraciae Compositus, Br.*

ARNICA. U. S. (Br.)

ARNICA Arnica. [Arnicae Flores, U. S. 1890 Arnica Flowers]

"The dried flower-heads of *Arnica montana* Linne (Fam. *Compositae*)." U. S. "Arnica Flowers are the dried flower-heads of *Arnica montana*, Linn." *Br.*

Arnicae Flores, Br.; Leopard's Bane, Wolf's Bane, Mountain Tobacco; *Fleurs d'Arnique, Fr.;* *Flores Arnicas P. G.;* Wohlverleihbluthen, *Arnicabluthen, Arnika, Blutblume, Gemsblume, Fallkraut, G.;* *Fiori di arnica, It.;* *Flor de arnica, Sp.*

Arnica montana is a perennial herbaceous plant, having a woody, brownish, horizontal rhizome, from 2 to 10 cm. long, and 0.5 to 5 mm. thick, ending abruptly, and sending forth numerous slender fibers of the same color. The stem is about 3 dm. high, cylindrical, striated, hairy, and terminating in one, two, or three peduncles, each bearing a flower. The radical leaves are ovate, entire, ciliated, and obtuse; those of the stem, which usually consist of two opposite pairs, are lance-shaped. Both are bright green, and somewhat pubescent on their upper surface. The flowers are yellow.

This plant is a native of the mountainous districts of western and central Europe, and is found, according to Nuttall, in the northern regions of this country, west of the Mississippi. It has been introduced into England, and might no doubt be cultivated in the United States. The flowers, leaves, and root are employed; but the flowers only are official in the U. S. P. (9th Rev.). In the Swiss and German Pharmacopoeias the definition of arnica flowers is restricted to the flowers separated from the receptacles, this being done as the latter contain the larvae of *Trypeta arnicivora*. On the other hand the Austrian Pharmacopoeia permits the use of the entire flower heads, but the receptacles containing larvae must be removed.

Properties.—The whole plant, when fresh, has a strong, disagreeable odor, which is apt to excite sneezing, and is diminished by drying. The taste is acrid, bitterish, and durable. Water extracts its virtues. The U. S. Pharmacopoeia thus describes the flowers: "Consisting chiefly of the tubular and ligulate flowers, occasionally with the involucre and receptacle present; in-volucral bracts narrowly lanceolate, about 1 cm. in length, dark green and pubescent; receptacle slightly convex, deeply pitted and densely short-hairy; ray flowers bright yellow, the ligulate portion 2 cm. in length, more or less folded lengthwise, 3-toothed, 7- to 12-veined, pistillate; tubular flowers perfect, reddish-yellow, stamens without a tail-like appendage (distinguished from anthers in flowers of *Inula Helenium* Linne, which have two bristles or long tails at the base); the achenes spindle-shaped, from 5 to 7 mm. in length, dark brown, finely striate, glandular-pubescent and surmounted by a pappus a little longer than the achene and composed of a single circle of nearly white barbellate bristles; odor characteristic and agreeable; taste bitter and acrid. The powder is yellowish-brown; pollen grains numerous, from 0.025 to 0.035 mm. in diameter, spherical, triangular in section and spinose; non-glandular hairs of three kinds, either unicellular, 4- to 6-celled, or consisting of a pair of unicellular hairs with numerous pores on the dividing wall; glandular hairs of three kinds, either with a large unicellular stalk and a unicellular, glandular head, or with a 4-celled stalk and a unicellular, glandular head, or a stalk of a double row of 5 cells and a 2-celled, glandular head; pappus consisting of a multicellular axis with unicellular branches. Arnica yields not more than 9 per cent. of ash." *U.S.*

"Receptacle nearly flat, bristly, with two rows of dark-green, linear-lanceolate, acute, hairy bracts. Each ray-floret possesses a much

shriveled dark yellow ligulate corolla which, after expansion in water, exhibits from eight to twelve veins and three terminal teeth. Disc-florets numerous, yellow. Fruits slender, shriveled, with numerous appressed hairs, and crowned with a single row of stiff, whitish, barbed bristles. Slight aromatic odor; taste 'bitter and acrid.' *Br.*

Arnica flowers of commerce are not infrequently admixed with and substituted by other composite flowers. Farwell states that the heads of *Lapachis columnaris* T. et G., a western composite, have been offered in large quantities for arnica. Hartwich has recently found a sample of arnica adulterated with the flowers of the common dandelion. Beilstein reported having found in one lot approximately 90 per cent. of the flowers of *Inula*. The following flowers also have been used: *Anthemis tinctoria* L., *Calendula officinalis* L., *Doronicum Pardalianches* L., *Inula britannica* L., and *Scorzonera Jiumilis* L. The first three of these are distinguished by the fact that the achenes do not have any pappus. In *Inula* the receptacle is naked and the Ungulate flowers are four-nerved. In *Scorzonera* the flowers are all ligulate and the pappus is feather-shaped.

The rhizome which was formerly official in both the British and U. S. Pharmacopoeias was described by the latter as follows:

"Rhizome about 5 Cm. long, and 3 or 4 Mm. thick; externally brown, rough from leaf-sears; internally whitish, with a rather thick bark, containing a circle of resin-cells, surrounding the short, yellowish wood-wedges, and large, spongy pith. The roots numerous, thin, fragile, grayish-brown, with a thick bark containing a circle of resin-cells. Odor somewhat aromatic; taste pungently aromatic and bitter." *U. S.*, 1890.

Arnica rhizome is at the present time officially recognized only by the Austrian Pharmacopoeia. It is frequently substituted by or admixed with the rhizomes of other plants. Of these the following are easily recognized because of their absence of balsam canals: *Achyrophorus maculatus* Scop., *Hieracium murorum* L., *Fragaria vesca* L., and *Betonica officinalis* L. The rhizomes of *Eupatoria cannabinum* L. are completely surrounded with small roots. The rhizome of *Solidago Virgaurea* L. has a thicker and yellowish rhizome, the taste being very faintly aromatic. The rhizome of *Geum urbanum* L. has an odor resembling cloves.

Bastick (P. J., x, 389) separated what he believed to be an alkaloid from the flowers, to which he gave the name of *arnicine*. The *arnicin* of Walz (*N. Jahrb. Pharm.*, xiii), extracted from both the root and the flowers, is a different substance; it is an amorphous yellow mass of acrid taste, slightly soluble in water, freely in alcohol or ether, and dissolving also in alkaline solutions. It is precipitable from its alcoholic solution by tannic acid or by water. Walz assigns to arnicin the formula $C_{20}H_{30}O_4$; other chemists that of $C_{35}H_{54}O_7$. Arnicin has not been proved to be a glucoside, although it is decomposed by diluted acids. Sigel (1873) obtained from dried arnica root about $\frac{1}{2}$ per cent. of essential oil, and 1 per cent. from the fresh; the oil of the latter had a sp. gr. of 0.999 at 18° C. (64.4° F.). The oil was found to be a mixture of various bodies, the principal being the dimethyl ether of thymohydroquinone,

$C_{10}H_{12} \begin{cases} OCH_3, \\ OCH_3 \end{cases}$ boiling at about 235° C. (455° F.), and with this, *phloryl isobutyrate* to the extent of one-fifth of the oil, and the *methyl ether of a phlorol*. (*Pflanzenstoffe*, 2d ed., p. 1530.) Kondakow (1910) confirmed the results of Sigel's investigations. (*J. P. Chem.*, ii, 79.) (See also Gildemeister and Hoffmann, *Die Aetherische Oele*, p. 900.) The water from which the oil separates contains *isobutyric acid*, probably also a little *angelic* and *formic acids*, but neither capronic nor caprylic acid, which had been pointed out by Walz. Arnica root contains *inulin*, which Dragendorff extracted from it to the extent of about 10 per cent. (*Pharmacographia*, 2d edition, p. 391.) Klobb reported the presence in arnica flowers of a colorless, crystalline body which he at first named *arnisterin*, but in 1905 he changed its name to *arnidiol*. (*Ph. Ztg.*, 1905, xl, p. 846.)

Uses.—Arnica is an active irritant, which is capable when taken in overdose of producing symptoms of violent toxic gastro-enteritis, with great nervous disturbance, reduction or increase of the pulse rate, and collapse. In a number of cases of severe or even fatal poisoning by it, the symptoms have been burning pains in the stomach, vomiting, choleraic diarrhea, giddiness, intense muscular weakness, dilated pupils, finally complete insensibility and collapse. In some cases the disturbances of the gastro-intestinal canal have been absent, and the symptoms have chiefly been of cerebral origin. An ounce of the tincture (*L. L.*, Nov., 1864) has produced serious but finally not fatal symptoms.

Arnica has been used in Germany in the treatment of *palsies* and

various other diseases, but we have very little positive knowledge concerning its action upon the system, and there is no sufficient reason for believing that it is valuable in the treatment of internal diseases. It is largely employed externally in the treatment of *bruises* and *sprains*, generally in the form of the tincture.

The powdered flowers and leaves are employed as a sternutatory; and the inhabitants of Savoy and the Vosges are said to substitute them for tobacco. They may be given in substance or infusion. The dose of the powder is from five to twenty grains (0.32-1.3 Gm.), frequently repeated. The infusion may be prepared by digesting an ounce of the flowers in a pint of water, of which from half a fluid-ounce to a fluidounce (15-30 mls) may be given every three hours. It should always be strained through linen, in order to separate the fine fibers, which might irritate the throat. A tincture of the root was official in the British Pharmacopoeia 1898, this would be preferable for internal use. (See *Tinctura Arnicae*.)

Dose, of the flowers, fifteen grains (1 Gm.).

Off. Prep.—*Tinctura Arnicae*, U. S. (*Br.*) (from flowers); *Fluidextractum Arnicae*, N. F.

Artabotrys. *Artabotrys odoratissima*, (Roxb.), R. Br. (Fam. *Anonaceae*) and *Anona uncinata* Blanco. *Ilag-ilag de China*, Sp.-Fil. *Alag-ilag Sonson*, Tag.—A decoction of the leaves of these plants is used in the Philippine Islands in the treatment of cholera; the overdose is said to be capable of producing abortion.

Artar Root.—This is a drug coming from the west coast of Africa, possibly the product of *Fagara Xanthoxyloides* Lam. (Fam. *Rutaceae*), the leaves of which have been found in commercial specimens. Two alkaloids have been discovered in it by Giacosa and Nionari, one of which is said to resemble somewhat in its action veratrine, but to be a stimulant to the heart. (*Ph. Centralh.*, 1887, No. xxv.)

Artemisia frigida Willd. *Sierra Salvia*. *Colorado Mountain, Sage*. (Fam. *Compositae*.)—This Rocky Mountain plant, which is found growing in immense quantities from the Saskatchewan to Western Texas, and westward, is said to be much used in that region as a diaphoretic, antiperiodic, and mild cathartic. F. A. Weiss (*A. J. P.*, 1890) found indications of a glucoside. One or two drachms (3.9 or 7.7 Gm.) of the powdered leaves, or one or two fluidrachms (3.75 or 7.5, mls) of the *fluidextract*, may be administered in hot infusion every half hour until perspiration has set in. The *Artemisia nana*, one of the North American sage brushes, is reported to yield a volatile oil, which is rich in camphor. (*P. J.*, 1910, xxxiv, 237.)

Arum.—The root or corm of *Arum maculatum* L. (Fam. *Araceae*), is occasionally used as a medicine in Europe. Its properties closely resemble those of *Arisaema triphyllum*. Its constituents, according to Enz, are a neutral acrid volatile principle soluble in ether, starch, gum, mucilage, sugar, lignin, albumen, saponin, fixed oil, resin, and calcium phosphate, the fresh corm containing 58.4 per cent. of water, 5.2 of lignin, and 27.2 of starch. (*A. J. P.*, xxxi.)

Arisaema triphyllum (L.) Schott. *Gouet a trois feuilles*, Fr. *Dreibldttriger Aron*, G. (Fam. *Araceae*.) *Dragon-root, Pepper Turnip, Indian Turnip, Jack-in-the-pulpit, Wake-robin.*—This plant is common in all parts of the United States, growing in moist shady places. The corm was formerly official. It is roundish, flattened, an inch or two in diameter, covered with a brown, loose, wrinkled epidermis, and internally white, fleshy, and solid. In the recent state it has a peculiar odor, and is violently acrid. It was found by D. S. Jones to contain, besides the acrid principle and from 10 to 17 per cent. of starch, albumen, gum, sugar, extractive, lignin, and salts of potassium and calcium. (*A. J. P.*, xv, 83.) The acidity has been ascribed to the raphides of calcium oxalate by R. A. Weber (*J. Am. C. S.*, 1891, p. 215). This has been denied, Schneegans proving that *A. maculatum* contains saponin and Spica and Biscaro ascribe the acidity to the same principle. (*Ph. Centralh.*, 1895, p. 731.) The Indian turnip may be preserved fresh for a year, if buried in sand.

From both *Arum maculatum*, L., and *Arum italicum*. Mill., Herbert and Heim (P. J., July 31, 1897) separated a saponin, also a brownish, oily, liquid alkaloid closely resembling coniine in its properties, but less active. They also found a saponin in the arum tubers.

Both the European and American arum are, in their fresh state, violent irritants to the mucous membranes, producing when chewed insupportable burning in the mouth and throat. Taken internally, this plant causes violent gastro-enteritis, which may end in death. The fresh, partially dried root has been used internally as a stimulant to the secretions, especially in *asthma, whooping cough, chronic catarrh, and rheumatism*. Dose, ten grains (0.65 Gm.), two or three times a day, increased to half a drachm (2 Gm.). The perfectly fresh root should not be used, and the fully dried root is inactive.

The corm of the European arum contains much starch, and a farina is prepared from it, in small quantities, in the Isle of Portland, on the south coast of England, and called *Portland arrow root, or Portland sago*. The root of *A. esculentum*, L. (more correctly *Colocasia antiquorum* Schott.), which abounds in starch, is much used by the natives of the Hawaiian and other islands of the Pacific as an article of food, having been previously deprived of its acidity by heat.

Asarabacca.—*Asarum europaeum* L., is an acrid, herbaceous perennial plant, of the Fam. *Aristolochiaceae*, growing in woods and shady places in Europe, Siberia and the Caucasus. The rhizome is from 2 to 3 inches in thickness, of a grayish color, quadrangular, knotted and twisted, and sometimes furnished with rootlets at each joint. It has an odor similar to that of pepper, and acrid taste, and affords a grayish

powder. The leaves, which have long petioles, are kidney-shaped, entire, somewhat hairy, of a shining deep green color when fresh, nearly inodorous, with a taste slightly aromatic, bitter, acrid, and nauseous. According to Feneulle and Lassaigue, the root contains a concrete volatile oil (see *Asarum*), a very acrid fixed oil, a yellow substance analogous to cystin, starch, albumen, mucilage, citric acid, and saline matters. The root and leaves of asarabacca are powerfully emetic and cathartic, in doses of from thirty grains to a drachm (2.0-3.9 Gm.), but are used almost exclusively as an errhine in *headache*, and *rheumatic affections* of the face, mouth, and throat. One or two grains (0.065-0.13 Gm.), snuffed up the nostrils, produce much irritation, and a copious, persistent flow of mucus. For further information concerning this drug, see *U. S. D.*, 19th ed., p. 1400.

Asarum. *N. F. IV. Wild Ginger, Canada Snake-root. Asaret du Canada, Fr. Canadisehe Haselwurzel, G.*—"The dried rhizome and roots of *Asarum canadense* Linne (Fam. *Aristolochiaceae*), with only an occasional leaf or flower present, and without the presence of more than 5 per cent. of other foreign matter." *N. F.* The plant has in all its parts an aromatic odor and an aromatic, slightly bitter taste, which it imparts to alcohol and hot water. "Of horizontal growth, occasionally branched, two-edged when young, quadrangular when older, finely striate, usually more or less twisted, from 5 to 17 cm. in length and from 2 to 4 mm. in thickness; nodes enlarged with irregular scars from petioles and remains of pedicels; internodes with annular scars from scales; dark purplish-brown externally; fracture short, internally whitish, starchy or resinous; attached roots few, from 5 to 7 cm. in length and not over 1 nun. in thickness, having from four to six radial fibro-vascular bundles. Odor aromatic, non-irritating upon heating; taste pungent and slightly bitter. In transverse section the rhizome shows a thick bark with numerous oil cells, a wood with about twelve fibro-vascular bundles and a large pith. Examined microscopically, the powdered drug shows simple and two-to four-compound starch grains, the individual grains being from 0.004 to 0.02 mm. in diameter, and tracheae with scalariform or reticulate thickenings, a few spiral. *Asarum* yields not more than 12 per cent. of ash." *N. F.* The chief constituent is the volatile oil, at one time largely used in perfumery. According to Petersen, the oils of *Asarum Europaeum* and *Asarum canadense* are composed in the main of one compound, which is identical with the *methyl ether of eugenol*, $C_6H_3(OCH_3)_2.C_3H_5$, a compound which has been made synthetically but not previously found in nature. Under the trade name *Asaron* a camphor derivative of *Asarum Europaeum* is recommended as an antiseptic and tonic. It is given the formula $(CH_3)_3.C_6H_2(CH)_2CH_2OH_2$, and occurs as a whitish-yellow crystalline powder or fragments possessing a faint biting taste. According to the researches of Power and Lees (*Trans. Chem. Soc.*, 1902) the oil of *Asarum canadense* contains the following substances: a phenol, $C_9H_{12}O_2$; pinene, apparently a mixture of the d- and l- forms; d-linalool, l-borneol, l-terpineol, geraniol, eugenol-methyl-ether, a blue oil, of undetermined composition, consisting of oxygenated substances of alcoholic nature; a lactone, $C_{14}H_{20}O_2$, palmitic acid, acetic acid, and a mixture of fatty acids intermediate between acetic and palmitic acids. For formulas for fluidextract, syrup, and oleoresin, see *A. J. P.*, 1876, 155. F. P. Streeper (*A. J. P.*, 1888, 6) proved that strong alcohol was the proper menstruum for the fluidextract. The medicinal properties of this drug are those of a feeble aromatic. From a half to

one drachm (2-3.9 Gm.) may be used. It is employed as an aromatic adjuvant to tonic mixtures and infusions. From *Asarum arifolium* Michx., E. K. Miller obtained from 7 to 10 per cent. of volatile oil having a sassafras odor, sp. gr. 1.0585 (*P. J.*, lxi); see also *Schim. Rep*; 1902, p. 12; also *Proc. Alabama Pharm. Assoc.*, 1910, 56-58.

ASAFOETIDA. U. S. (Br.)

ASAFETIDA Asafoet. [Gum Asafetida]

"The gum-resin obtained by incising the rhizomes and roots of *Ferula Asafoetida* Linne and *Ferula foetida* Regel and of some other species of *Ferula* (Fam. *Umbelliferae*), indigenous to Persia and adjacent countries, and yielding not less than 60 per cent. (or if powdered 50 per cent.) of alcohol-soluble constituents." U. S. "Asafetida is an oleo-gum-resin obtained by incision from the root of *Ferula foetida*, Regel, and probably other species of *Ferula*." Br.

Asafetida, Br.; Stercus Diaboli, Cibus Deorum; Gummi resina Asafoetida; Asa foetida, Asse-fetide, Aasafoetida, *Fr.*; Asa foetida, *P. G.*; Asant, Stinkasant, Teufelsdreck, *G.*; Assa fetida, *It.*; Asafetida, *Sp.*; Ungoozeh, *Pers.*; Hilteet, *Arab.*; Hing, *India*; Angusa-kema, *Afgh.*

Ferula Asafoetida was first described from actual observation by H. Falconer, who found it near Kashmir, and has long been successfully cultivated in the Edinburgh Botanical Gardens. It is distinguished by the greater height of the stem (6 to 10 feet), and by the numerous stem leaves furnished with wide sheathing petioles. The flowers are pale yellow, and the oval fruit thin, flat, foliaceous, and reddish brown, with pronounced vittae. It yields a milky juice having a powerful odor of asafetida.

Ferula foetida is a coarse umbelliferous plant, growing from five to seven feet high, with a large fleshy root, the crown of which is covered with coarse bristly fibers, and gives origin to large bipinnate radical leaves and a nearly naked stem which has only a few bipinnate leaves without wide sheathing petioles, and ends at the top in very numerous umbels. The flat-winged fruit have the vittae almost obsolete. This plant was first discovered in the sandy desert near the sea of Aral, by Lehmann, in 1844. Bunge found it in Persia about twenty years later. It would seem to be native all through Afghanistan.

It is possible that asafetida is obtained from various species of *Ferula*,

yet the bulk of the drug probably comes from the official plants. Among the other plants yielding asafetida is *Ferula Narthex* Boiss. While this is disputed by Aitchison yet it appears that it is the source of the gum-resin obtained from certain portions of Afghanistan. Tschirch describes this plant with illustrations in *S. W. P.*, 1910, p. 289. E. M. Holmes's discussion of the asafetida plants (*P. J.*, ser. iii, xix, 1888-1889) still remains one of our chief sources of information on the subject. (See also article on the sources of the fetid gum-resins by James Small, *P. J.*, 1913, vol. xc, p. 287.) *Ferula Jaeschkeana* Vatke, which has been believed to be the source of asafetida, according to E. M. Holmes, has, at least in its dried state, not the slightest odor of asafetida, and yields a strongly celery-scented juice. (*P. J.*, 1894, xxv.)

The asafetida plants are indigenous to Western Afghanistan and Eastern Persia. In 1687 the collection of asafetida was witnessed by Kaempfer, whose description of the method is very similar to that given by H. W. Bellew in 1872, and by J. E. T. Aitchison in 1884. According to Aitchison, the high plains of Afghanistan, two to four thousand feet above the sea, are arid and bare in winter, but in the early summer are covered with a thick growth of *Ferula foetida*, *Dorema ammoniacum*, and *Ferula glabaniflua*. The great cabbage-like heads of the asafetida plant, representing the primary stage of the flower heads covered over by the stipules of its leaves, are eaten raw by the natives as a sort of green. In June the asafetida is obtained. The root stock is first laid bare to the depth of a couple of inches, those plants only which have not reached their flower-bearing stage being selected. A slice is then taken from the top of the root stock, which is immediately covered with twigs and clay, forming a sort of dome, with an opening towards the north, so that the sun cannot get at the exposed root. About five or six weeks later, a thick, gummy, not milky, reddish substance found upon the exposed surface of the root in more or less irregular lumps is scraped off with a piece of iron hoop or removed with a slice of the root and at once placed in a leather bag. The asafetida is conveyed to Herat, where it is adulterated with red clay before being sent into commerce. It is brought to this country directly from India, whither it is conveyed from Bushire and down the Indus, or it is shipped first to London and then to America. It sometimes comes in mats, but more frequently in cases, the former containing eighty or ninety pounds, the latter from two hundred to four hundred pounds. Asafetida is sometimes also imported in casks.

The fruit of the asafetida is said to be sent to India, where it is highly

esteemed as a medicine.

Properties.—As usually found in commerce, asafetida is in irregular masses, soft when not long exposed, of a yellowish or reddish-brown color externally, exhibiting when broken an irregular, whitish, somewhat shining surface, which soon becomes red on exposure, and ultimately passes into a dull yellowish-brown. This change of color is characteristic of asafetida, and is ascribed to the influence of air and light upon its resinous ingredient. The masses appear as if composed of distinct portions agglutinated together, sometimes of white, almost pearly tears, embedded in a darker, softer, and more fetid paste. Occasionally the tears are separate, though rarely in the commerce of this country. They are roundish, oval, or irregular, and generally flattened, from the size of a pea to that of a large almond, sometimes larger, yellowish or brownish externally and white within, and not unlike ammoniac tears, for which they might be mistaken except for their odor, which, however, is weaker than that of the masses. A very fine variety of asafetida is spoken of by Bellew as being procured from the leaf bud in the center of the root. It does not come into European commerce, but is the *Kandaharee Hing* of the Indian bazaars. (*P. J.*, viii, 103.) It occurs in moist flaky pieces and tears, yielding a reddish-yellow oil on pressure, and mostly mixed with the remains of leaf buds. The ordinary asafetida of the Indian bazaars is known in the superior grade as *Hing*, in the inferior grade as *Hingra*. The odor of asafetida is alliaceous, fetid, and tenacious; the taste, bitter, acrid, and persistent. The effect of time and exposure is to render it more hard and brittle, and to diminish the intensity of its odor and taste, particularly the former. Kaempfer assures us that one drachm of the fresh juice diffuses a more powerful odor through a close room than one hundred pounds of the drug as usually kept in the stores. The color, which is at first white, becomes pink, and finally the well known brown, on exposure. Asafetida softens by heat without melting, and is difficult of pulverization. Its sp. gr. is 1.327. (Berzelius.) It is inflammable, burning with a clear, lively flame. It yields all its virtues to alcohol, and forms a clear tincture, which becomes milky on the addition of water.

The description in the U. S. P. IX has been considerably enlarged and is as follows: "In a soft mass, sometimes almost semi-liquid, or in irregular, more or less pliable masses composed of agglutinated tears of variable size imbedded in a yellowish-brown or dark brown matrix, or in loose ovoid tears, from 1 to 5 cm. in diameter, the surface sometimes

containing streaks of violet, yellowish-red or brownish-red and with a few vegetable fragments; when fresh the mass is either soft or tough, becoming hard and occasionally even brittle on drying; the surface of the freshly fractured tears is milky-white and opaque, changing gradually on exposure to a pinkish or reddish-purple or even reddish-brown; on moistening with water, the tears become milky-white; odor persistent, alliaceous; taste bitter, alliaceous and acrid. Triturate one part of Asafetida with three parts of water; it forms a milk-white emulsion which becomes yellowish on the addition of alkalis. Heat a fragment of one of the tears of Asafetida with sulphuric acid; a reddish-brown solution is formed; greatly dilute the latter with water, filter, and add an excess of any of the alkalis; the solution acquires a blue fluorescence, which becomes more pronounced upon the addition of a slight excess of ammonia water. An alcoholic solution of Asafetida, on the addition of a few drops of phloroglucinol T.S. and a few drops of hydrochloric acid, acquires a cherry-red color. Add a few drops of ferric chloride T.S. to a portion of the alcoholic solution of Asafetida, obtained in the assay process given below; an olive-green color is produced (*most foreign resins*). Add hydrochloric acid to another portion of the same alcoholic solution of Asafetida until a faint turbidity results; a bluish-green color is developed, which fades on standing (*galbanum*). Evaporate a quantity of the same alcoholic solution, representing 5 Gm. of Asafetida, to 25 mls, mix it with 25 mls of petroleum benzin, in a separatory funnel, and afterwards add to it twice its volume of water and agitate. The petroleum benzin layer, after washing with water and subsequent separation, exhibits no green color when shaken with 30 mls of a freshly made aqueous solution of copper acetate (1 in 20) (rosin). Mix 2 mls of emulsion, prepared as directed under *Emulsum Asafoetida*, with 5 mls of water and add 5 mls of sodium hypobromite T.S., so as to form a separate layer; a red color is not produced (*ammoniac*). The yield of ash of the gum-resin does not exceed 15 per cent. The powder is prepared by drying the gum-resin over freshly-burnt lime or by exposure to currents of warm air until it ceases to lose weight and then reducing it to a powder at a low temperature. Diluents of starch or magnesium carbonate may be added in order to maintain the powdered form. The color of powdered Asafetida is light brown. The yield of ash of powdered Asafetida does not exceed 30 per cent.

"Assay.—Introduce about 10 Gm. of Asafetida into a tared, 250 ml Erlenmeyer flask, determine the exact weight of the drug, add 100 mls of alcohol, and having connected the flask with an upright condenser,

boil the mixture in the flask during one hour or until the drug is completely disintegrated. Then transfer the contents of the flask to two counterpoised, plainly folded filters one within the other, so that the triple fold of the inner filter is laid against the single side of the outer, and wash the flask and filter with consecutive, small portions of boiling alcohol until the washings no longer produce a cloudiness when dropped into water. Collect and reserve the mixed alcoholic solutions, for the qualitative tests given above. Dry the filters and flask to a constant weight at a temperature of about 115° C. (239° F.). Now determine the weight of the residue on the filter and in the flask and calculate its percentage from the amount of Asafetida originally taken. This percentage of alcohol-insoluble material, when subtracted from 100, gives the percentage of alcohol-soluble constituents contained in the Asafetida." *U. S.*

"Rounded or flattened tears from twelve to twenty-five millimetres in diameter, or masses containing tears, greyish-white to dull yellow, darkening on keeping. Fresh tears usually tough at ordinary temperatures, hard when cold. Internally yellowish and translucent, or milk-white and opaque; freshly exposed surfaces often slowly become pink, then red, and finally reddish-brown. Odor strong, alliaceous and persistent; taste bitter, acrid and alliaceous. When triturated with *water* Asafetida forms a white emulsion. When the freshly fractured surface of a tear is touched with *sulphuric acid*, a bright red or brownish-red color is produced. The tincture obtained by macerating 0.5 gramme of Asafetida with 10 millilitres of *alcohol* (90 per cent.), filtered, made alkaline with *strong solution of ammonia*, and then largely diluted with *alcohol* (90 per cent.), does not exhibit a blue fluorescence (distinction from and absence of galbanum). Contains not more than 50 per cent. of matter insoluble in *alcohol* (90 per cent.). Ash not more than 15 per cent." *Br.*

Much commercial asafetida of prime appearance fails to come up to the requirements of the U. S. Pharmacopoeia. Large quantities are said to be returned from the United States ports to Europe on account of their failure to contain the proper percentage of material soluble in alcohol, and in reducing the requirements from 60 to 50 per cent. the revisers of the U. S. P. VIII yielded to a slight extent to the necessities of the situation, but the U. S. P. IX raised the percentage of alcohol-soluble constituents to 60 per cent. for asafetida and to 50 per cent. of powdered asafetida. Macerated in water it produces a turbid red solution, and

triturerated with that fluid it gives a white or pinkish milky emulsion of considerable permanence. Touched with nitric acid (sp. gr. 1.2) the tear becomes of an evanescent green color. In 100 parts, Pelletier found 65 parts of resin, 19.44 of gum, 11.66 of bassorin, 3.60 of volatile oil, with traces of acid calcium malate. J. Polasek examined the pure tears of *Asafoetida amygdaloides*, finding the following constituents: 61.40 per cent. of resin soluble in ether, which is regarded by him to be the ferulaic acid ester of *asaresino-tannol*; 0.60 per cent. of resin insoluble in ether, regarded to be free *asaresino-tannol*; 25.10 per cent. of gum; 6.70 per cent. of volatile oil; 0.06 per cent. of vanillin; 1.28 per cent. of free *ferulaic acid*; 2.36 per cent. moisture; 2.50 per cent. impurities. *Asaresino-tannol* has the composition corresponding to the formula $C_{24}H_{35}O_5$. The author has prepared a benzoyl derivative, $C_{24}H_{33}O_5.C_6H_5CO$, and an acetyl derivative, $C_{24}H_{33}O_5.CH_3CO$, which prove it to contain a hydroxyl group—viz., $C_{24}H_{33}O_4.OH$. Umbelliferone was obtained as a secondary product of hydrolysis with sulphuric acid from *asaresino-tannol*, and was also obtained from ferulaic acid synthetically, guaiacol being produced at the same time. By nitrification of *asaresino-tannol*, picric acid is produced. (*A. Pharm.*, 1897, ccxxxv, 125, 132.) The odor of the gum-resin depends on the volatile oil, which may be procured by distillation with water or alcohol, and amounts to from 6 to 9 per cent., according to Fluckiger. It is lighter than water, colorless when first distilled, but becomes yellow with age, of an exceedingly offensive odor, and of a taste at first flat, but afterwards bitter and acrid. Hlasiwetz (*Ann. Ch. Ph.*, lxxi, 23) considers it a mixture, in variable proportions, of the sulphide and disulphide of a compound radical consisting of carbon and hydrogen (C_6H_{11}). Allyl persulphide, which is sublimed when oil of mustard is heated with potassium persulphide, is said by Wertheim to have an extremely intense odor of *asafetida*, a fact which justifies the supposition that it may be identical with the oil of that gum-resin. (Gmelin, ix, 377.) Semmler, in a later study (*Ber. d. Chem. Ges.*, 23, p. 3530, and 24, p. 78), states that it contains pinene and a second terpene in smaller amount, and in the higher boiling fractions, a disulphide, $C_7H_{14}S_2$; a disulphide, $C_{11}H_{20}S_2$; a body $(C_{10}H_{16}O)_n$; a disulphide, $C_8H_{18}S_2$; and $C_{10}H_{18}S_2$.

The resin is, according to Hlasiwetz and Barth (*Ann. Ch. Ph.*, cxxviii, 61), a mixture containing *ferulaic acid*, $C_{10}H_{10}O_4$, crystallizing in

iridescent needles, and obtained by precipitating the alcoholic solution with lead acetate, washing the precipitate, and decomposing it with diluted sulphuric acid. Submitted to dry distillation, the resin yields *umbelliferone*, $C_9H_6O_2$, and blue-colored oils. Fused with potassium hydroxide, ferulaic acid yields oxalic acid and carbon dioxide, several acids of the fatty series, and protoeatechuic acid. The resin itself treated in like manner, after it has been freed from gum, yields resorcinol. Tsehirsch (*Harze und Harzebehalter*, 1900, p. 234) states that the resin is the *ferulaic ester of asaresino-tannol* containing some free *ferulaic acid*, and some *vanillin*, which latter is a product of the oxidation of the ferulaic acid.

Impurities and Adulterations.—Asafetida is often purposely adulterated; it frequently comes of inferior quality, and mixed with various impurities, such as sand and stones. It is generally conceded to be the worst adulterated drug upon the market, the chief adulterant being gypsum. Portions which are very soft, dark brown, or blackish, with few or no tears, and indisposed to assume a red color when freshly broken, should be rejected. We have been informed that a case seldom comes without more or less of this inferior asafetida, and of many it forms the larger portion. It is sold chiefly for horses. A factitious substance, made of garlic juice and white pitch with a little asafetida, has occurred in commerce. Asafetida is said to be sometimes mixed with wheat or barley flour or with earthy matters at the place of its production, the impurities sometimes exceeding 30 per cent. The gum-resin imported from the Persian Gulf and Bombay is largely adulterated with sand and other gum-resins. *Hingra* of the Bombay bazaars is a very stony variety, composed largely of earthy matter. Gaul has recently reported having met with an asafetida containing 45 per cent. of sand. Patch (*Proc. A. Ph. A.*, 1905, p. 183) has found asafetida on the market which yielded 62, 62.5 and 73.3, respectively, of material insoluble in alcohol. The Belgian inspectors reported in 1905 finding as high as 75 per cent. of ash in some commercial samples. In spite of these figures Gehe & Co. report that the quality of the available asafetida has materially improved.

J. U. Lloyd, after examining a large number of samples of commercial asafetida, was convinced that it is impracticable to obtain the crude drug of the official standard, gypsum, carbonates, and other insoluble matters being present in large amounts. He did not find white turpentine or rosin in any of the samples; exhausting asafetida with

alcohol and evaporating the alcohol carefully, he obtained an extract for which he proposed the name of *Purified Asafetida*. (Ph. Rev., 1896.) H. William Jones (Y. B. P., 1900, 503) purifies asafetida by pouring a concentrated alcoholic solution into water slightly acidulated with hydrochloric acid, collecting the precipitate, washing and drying it.

A few years ago a new method was proposed for the detection of adulteration in asafetida which depended upon the combining power of the purified resins with the lead in a standard solution of lead acetate. This method, the details of which will be found in *J. A. C.*, vol. ii, p. 86, is called the lead number and has hardly been in use long enough to warrant its adoption as an official method. Some observers, including Rippetoe (*A. J. P.*, 1913, p. 199) find it to be subject to fluctuations as yet unexplained. Harrison and Self (*Ph. J.*, 1912, 205) present what they term a preliminary report on the investigation of this drug for the purpose of suggesting an improved method of standardization. They claim that there is good reason to believe that the virtues of asafetida are due not only to the volatile oil, but to the sulphur containing constituents of the volatile oil. They give abundant analytical data in support of their views and as showing how adulterations with other gum-resins may be readily detected. They state that if a gum-resin contains not less than 1.5 per cent. of sulphur it may unhesitatingly be pronounced as genuine asafetida. Bernegau and E'we propose a method for estimating asafetida in commercial tablets, pills, etc., depending upon extractions with hot chloroform under specified conditions. (Proc. P. P. A., 1912, p.305.)

Asafetida is sometimes kept in a powdered state, but this is objectionable, as the drug is thus necessarily weakened by the loss of volatile oil, and is more liable to adulteration. Powdered asafetida is best prepared by exposing the gum-resin to a low temperature for several hours or several days.

Uses.—Asafetida appears to have been used in the East from the earliest times of which we have any record and notwithstanding its repulsive odor is at present much used in India and 'Persia as a condiment. It is by some believed to have been imported into Europe as far back as the second century, but the earliest undoubted reference to it in European medical literature is in the twelfth century. Although it is without doubt capable of being absorbed from the intestinal tract in greater or lesser quantities there is no convincing evidence that after its

absorption it exercises any distinct effect upon the system. Pidoux took a half an ounce at one dose without perceptible effects not ascribable to its local action. It has in the past been supposed to exercise a stimulant action upon the cerebral centers. The evidence in favor of this view is based upon the beneficial effects which have followed its administration in *hysteria* and conditions of *nervous exhaustion*. Its effects in these conditions, however, is entirely explicable on the grounds of the psychical impression made by taking a drug of so powerful odor and taste. On the other hand as a local stimulant to the mucous membranes, especially of the alimentary tract, it is a remedy of much value, thus it is a favorite carminative in the treatment of *flatulent colic*; it is often useful as an addition to laxative drugs in various types of *constipation*. There is evidence that after its absorption the volatile oil of asafetida is eliminated through the lungs and consequently it has been used as a stimulating expectorant in various forms of *bronchitis*, in *whooping cough*, and in *asthma*.

When used internally in adults it is generally preferable to administer it in the form of a pill on account of its disagreeable taste. In colic., especially in infants, it is often administered per rectum. For this purpose the emulsion of asafetida in the proportion of from one-half to one fluidounce to a pint of water may be employed.

Asafetida may be given in pill or emulsion. The tincture is official, and is much used. It may also sometimes be conveniently used in the form of a suppository, or plaster. (See *Emplastrum Asafostidae*, 18th ed. U. S. D., p. 238.) A syrup has been recommended in which the fetid odor of the drug is disguised by the use of the infusion of wild cherry bark. (See *A. J. P.*, 1871, p. 397.)

J. W. Wood prepared *syrup of asafetida* by dissolving 256 grains of asafetida in two fluid-ounces of glycerin by the aid of a gentle heat and straining. He then dissolved 15 drops of oil of wintergreen, 5 drops of oil of cinnamon and 1 drop of oil of bitter almond in 3 fluidrachms of 95 per cent. alcohol, and added to it the above, together with enough syrup to make one pint. Each teaspoonful represents two grains of asafetida. (*A. J. P.*, 1874.)

Dose, of asafetida, five to ten grains (0.32-0.65 Gm.).

Off. Prep.—Emulsum Asafoetidae, *U. S.*; Pilula Aloes et Asafoetidae,

Br., *N. F.*; *Pilulee Asafoetidae*, *U. S.*; *Spiritus Ammonias Fetidus*, *Br.*; *Tinctura Asafoetidae*, *U. S.*, *Br.*; *Mistura Magnesia*, *Asafoetidae et Opii* (from Tincture), *N. F.*

Asclepias .*N. F. IV. Butterfly weed. Pleurisy root.*—This is described in the *N. F.* as "the dried roots of *Asclepias tuberosa* Linne (Fam. *Asclepiadaceae*), without the presence of more than 6 per cent. of foreign matter. Usually cut or broken pieces, of variable size, of an irregularly fusiform root, which, when entire is from 10 to 20 cm. in length and from 0.5. to 5 cm. in thickness; occasionally branched; externally pale orange-brown, becoming grayish-brown, annulate above, tho surface roughened by numerous fine intersecting grooves; bark thin; fracture tough, the broken surface granular and white, with inconspicuous pale yellow wood bundles and large white medullary rays. Odor slight; taste bitterish and disagreeable, somewhat acrid. The powdered drug is yellowish-brown and, when examined with the microscope, shows numerous simple or two- to four-compound starch grains, the individual grains up to 0.015 mm. in diameter, somewhat spherical in shape, or truncate and often with a sleft at center; calcium oxalate crystals in rosette aggregates up to 0.04 mm. in diameter; strongly lignified thick-walled stone cells up to 0.075 mm, in diameter and with simple or branching pores; tracheae with reticulate markings, occasionally bordered porea; spindle-shaped sclerenchyma fibers few, lignified and mostly with simple pores. *Asclepias* yields not more than 9 per cent. of ash." *N. F.* It grows from Ontario to Minnesota, most abundantly southward and southwestward. It contains a glucosidal principle, *Asclepiadin*, which occurs as an amorphous body, is soluble in ether, alcohol and hot water. It also contains several resins and a trace of volatile oil. Besides the American species *Asclepias tuberosa*, *A. syriaca*, and *A. incarnata*, which were formerly recognized by the *U. S. Pharmacopoeia*, various other species of the genus have been used medicinally.

To the root of the *A. tuberosa*, have been ascribed diaphoretic, expectorant, and cathartic properties. In the Southern United States the drug has been given in *pulmonic catarrhs* in doses of from twenty grains to a drachm (1.3-3.9 Gm.) in a powder or in the form of a decoction; as a diaphoretic, a teacupful of the decoction (1 in 30) every hour until some effect is produced. For additional information concerning *Asclepias* species, see *U. S. D.*, 19th ed., p. 1400.

Asimina. *Asimina triloba*, (L.) Dunal. (Fam. *Anonaceae*.)—J. U. and C. G. Lloyd have found in the common pawpaw an alkaloid, *asiminine*, besides a volatile oil. (*A. J. P.*, 1886.) T. M. Fletcher failed to find an alkaloid, but gives the principal constituents as fixed oil, 3.53 per cent.; resin, 343 per cent.; resin insoluble in ether, 9.5 per cent.; glucose and extractive, 8 per cent. (*A. J. P.*, 1891, 476.)

Asparagus. *Asparagus officinalis*, L. *Asperge*, Fr. *Spargel*, G. *Esparaguera*, Sp. (Fam. *Convallariaceae*.)—This well-known garden vegetable is a native of Europe. It is perennial and herbaceous. The root, which is inodorous, and of a weak, sweetish taste, is used in France as a diuretic and aperient in the form of decoction, made in the proportion of one or two ounces of the root to a quart of water. Hayne asserts that, in the dried state, it is wholly inert. In the berries H. Reinsch has found a large

proportion of glucose and a yellowish-red coloring matter, *spargin*. (A. J. P., xlii, 371.) From the juice of the young shoots Robiquet and Vauquelin obtained a peculiar crystallizable principle, called *asparagin*, C₄H₈N₂O₃, which has since been found in a number of plants. (See *Althaea*.)

There is at present no sufficient reason for believing that asparagus is of value in practical medicine. The peculiar heavy odor which it imparts to the urine has been the chief foundation for the belief in its diuretic properties; but Nencki (Provincial Med. Journ., March, 1891) appears to have demonstrated that this odor is due to the presence in the urine of methyl-mercaptan, a gas which is frequently produced in minute quantities in the intestines by the decomposition of proteids. According to Justin D. Lyie (N. Y. M. J., July, 1892), eating asparagus causes the urine to answer Trommer's, Fehling's, and Bottger's glycosuria tests, although sugar is not present. Tanret found two carbohydrates, *aspara-gose* and *pseudo-asparagose*, in the roots and green berries of asparagus. (P. J. Tr., 1909, 205.) Certain physiologists have claimed that asparagin has an effect on metabolism, but this view is probably incorrect. (See Z. B., 1892, x.) Asparagus may be administered internally in the form of the syrup produced from the fresh juice or from the tincture. For further information concerning Asparagus, see U. S. D., 19th ed., p. 1401-1402.

ASPIDIUM. U. S. (Br.)

ASPIDIUM [Male Fern]

"The rhizome and stipes of *Dryopteris Filix-mas* (Linne) Schott, or of *Dryopteris marginalis* (Linne) Asa Gray (Fam. *Polypodiaceae*), collected in the autumn, freed from the roots and dead portions of rhizome and stipes and dried at a temperature not exceeding 70° C. (158° F.). Preserve Aspidium in tightly-closed containers and protect from light." U. S. " Male Fern is the rhizome of *Dryopteris Filix-mas*, Schott. Collected late in the autumn, divested of its roots, leaves, and dead portions, and carefully dried. Should not be kept more than a year." Br.

Filix Mas, Br., and U. S. 1870; Stipites aspidii. Radix Filicis maria. Male Shield Fern, Knotty or Sweet Brake, Basket Fern, Bear's-paw Root: Fougere Male, Fr.; Rhizoma Filicis, P. G.; Wurmfarne wurzel, Waldfarne wurzel, Johannis-wurzel, Farnwurzel, G.; Felce maschio, It.; Helecho macho (Rhizoma de), Sp.

As the term *Dryopteris* was first used by Amman in 1739, and applied in 1763 by Adamson, as the name of the genus to which the *Aspidium* was applied in 1800 by Swartz the use of the generic term *Dryopteris* would seem to be necessitated by the ordinary laws of botanic nomenclature. The synonyms of the male fern are extraordinarily numerous. We append some of them: *Aspidium Filix-mas*, of many

authors; *Polypodium Filix-mas* Linn.; *Polystichum Filix-mas* Roth.; *Nephrodium Filix-mas* Rich.; *Lastrea Filix-mas* Presl; *Tectarea Filix-mas* Cavan.; *Dryopteris Filix-mas* (L.) Schott; *Lophodium Filix-mas* Newm.; *Polypodium memorale* Salisb.; *Polystichum durum et induratum* Schur.; *Polystichum abbreviatum* De Can-dolle; *Aspidium mildeamim* Goppert; *Dryopteris affinis*; *Polypodium heleopteris*. Under the name of *inkomankomo* or *uncomocomo*, the rhizome of *Aspidium athamanticum* (Hook.) Kuntze, has long been used by the South African Kaffirs, and has entered European commerce as *pannum*.

The male fern has a perennial, horizontal rhizome, from which numerous annual fronds or leaves arise, forming tufts from a foot to four feet in height. The stipe, or footstalk, and midrib are thickly beset with brown, tough, transparent scales; the frond itself is ovate-oblong in outline, the pinnae being lanceolate, acuminate, slightly broadest above the base (*D. marginalis*), or lanceolate, the pinnae being linear-lanceolate, tapering from base to apex (*D. Filix-mas*). The fructification is in small dots on the back of each lobe, occurring close to the margin in *D. marginalis* and nearer the midvein than the margin in *D. Filix-mas*. The latter is a native of Europe, Asia, and the north of Africa. It is also found in some of the Polynesian islands, and grows in British America, following the Rocky Mountain chain through Mexico, Venezuela, etc., as far south as Peru.

D. marginalis is common in the Eastern United States, especially northward, on rocky hillsides and in the woods.

It is probable that most species of the genus, if not of the family, are medicinally active. J. L. Patterson (*A. J. P.*, 1875) found that the *D. marginalis* contained all of the active principles of *D. Filix-mas*, and Chas. H. Cressler has demonstrated the activity of its oleoresin. (*Ibid.*, 1878.) According to Rosendahl (*P. J.*, 1911, lxxxvii, p. 35) the *Dryopteris dilatata* is indeed four times as active a poison to the tapeworm as the true aspidium. According to V. Penndorf (*Ap. Ztg.*, 1903), in Germany the rhizomes of *D. spinulosum* and *Athyrium Filix-fosmina* are frequently found mixed with those of the true male fern, in quantities varying from five to ninety per cent. The rhizomes of *D. Filix-faemina* are readily recognized by having only two large dumb-bell-shaped steles. The rhizomes of *D. spinulosum* closely resemble those of the genuine drug, but it is stated that they can be distinguished by the numerous small glands found on the margin of their scales, the scales of

D. Filix-mas having only two upon each. On account of this substitution, many of the German extracts of the male fern are said to contain *aspidin*, a yellow crystalline substance having a melting point of 124° to 125° C. (255.2°-257° F.), which is found only in *D. spinulosum*. (*Ap. Ztg.*, 1903.) Lauren of Helsingfors states that the extract of *A. spinulosum* is a very active tenicide, and is less apt to produce disagreeable sensations in the patient than is the official drug. He gives the dose as sixty grains (3.9 G-m.), followed by a laxative, and states that some Finnish apothecaries are especially noted for their fern extracts, because they use only the rhizome of *A. spinulosum*. (*Ap. Ztg.*, 1903.) Under the name of *filicone* there is used what is asserted to be the active principle of *Aspidium spinulosum*. The dose is thirty grains. On the Pacific slope the indigenous *A. rigida* Underw. is locally used against the tapeworm, and W. J. Bowman has found in it filicic acid and resin. Popular belief has long ascribed tenicidal virtues to our native *Asplenium Filix-femina*, commonly known as Lady Fern. It occurs in conical pieces from 8 to 13 cm. long, 2 to 5 cm. in diameter, of a reddish-brown color, covered with root fibers and leaf scars. According to R. Kiirsten (*P. J.*, xxii, 1891), its active principle is closely allied to filicic acid, differing in being especially soluble in strong alcohol, in subliming at 80° C. (176° F.), and is not yielding iso-butyric acid when heated in a sealed tube with water. *Pannic acid* crystallizes in thin, shining, light yellow, rectangular prisms, melting at 187° C. (368.6° F.).

Heffter (*A. E. P. P.*, 1897, 458) finds three well characterized and crystallized principles in pannum: *flavopannin*, $C_{21}H_{26}O_7$, crystallizing in citron-yellow prisms, melting at 151° C. (303.8° F.), and soluble in ether, benzene, acetic ether, acetone, and boiling methyl and ethyl alcohols, insoluble in petroleum, ether and water; *albopannin*, $C_{21}H_{24}O_7$, crystallizing in silky-white needles, which melt at 147° C. (296.6° F.); and *pannol* (pannic acid of Kursten), $C_{11}H_{14}O_4$, fusing at 192° C. (377.6 °F.), which is easily soluble in hot glacial acetic acid and acetone, more difficultly soluble in alcohol and ether, and very slightly soluble in petroleum benzin, benzene, and water. The alcoholic solution is colored intensely dark green with ferric chloride. Heffter compares these three compounds with the three obtained from *D. Filix-mas*, and finds a close chemical and therapeutic correspondence between *aspidin* and *flavopannin*, between *albaspidin* and *albopannin*, and between *aspidinol* and *pannol*. According to the experiments of A. Heffter, both flavopannin and albopannin are powerful muscle poisons, directly

affecting the heart. (*A. E. P. P.*, Bd. xxxviii.)

Aspidium deteriorates rapidly when kept, and in about two years becomes entirely inert. The rhizomes of other species of fern are frequently substituted for the official, and in the dried state it is difficult to distinguish them. The varying results reported by physicians when using this drug, can undoubtedly be ascribed to the employment of spurious male fern, or old brownish rhizomes which should have been thrown away.

Properties.—As taken from the ground, the rhizome consists of a long cylindrical caudex, around which are closely arranged, overlapping each other like the shingles of a roof, the remains of the leafstalks or stipes, which are 2 to 5 cm. in length, from 3 to 8 mm. thick, somewhat curved and directed upwards, angular, brown, shining, and surrounded near their origin from the rhizome with thin silky scales of a light brown color. From between these remains of the footstalks emerge numerous small radical fibers. The whole rhizome, thus constituted, presents a somewhat flexible, cylindrical mass, 2.5 to 5 cm. thick, and from 7 cm. to 4 dm. in length. In this form, however, it is not usually found in commerce. The whole is ordinarily broken up into fragments, consisting of the separated remains of the leafstalks before described, with a small portion of the substance of the rhizome attached to their base, where they are surrounded by the silky scales. These fragments, as seen in commerce, often appear as if long kept, and are probably, in general, much deteriorated by time. The official description is as follows:

“Usually with the blackish-brown outer layers removed; rhizome 1 to 3 cm. in thickness, cylindraceous and nearly straight, or curved and tapering toward one end, usually split longitudinally, roughly scarred with remains of the stipe-bases, or bearing several coarse longitudinal ridges and grooves; stipes cylindrical, 3 to 5 cm. in length, about 6 mm. in thickness, nearly straight or somewhat curved, tapering toward one end, and with occasional elongated patches of the still-adhering, blackish-brown outer layers; fracture short, pale green in the inner half, the texture rather spongy, and exhibiting, in an interrupted circle, from 6 to 12 vascular bundles, each surrounded with an endodermis; odor slight; taste sweetish, astringent, bitter, acrid. Use only such portions as have retained their green color. *Aspidium* yields not more than 3 per cent. of ash.” *U. S.*

"From seven to fifteen centimetres or more in length; the rhizome itself about two centimetres in diameter. Entirely covered with the hard, persistent, curved, angular, dark brown bases of the petioles, which bear numerous brown membranous scales. Petioles green internally and exhibiting in transverse section about eight pale yellow fibrovascular bundles arranged in a diffuse circle (distinction from the petioles of *Athyrium Filix foemina*, Roth.). Rhizomes brown externally, green internally. In transverse section, stalked secreting glands in intercellular spaces. Margins of the membranous scales with two-celled projections but no glands; at the base two minute glands (distinction from the rhizomes of certain other ferns). Feeble but disagreeable odor; taste sweetish and astringent at first, but subsequently bitter and nauseous." *Br.*

In collecting male fern, all the black discolored portions should be cut away, the fibers and scales separated, and only the sound green parts preserved. These should be immediately but carefully dried, and then pulverized; and the powder should be kept in small well-stoppered glass bottles. Powdered althsea leaves are sometimes used as an adulterant of powdered aspidium, giving the desirable light-green tint indicative of a good quality of drug. At other times the powder is said to consist entirely of the chaff and other inert material which the Pharmacopoeia directs should be rejected.

Kraemer has reported that much of the aspidium in the American market consists of the large rhizomes of *Osmunda Claytonia*. For distinction see *Proc. A. Ph. A.*, 1906, p. 345. Capelle discusses the characteristics of genuine aspidium and the differentiation of related species. (*Ap. Ztg.*, 1907, p. 433.)

Microscopic examination shows that aspidium is composed of polyhedral parenchyma and vascular bundles containing sealariform ducts; in *D. Filix-mas* ten of these bundles are arranged in an interrupted circle near to the surface; while in *D. marginalis* there are only six bundles in the circle. It has been analyzed by H. Bock, who gives as its constituents volatile oil, fixed oil, resin, starch, vegetable jelly, albumen, gum, sugar, tannic and gallic acids, pectin, lignin, and various salts. (See *A. J. P.*, xxiv, 64.) Peschier ascertained that its active properties reside in the ethereal extract, which is the fixed oil in an impure state, containing volatile oil, resin, coloring matter, etc. It is a thick dark liquid, with the odor of the fern, and a nauseous, bitterish, somewhat acrid taste. E.

Luck found in it a peculiar acid, which he denominated *filicic acid*. Dacomo gives to filicic acid the formula $C_{14}H_{16}O_5$, and finds in addition a white waxy substance, melting at $80^{\circ} C.$ ($176^{\circ} F.$), with the formula $(C_{13}H_{26}O)_n$, glucose, tannin, a red coloring matter (*filix red*), a green oil which he separated into several fractions, and two resins, one brick-red, melting at 85° to $93^{\circ} C.$ (185° - $199.4^{\circ} F.$), the other black and plastic. He considers that filicic acid is probably an iso-butyric acid derivative of hydroxynaphthaquinone. Poulson (*A. E. P. P.*, 1891) states that, when pure, crystalline, inactive filicic acid is dissolved in alkalis and reprecipitated by an acid, the amorphous precipitate possesses the active properties of the extract. He thinks that the inactive crystalline body is an anhydride or lactone of the amorphous filicic acid, and should be called *filicin*. Bohm announced three additional substances which he named *flavaspidic acid*, *albaspidin* and *aspidinol*. Kraft (*Ph. Ztg.*, 1903, p. 275) confirms this and finds in addition, *flavaspidin*, and an amorphous acid which he names *filmaron*, which pharmacological examination has proven conclusively to be the true anthelmintic constituent of male fern. *Filmaron* is a bright yellowish-brown powder, insoluble in water, difficultly soluble in cold alcohol, but very soluble in other general solvents. The rhizome contains about 5 per cent. of filmaron. Its formula is $C_{47}H_{54}O_{16}$. The other different constituents seem to be largely decomposition products of filmaron. For an assay method for male fern extract, see *Am. Drug.*, 1897, 73.

Uses.—Male fern was used by the ancients, and is mentioned as a vermifuge in the works of Dioscorides, Theophrastus, Galen and Pliny, and by some of the earlier modern writers. But it does not appear to have been generally known till about the year 1775, when the King of France purchased from Madame Nouffer, the widow of a Swiss surgeon, a secret remedy for tapeworm, which proved to be the powdered root of the male fern. As was first demonstrated by Straub (*A. E. P. P.*, 1902, xlviii, p. 1) the principles of aspidium paralyze the voluntary muscles of the higher animals as well as the analogous contractile tissue of the invertebrates. In smaller quantities these principles are stimulant to the central nervous system and may cause even tetanic convulsions.

Aspidium is used in medicine almost solely for the purpose of getting rid of various intestinal parasites, especially the *tapeworm*. As to its value in other forms of *helminthiasis* there is difference of opinion. Schultz (*J. A. M. A.*, 1911, lvii) reports 75 per cent. of cures in cases of hookworm

infection, but Patterson (*T. G.*, 1908, xxxii), on the other hand, states that it has been found absolutely without value in this infection. Its action appears not to be so much to kill the parasite as to paralyze it so that it can be washed out of the alimentary canal with an active purge. For the latter purpose castor oil is often employed, but there is little doubt that its use increases the absorbability of the drug and hence adds to the danger of poisoning. For this reason calomel is generally to be preferred.

Besides as a vermifuge aspidium has been recommended by La Nara (*J. des Pract.*, 1910) as a local application in *eczema* and *acne*.

Aspidium is a violent poison, the relative rarity of serious symptoms from its use being due to its non-absorbability. Under certain conditions, probably when there is a large amount of fatty matter in the bowel, it may be absorbed with unexpected readiness and give rise to serious and even fatal poisoning. Six drachms of it have caused death. (*L. L.*, 1882.) The common symptoms have been vomiting, diarrhea, vertigo, headache, tremors, cold sweats, dyspnea, cyanosis, convulsions and mental disturbances. In nearly half of the cases there was disturbance of vision and even blindness, which in a few instances remained permanently. According to Harnack (*M. M. W.*, 1912, lix, 1941) the blindness is due to spasm of the retinal vessels and subsequent optic atrophy. Prevost and Binet have found that in the lower animals, given hypodermically, the oleoresin produces violent dyspnea and death from arrest of the heart in systole, and Frohner has found parenchymatous nephritis in animals fatally poisoned by it.

Dose, sixty to one hundred and twenty grains (3.9-7.7 Gm.). Filmaron has been used clinically in doses of fifteen to twenty grains (1.0-1.3 Gm.).

Off. Prep.—Oleoresina Aspidii, U. S. (*Br.*).

ASPIDOSPERMA. U. S.

ASPIDOSPERMA Aspidosp. [Quebracho]

"The dried bark of *Aspidosperma Quebracho blanco* Schlechtendal (Fam. *Apocynaceae*), without the presence or admixture of more than 2 per cent. of wood or other foreign matter." *U. S.*

Aspidosperma Quebracho. Quebracho Bark. Quebracho Blanco.

Quebracho is an evergreen tree which sometimes reaches the height of one hundred feet, and is remarkable for its erect stem and its wide-spreading crown reaching out over the cacti and lower bushes among which it grows. The tree is indigenous to the western provinces of Argentine and is also found growing in Chili, Bolivia and Southern Brazil. The bark has been used for a long time in South America as a febrifuge and was not introduced into Europe until about 1878. The name quebracho is derived from the two Spanish words, *quebrar* and *hacha*, signifying "The axe breaks." The wood of the quebracho tree is not met with in commerce, but is said to be very hard, distinctly marked with rings of growth, and of a bright chocolate-brown color, except the very young wood, which is yellowish or reddish. According to Hesse and Penzoldt, the wood contains no alkaloids; it is used for tanning. In addition to *Aspidosperma quebracho blanco* there are two other plants which are known as quebracho. (1) The wood and bark of *Schinopsis Lorentzii* (Grisebach) Engl. (Fam. *Anacardiaceae*) are extensively used in tanning. The plant was formerly known as *Aspidosperma quebracho Colorado* and the wood is sold in commerce as "quebracho wood." Under the name of "quebracho flojo," the wood and bark of *Iodina rhombifolia* Hook. et Am. (Fam. *Santalaceae*) are substituted and sold for quebracho Colorado in Southern Brazil to Argentina and Uruguay.

Properties.—Quebracho bark is remarkable for the extreme thickness of the corky layer which often constitutes more than half of its entire substance, and is separated from the lower layer by a more or less sharply defined outline. The corky layer is usually externally dirty gray, or where it has been rubbed appears yellowish-red. "In irregular chips or in longitudinal pieces attaining a length of 14 cm. and a thickness of 35 mm.; outer corky layer from 3 to 25 mm. in thickness, brownish-gray or reddish-brown and deeply furrowed, frequently somewhat reticulate with longitudinal and shallow transverse fissures, the crevices being occasionally lined with the mycelia of a grayish mold; outer surface of bark, from which the cork has been separated, light brown or reddish-brown and usually more or less roughened; inner surface occasionally with adhering wood, otherwise light yellowish-brown to light reddish-brown, longitudinally finely striate and finely porous; fracture short-fibrous with projecting bast-fibers; nearly inodorous, taste bitter and slightly aromatic. Under the microscope, transverse sections of

Aspidosperma show a number of successive layers of cork separated by large groups of stone cells, isolated bast-fibers and parenchyma; inner bark with starch-bearing medullary rays 1 to 5 cells in width, separating" narrow wedges composed of large prominent groups of stone cells in which are occasionally included one or more thick-walled bast-fibers; bast-fibers usually single, very thick-walled, strongly lignified and surrounded with crystal fibers and starch-bearing parenchyma. The powder is reddish-brown; bast-fibers single, very long and surrounded by crystal fibers, the crystals being in prisms frequently terminated by pyramids and from 0.008 to 0.03 mm. in length; stone cells in large thick groups composed of numerous more or less tabular cells; cork cells more or less polygonal in outline with thick, slightly lignified walls; starch grains single or 2- to 4-compound, the individual grains spherical, ovoid or more or less plano-convex, from 0.003 to 0.025 mm. in diameter." *U. S.*

In 1878, Fraude (*Ber. d. Chem. Ges.*, 1878, p. 2189; 1879, p. 1560) discovered in the quebracho blanco an alkaloid, *aspidospermine*, $C_{22}H_{30}N_2O$, but Hesse has found five other alkaloids, *aspidospermatine*, $C_{22}H_{28}N_2O_2$, and isomeric with it *aspidosamine*, $C_{22}H_{28}N_2O_2$, *quebrachine*, $C_{22}H_{26}N_2O_3$, and isomeric with this *hypoquebrachine*, $C_{21}H_{26}N_2O_2$, and *quebrachamine*, *quebrachol*, $C_{20}H_{34}O + H_2O$, *quebrachit*, $C_6H_{11}(OCH_3)O_5$. (*Ber. d. Chem. Ges.*, xiii, 2308.)

Aspidospermine is a brownish-yellow amorphous powder or needle-shaped crystals, fusing at 205° to 206° C. (401° – 403° F.), is soluble in about 6000 parts of water at 15° C. (59° F.), the solution having a decidedly bitter taste, soluble in about 48 parts of absolute alcohol, in 106 parts of ether, insoluble in glycerin; it dissolves readily in fats and fixed oils, cod liver oil dissolving a larger proportion than it does of quinine. Its *sulphate* and *hydrochloride* are very soluble in water. The citrate is crystallizable, and very soluble. The yield of aspidospermine is small, 0.33 per cent. of the bark. *Aspidospermatine* is crystalline, and fuses at 162° C. (323.6° F.); *aspidosamine* is amorphous, and fuses at 100° C. (212° F.); *quebrachine* in colorless crystals fuses at 214° to 216° C. (417.2° – 420.8° F.); *hypoquebrachine* is a yellowish mass resembling albumin, and fuses at 80° C. (176° F.); *quebrachamine* forms colorless silky needles, only slightly soluble in alcohol, ether, chloroform, and benzin, and fuses at 142° C. (287.6° F.). Two new sugars have also been extracted by Tanret, *quebrachite* and *Iaevogyrate inosite*. Tannin and starch have also been found in the bark. According to H. C. Wood, Jr.,

the most important principle is *quebrachine*. (*U. P. M. B.*, 1910, xxiii.)

Uses.—When a preparation of *aspidosperma* is injected into the circulation it causes an enormous increase in the rate and depth of the respiration with some fall in the blood pressure. Pentzold, who first described the effects of this drug on the respiration, believed that the breathing was dyspneic in type and that the drug acted by preventing the red corpuscles from giving up their oxygen. He based his belief on the fact that after death from the poison the blood had the same color in both arteries and veins, but Wood and Hoyt (*U. P. M. B.*, Sept., 1903) showed that the blood retained its normal oxidizing powers after *aspidospermin* and believed that the arterial hue in the veins was due to the violence of the respiration. The fall of blood pressure is due primarily to weakness of the heart, although larger doses also cause dilatation of the blood vessels— according to Cow (*J. P. Ex. T.*, 1914, v, p. 341), by a depressant action on the medullary centers. The increase in the respiration which is the most marked effect of *aspidosperma* appears to be due to a direct action upon the respiratory center as H. C. Wood, Jr. (*U. P. M. B.*, 1910, xxiii), has shown that it does not affect the circulation in the lungs, and Cow that it does not affect the bronchioles.

All of the alkaloids of *aspidosperma* as far as they have been studied are possessed of similar physiological properties, although to different degree. Both Wood and Cow agree that *quebrachine* is the most active alkaloid in the drug.

Aspidosperma is used in medicine for the relief of various types of dyspnea, especially in *emphysema* and *asthma*. In the latter condition it is not generally useful to interrupt the paroxysm, but in many cases if used continuously will greatly reduce the frequency and severity of attacks.

Under the name of *amorphous aspidospermine* there has entered in commerce a mixture of the various alkaloids of this drug. Dose of this preparation is from a quarter to one grain (0.016-0.065 Gm.); that of the crystalline *aspidospermine* is from one-fortieth to one-twentieth of a grain (0.0016-0.003 Gm.).

Dose, of *aspidosperma*, fifteen grains (1 Gm.); it is not, however, used in the crude state.

Off. Prep.—Fluidextractum Aspidospermatis, U. S.

Asplenium. *Asplenium Filix-foemina* (L.) Bern. *Female Fern*.—The rhizome of the female fern has been supposed to possess similar vermifuge properties to that of the male fern. At present, however, it is not used. The vulgar name of female fern is also given to the *Pteris aquilina*, or common brake, which is further said by some authors to have the property of destroying the tape worm. The leaves of two species of *Asplenium*, *A. Trichomanes*, L., or *common spleenwort*, and *A. Adiantum-nigrum*, L., or *black spleenwort*, are mucilaginous, and have been used as substitutes for maidenhair (*Adiantum Capillus-Veneris* L., and *A. pedatum*. L.) as pectorals, though destitute of their aromatic flavor.

Aster. *Aster puniceus*, L. (Fam. *Compositae*.) —The aromatic astringent rootlets of this indigenous plant have been employed as a stimulating diaphoretic in rheumatic and catarrhal affections.

Asteracantha. *Asteracantha longifolia* Nees. Ik Kirit. (Fam. *Acanthaceae*.)—This Indian plant is said by A. Jayesingha to be an energetic hydragogue diuretic. (*Ph. Z. R.*, Sept., 1887.)

Atherosperma. *Atherosperma moschatum* Labill. *Australian Sassafras*. (Fam. *Monimiaceae*.) —The bark of this tree, a native of Southern Australia, is said to have been long used by the aborigines, and later by the settlers, in *rheumatism* and in secondary *syphilis*, and has been highly commended by Grooves (L. L., 1862) in acute *bronchitis*. It has been stated that both the bark and the volatile oil are powerful poisons, and Zeyer (*Vierteljahrschr. f. Pract. Pharm.*, x, 504) obtained from the drug an alkaloid, *atherospermine* (C₃₀H₂₀NO₅); see also Wittstein's *Organic Constituents of Plants*, 20. The abundant volatile oil is light yellow, and has a pleasant aromatic odor and taste, resembling those of oil of sassafras. Scott obtained from the leaves 1.7 to 2.65 per cent. of volatile oil. (*J. Chem. S.*, 101, 1912, 1612.) Ralph Stockman (*Lab. Rep. Royal Coll. Phys.*, vi, 1897) found it to resemble in its physiological action oil of sassafras and other allied volatile oils. He took repeatedly ten minims (0.6 mil) without any pronounced effect, and one fluidrachm (3.75 mils) given to a rabbit caused only temporary stupor, with slowing of the respiration, but not of the pulse. Three fluidrachms (11.25 mils) caused in the rabbit marked depression of the heart and of the respiration, coma, and death in twelve hours by asphyxia.

AURANTII AMARI CORTEX. U. S. (Br.)

BITTER ORANGE PEEL Aur. Amar. Cort.

"The dried rind of the fruit of *Citrus Aurantium amara* Linne (Fam. *Rutaceae*)." U. S. "Dried Bitter-Orange Peel is the dried outer part of the pericarp of *Citrus Aurantium*, var. *Bigaradia*, Hook. f." Br.

Aurantii Cortex Siccatus, *Br.*; Aurantii Pericarpium; Cortex Aurantiorum, Cortex Pomorum Aurantii; Seville Orange Peel, Wild Orange Peel; Ecorce (Zeetes) d'Oranges ameres, Ecorce de Bigarade, *Fr.*; Cortex Aurantii Fructus, *P. G.*; Pomeran-Eenschale, *G.*; Cortecchia di arancio amaro, *It.*; Corteza de naranja amarga, *Sp.*

Bitter Orange Peel of the U. S. P. IX is the dried rind. In the *Br. Pharm.*, 1914, both the dried and the fresh rind are official, while under the name of *Aurantii Cortex Indicus*, Indian Orange Peel, the *British Pharmacopoeia*, 1914, recognizes the bitter orange peel obtained from varieties of the *Citrus Aurantium*, grown in India and Ceylon. For description and properties, see under *Aurantii Dulcis Cortex*.

Off. Prep.—Fluidextractum Aurantii Amari, *U. S.*; Infusum Aurantii, *Br.*; Infusum Aurantii Compositum, *Br.*; Tinctura Aurantii Amari, *U. S. (Br.)*; Syrupus Aurantii (from Tincture), *Br.*; Vinum Aurantii Compositum, *N. F.*

AURANTII CORTEX INDICUS. Br.

INDIAN ORANGE PEEL

"Indian Orange Peel is the fresh and the dried outer part of the pericarp of varieties of *Citrus Aurantium*, Linn., grown in India and Ceylon." *Br.*

It is thus described: "Possesses the pleasant aromatic odor and bitter taste characteristic of Bitter-Orange Peel derived from *Citrus Aurantium*, var. *Bigaradia*, Hook, f. Inner surface retains not more than a very small amount of the white spongy part of the pericarp." *Br.*

In India and the Eastern divisions of the Empire, Indian Orange Peel, fresh or dried, may be employed in making the official preparations for which Fresh or Dried Bitter-Orange Peel is directed to be used.

AURANTII CORTEX RECENS. Br.

FRESH BITTER-ORANGE PEEL

"Fresh Bitter-Orange Peel is the fresh outer part of the pericarp of *Citrus Aurantium*, var. *Bigaradia*, Hook. f." *Br.*

It is thus described: "Outer surface red or deep orange-red in color, and generally rough. Inner surface retains not more than a very small

amount of the white spongy part of the pericarp; in transverse section numerous large oil-glands below the epidermis. Pleasant aromatic odor; taste aromatic, bitter." *Br.*

AURANTII DULCIS CORTEX. U. S.

SWEET ORANGE PEEL Aurant. Dulc. Cort.

"The outer rind of the fresh, ripe fruit of *Citrus Aurantium sinensis* Gallesi (Fam. *Rutaceae*)." *U.S.*

Cortex Aurantiorum Dulcium; Ecorce (Zestee) d'Orangea douces, *Fr.*; Apfelaenschalen, *G.*; Scorze del frutto dell' arancio, *It.*; Corteza de naraja dulce, *Sp.*

The U. S. Pharmacopoeia includes two kinds of orange peel, bitter and sweet, the former dried and the latter fresh. On the other hand, the British Pharmacopoeia recognizes bitter orange peel in three forms, the fresh and the dried, under the respective names of Aurantii Cortex Recens, fresh bitter orange peel, Aurantii Cortex Siccatus, dried bitter orange peel, and Indian Orange Peel; but the orange peel which is called sweet by the U. S. Pharmacopoeia—i.e., *Citrus Aurantium*—is termed *C. Aurantium* var. *Bigaradia*, bitter orange peel, by the British authority.

The orange tree grows to the height of about thirty feet. Its stem is rounded, much branched, and covered with a smooth, shining, greenish-brown bark. In the wild state, and before inoculation, it is often furnished with axillary spines. The leaves are ovate, pointed, entire, smooth, and of a shining pale green color. When held between the eye and the light, they exhibit numerous small transparent vesicles, filled with volatile oil, and when rubbed between the fingers, are highly fragrant. Their footstalks are about an inch long, and have wing's or lateral appendages. The flowers, which have a delightful odor, are large, white, and attached by short peduncles, singly or in clusters, to the smallest branches. The calyx is saucer-shaped, with pointed teeth. The petals are oblong, concave, white, and beset with numerous small glands. The filaments are united at their base in three or more distinct groups, and support yellow anthers. The ovary is roundish, and bears a cylindrical style, terminated by a globular stigma. The fruit is a spherical berry, often somewhat flattened at its base and apex, rough, of a yellow or orange color, and divided internally into a number of

vertical loculi, each containing from two to four seeds, surrounded by a pulp. The rind of the fruit consists of a thin exterior layer, abounding in schizolysigenous cavities filled with a fragrant volatile oil, and of an interior one, which is thick, white, spongy, insipid, and inodorous.

According to Lloyd, the orange was unknown to the ancient Greeks and Romans and was probably introduced into Europe by the Arabians. (*Bull. Lloyd Libr.*, 1911, p. 7.) According to Tschirch, the word orange is derived from the Sanscrit, Nagaranga or Naranga. (*J. P. C.*, 1910, p. 2.)

There are two varieties of *C. Aurantium*, considered by some as distinct species. They differ chiefly in the fruit, which in one is sweet, in the other is sour and bitterish and often has a darker and rougher rind. The sweet is officially recognized as *Citrus Aurantium sinensis* L., and the bitter or Seville variety as *Citrus Aurantium amara* L. The latter is ascribed by the British authority to *Citrus Aurantium* var. *Bigaradia* Hook, f., which is the Mandarin Orange. This is probably a native of China, but cultivated in Sicily, the south of Italy, and Florida, bears a fruit much smaller than the common orange, round, but flattened above and below, with a smooth, thin, delicate rind, and a very sweet delicious pulp. A volatile oil is obtained from the rind by expression, of a yellow color, a very bland agreeable odor, different from that of the orange or lemon, and a not unpleasant taste, like that of the rind. When freed from coloring matter by distillation, it was found by M. S. de Luca to be a pure hydrocarbon, with the formula $C_{10}H_{16}$. (*J. P. C.*, 3e ser. xxxiii, 52.) This constituent is now recognized as *d-limonene*.

The orange tree is a beautiful evergreen, in which the fruit is mingled, in every stage of its growth, with the blossoms and foliage and has been applied to numerous purposes of utility and ornament. A native of China and India, it was introduced into Europe at a very early period, was transplanted to America soon after its first settlement, and is now found in every civilized country where the climate is favorable. The fruit is brought to us chiefly from California, Florida, Southern Europe, and the West Indies. The Florida and Havana oranges are the sweetest. A seedless variety termed the *navel orange* is rapidly replacing all others in cultivation.

Various parts of the plant are used medicinally. The leaves, which are bitter and aromatic, are employed in some places in the form of infusion as a gently stimulant diaphoretic. They yield by distillation with water a

volatile oil, which is said to be often mixed by the distillers with the oils obtained from the flowers and unripe fruit. In regard to polarized light it has a rotary power to the left, which is considerably weakened by the prolonged action of heat. (Chautard, *J. P. C.*; 3e ser. xlv, 28.) The fresh flowers may be kept for some time by mixing them well with half their weight of sodium chloride, pressing the mixture in a suitable jar, and keeping it well closed in a cool place. They were formerly recognized by the U. S. P. under the name of *Aurantii Flores*, and were officially described as "about half an inch (12 mm.) long; calyx small, cup-shaped, five-toothed; petals five, oblong, obtuse, rather fleshy, white and glandular-punctate; stamens numerous, in three or more sets; ovary globular, upon a small disk, with a cylindrical style, and a globular stigma; odor very fragrant; taste aromatic and somewhat bitter." U. S., 1880. The dried flowers are used on the continent of Europe as a gentle nervous stimulant, in the form of infusion, two drachms to the pint of boiling water, taken in the dose of a teacupful. The flowers should be dried in the shade, at a temperature between 24° C. (75° F.) and 35° C. (95° F.).

An oil is obtained also from the flowers by distillation,, which is called *oil of neroli*, and is much used in perfumery, and in the composition of *liqueurs*. It is an ingredient of the famous Cologne water. That obtained from the flowers of the Seville or bitter orange is deemed the sweetest. It was introduced into the Edinburgh Pharmacopoeia, with the title of *Aurantii Oleum*, to serve for the preparation of orange flower water. Soubeiran considers this oil rather as a product of the distillation than as pre-existing in the flowers. The fact may thus be explained that orange flower water made by dissolving even the finest neroli oil in water has not the precise odor of that procured by distillation from the flowers.

The fruit is applied to several purposes. Small unripe oranges, about the size of a cherry or less, previously dried, and rendered smooth by a turning-lathe, were sometimes employed to maintain the discharge from issues. They were preferred to peas on account of their agreeable odor, and by some were thought to swell less with the moisture; but this was denied by others, and it was asserted that they required to be renewed at the end of twenty-four hours. These fruits are sometimes found in commerce under the name of *orange berries*. They are sub-globular, 5 to 20 mm. in diameter, of a grayish or greenish-brown color, fragrant odor, and bitter taste, and are said to be used for flavoring cordials. A volatile

oil is obtained from them by distillation, known to the French by the name of *essence de petit grain*, and employed for similar purposes with that of the flowers. The oil, however, which now goes by this name is said to be distilled from the leaves, and those of the bitter orange yield the best. The oils from the unripe and the ripe fruit have a rotating power to the right, the latter much greater than the former; and this property might serve to distinguish them from the oil of the leaves. Several of the oils from the *Rutaceae* deposit a crystalline substance, differing from camphor. (Chautard.) The juice of the Seville orange is sour and bitterish, and forms with water a refreshing and grateful drink in febrile diseases. It is employed in the same manner as lemon juice, which it resembles in containing citric acid, though in much smaller proportion. The sweet orange is more pleasant to the taste, and is extensively used as a light refrigerant article of diet in inflammatory diseases, care being taken to reject the membranous portion. The best mode of separating the outer rind, when its desiccation and preservation are desired, is to pare it from the orange in narrow strips with a sharp knife, as we pare an apple. When the object is to use the fresh rind for certain pharmaceutical purposes, as for the preparation of the *confection of orange peel*, it is best separated by a grater, carefully avoiding the grating of the white portion which contains the bitter principle. The dried peel sold in the shops is usually that of the Seville orange, and is brought chiefly from countries adjacent to the Mediterranean.

Properties.—*Bitter orange peel* has a grateful aromatic odor, which depends upon the volatile oil contained in its schizo-lysigenous cavities, and a warm, bitter taste. Bitter orange peel occurs "in narrow, thin bands (ribbons), or more often elliptical, flattened, more or less curved, pieces (quarters), varying from 3 to 6 cm. in length; outer surface convex, varying from reddish- or yellowish-brown (ribbons) to greenish-brown (quarters), coarsely reticulate and with the edges recurved; inner surface concave, whitish, with numerous conical projections and yellowish-white, linear, more or less anastomosing fibro-vascular bundles; fracture hard; transverse section light brown, somewhat spongy, outer layer with 1 or 2 rows of oil reservoirs; odor fragrant; taste aromatic and bitter. The powder is yellowish-white or light brown; fragments of parenchyma cells numerous, the walls from 0.004 to 0.012 mm. in thickness; few fragments of tracheae with close spiral markings or simple pores; occasional membrane crystals of calcium oxalate in monoclinic prisms, from 0.02 to 0.035 mm. in diameter. Powdered Bitter

Orange Peel is colored yellowish upon the addition of potassium hydroxide T.S. Bitter Orange Peel yields not more than 7 per cent. of ash." *U. S.*

"In thin strips. Outer surface deep orange-red and rough. Inner surface retains not more than a very small amount of the white spongy part of the pericarp; in transverse section numerous large oil-glands below the epidermis. Pleasant aromatic odor; taste aromatic, bitter." *Br.*

The *Br. Pharmacopoeia* requires that the outer surface both of the fresh and of the dried bitter orange peel shall be of a deep orange-red color, and rough and glandular.

The sweet peel is described officially as having "the outer, orange-yellow layer recently separated by grating or paring and consisting of epidermal cells, parenchyma cells of the sarco-carp with chromoplastids, oil reservoirs and globules of volatile oil; odor highly fragrant; taste pungently aromatic." *U. S.*

For the preparation of powdered bitter orange peel the German *Pharmacopoeia* directs that the drug should be previously dried over freshly burnt lime. For histological study of orange fruit, see Winton and Moeller, "The Microscopy of Vegetable Foods." Bitter orange peel is sometimes adulterated with sweet orange peel. The latter is distinguished by the pieces being thinner and of a more orange-red color. They are less aromatic and bitter. The following test which is distinctive for bitter orange peel is recognized by the *Netherland Pharmacopoeia*: the section of the fruit is mounted in a solution of potassium bichromate slightly heated when the tissues become colored brown. This reaction does not take place with sweet orange peel. A distinctive test for the latter is the use of fuming nitric acid (containing 55 per cent. N_2O_5) which gives a dark green color distinguishing it from bitter orange peel which is colored brown.

Both orange peels yield their sensible properties to water and alcohol. The bitter principle, hesperidin $C_{28}H_{34}O_{15}$, was discovered by Le-breton in 1828, but its character as a glucoside was first established by Hilger and Hoffmann. (*Ber. d. Chem. Ges.*, 9, 26, 685.) Treated with diluted acids it yields *hesperedin*, $C_{16}H_{14}O_6$, and glucose. It is crystalline (fusing point 250° to 251° C. (482° - 483.8° F.)), and may be prepared by Patemo and Briosi's process, as follows: The cut and bruised oranges are covered

with diluted alcohol, solution of potassium hydroxide added in excess, the liquor filtered after two days, and impure hesperidin precipitated by hydrochloric acid; the precipitate is boiled with acetic acid for ten minutes, and, after cooling, filtered from the resinous mass left. The hesperidin gradually separates from the filtrate upon standing, in white fine needles. From 4000 oranges about 6 ounces av. of the principle were obtained. (*Ber. d. Chem. Ges.*, 1876, 250-252.) Tanret found in the rind of the bitter orange,

- (1) a crystalline acid, $C_{44}H_{28}O_{14}$;
- (2) a non-crystalline resinous body;
- (3) *hesperidin*;
- (4) *isohesperidin*, a crystalline glucoside isomeric with hesperidin;
- (5) *aurantiamarin*, another glucoside to which, in part, the bitterness of the peel is due. (*P. J.*, 1886, 839.)

Orange peel contains also albumen, gum, resin, a trace of fixed oil, volatile oil, and a principle resembling tannin in its action on salts of iron. The bitter principles are much more abundant in the white spongy inner portion of the peel than in the outer yellowish layer. The volatile oil, *Oleum Aurantii*, U. S., may be obtained by expression from the fresh grated rind, or by distillation with water. It is imported into the United States in tinned copper cans. It has properties resembling those of the oil of lemons, but spoils more rapidly on exposure to the air, acquiring a terebinthinate odor. The perfumers use it in the preparation of Cologne water, and for other purposes; and it is also employed by the confectioners. According to Imbert-Gourbeyre, persons who are much exposed to the inhalation of the oil of bitter oranges are apt to be affected with cutaneous eruptions, and various nervous disorders, as headache, tinnitus aurium, oppression of the chest, gastralgia, want of sleep, and even muscular spasm. (*Ph. Cb.*, Feb., 1854, 128.)

Uses.—Bitter orange peel is a mild tonic, carminative, and stomachic; the sweet is simply aromatic; but neither is much used alone. They are chiefly employed to communicate a pleasant flavor to other medicines, to correct their nauseating properties, and to assist their stimulant impression upon the stomach. They are a frequent and useful addition to bitter infusions and decoctions, such as those of gentian, quassia, calumba, and Peruvian bark. It is obviously improper to subject orange peel to the action of heat, as the volatile oil is thus driven off. Violent colics, convulsions, and even death have been caused in children by

eating large quantities of the rind. When orange peel is used simply for its agreeable flavor, the rind of the sweet orange is preferable; as a tonic, that of the Seville orange.

Dose, from half a drachm to a drachm (2.0-3.9 Gm.).

Off. Prep.—Syrupus Aurantii, *U. S.*, *Br.* (from Tincture); Tinctura Aurantii Dulcis, *U. S.*; Vinum Aurantii (from Fresh Peel), *Br.*

Azadirachta. Azedarach, *U. S.* 1880. *Pride of India. Pride of China. Ecorce d'Asedarach, Ecorce de Margousier, Fr. Zedrachrinde, G.*—The *U. S. P.* formerly recognized the bark of the root of *Melia Azedarach* L. (Fam. *Meliaceae*), a beautiful tree, thirty or forty feet high, with a trunk fifteen or twenty inches in diameter. This species of *Melia* is a native of Syria, Persia, and the north of India, and is widely cultivated. It is abundant in our Southern States. North of Virginia it does not flourish. "The bark [root] is in curved pieces or quills of variable size and thickness; outer surface red-brown, with irregular, blackish, longitudinal ridges; inner surface whitish or brownish, longitudinally striate; fracture more or less fibrous; upon transverse section tangentially striate, with yellowish bast fibers; inodorous, sweetish, afterwards bitter and nauseous. If collected from old roots, the bark should be freed from the thick, rust-brown, nearly tasteless, corky layer." *U. S.*, 1880. The bark of the trunk is "externally of a rusty-gray color, internally yellowish, and much foliated; coarsely fibrous; inodorous, bitter and slightly astringent, structure and thickness varying according to age." *Br. Add.* (For a description of the leaves and root bark, see *Ph. Rev.*, 1896, p. 231.)

Oil of Azedarach is found of two kinds in Eastern Asia where it is used. One is employed for burning, the other medicinally. The latter oil, according to Lewkowitch (*Oils, Fats, Waxes*, vol. ii, p. 426), is known as *Veepa Oil, Veppam Fat* and *Neem Oil*, and has a specific gravity of 0.914, a saponification value of 196.9, and iodine value of 69.6, a Reichert-Meissel value of 1.1 and a butyro-refractometer reading of 52° at 25° C. (77° F.).

Azadirachta indica *Br. Add. Neem Bark, Margosa Bark.* Under this name was recognized the bark of the stem of *Melia Azadirachta* L., or *Indian Lilac Tree*.—This contains, according to Broughton (*P. J.*, 1873, 992), a bitter amorphous resin, and a crystallizable principle, melting at

175° C. (347° F.). (See also *Ph. Rev.*, 1896,231.) Cornish (*Ind. Ann. Med. Sci.*, 4, 104) had previously announced the presence of a bitter alkaloid, to which he gave the name *margosine*.

The decoction of azedarach is affirmed to be cathartic and emetic, and in large doses narcotic; but in a number of experiments made by H. C. Wood with extracts from the dried bark and fruit, it was found impossible to poison frogs or rabbits. Robins eating of the sweetish fruit, of which they are very fond, are often rendered so far insensible as to be picked up under the tree; though they usually recover in a few hours. Children are said to eat the fruit without inconvenience, and possibly the robins simply choke themselves with the large berries. The bark is considered, in the Southern States, an efficient anthelmintic. The form of decoction is usually preferred. A quart of water is boiled with four ounces of the fresh bark to a pint, of which the dose for a child is a tablespoon-ful every two or three hours, until it affects the stomach or bowels. Another plan is to give a dose morning and evening for several successive days, and then to administer an active cathartic. The fresh bark and the fruit are said to be superior as vermifuges. The *Br. Add.* recognized an infusion (*Infusum Azadirachtae Indicae*, *Br. Add.*), eighty-eight grains in a pint of cold water, *dose*, one-half to one fluidounce (15-30 mils); also a tincture (*Tinctura Azadirachtae Indicae*, *Br. Add.*), two ounces in a pint of 45 per cent. alcohol, *dose*, one-half to one fluidrachm (1.8-3.75 mils).

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Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Baccharis. *Baccharis cordifolia* DC. *Mio Mio*. —This composite plant of Southeastern South America is notorious for its deadly effect upon sheep and cattle. Pedro N. Arata has isolated from it an alkaloid *baccharine*. (*P. J.*, x, 6.)

Balanites. *Agialida*. *Balanites Roxburghii* Planch. (Fam, *Zygophyllaceae*.) —The fruit of this plant is used medicinally in India. It contains a principle closely resembling saponin. The ripe seed yield about 50 per cent. of a fixed oil (*zachun oil*), which is used for burning. (See *P. J.*, 1913, 905.) The unripe fruit is anthelmintic and purgative.

Balata. *Gum Chicle*. *Chicle*. *Tuno Gum*. *Leche de Popa*, Fr. *Zapota Gum*.—This is the dried milky juice of the Bully Tree, *Mimusops Balata* Gartn. (*Sapota Muelleri* Linden) of the Fam. *Sapotaceae*, a native of Northern South America from Mexico to Guiana. It is an oxidized hydrocarbon, both physically and chemically closely related to caoutchouc and gutta-percha, of a grayish-white color, with dark spots and veins; specific gravity 1.05; tasteless, but emitting an agreeable odor when warmed. It has the general properties of gutta-percha, differing, however, in being but slightly extensible, a property which specially fits it for the manufacture of transmission belts. Solid and somewhat crumbling at ordinary temperature, it softens at 49° C. (120.2° F.), and can be molded like gutta-percha. The chemical constituents of chicle have been investigated by Tschirch and Schereschewski who found so-called resins, two of them being crystallizable *a-balatan* and *b-balaban* and a yellow substance, *balaflluavil*. (*A. Pharm.*, 243, No. 5, 1905, 358; see also Bosz and Cohen's investigations, *A. Pharm.*, 250, 1912, No. I, 52; also *P. J. Tr.*, 1910, 609.) It is used as a substitute for gutta-percha, but more especially in the manufacture of chewing gum, for which purpose it is imported in large amounts from Mexico. It is sometimes adulterated with paraffin wax. It is not used in medicine.

Balm of Gilead. *Balsam of Gilead*. *Mecca Balsam*. *Balsamum Meccae* v. *Judiacum*. *Balsamum Oileadense*. *Baume de la Mecque*, Fr.—The genuine balm of Gilead is the resinous juice of *Commiphora Opobalsamum* (L.) Engl. (Fam. *Burseraceae*), a small evergreen tree, growing on the Asiatic and African shores of the Red Sea. It was in high repute with the ancients, and is still esteemed by the Eastern nations as a medicine and cosmetic. In Western Europe and in this country it is seldom found in a

state of purity, and its use has been entirely abandoned. It is described as a turbid, whitish, thick, gray, odorous liquid, becoming solid by exposure. It possesses no medicinal properties not existing in other balsamic or terebinthinate juices. It was formerly known as *opobalsamum*, while the dried twigs of the tree were called *xylobalsamum*, and the dried fruit, *carpobalsamum*. In this country Poplar buds are often, incorrectly, called Balm of Gilead Buds.

Balsam of Cativo. *Cativo Balsam.*—This substance appeared in the London market in 1902 as a substitute for copaiba. It is a balsamic resin, opaque, of a dirty light brown color and slightly bitter taste, and having an extremely adhesive quality. According to Umney, it is not soluble in 90 per cent. alcohol, but is soluble in ether and consists chiefly of acid resins with the addition of an oily substance. According to Weigel's analysis it consists of 80 per cent. of resin acids and 2 per cent. of volatile oil. It is supposed to be a product of *Prioria copaifera* Gris. (Fam. *Leguminosae*), a large tree indigenous to Panama and Jamaica. (See *P. J.*, vol. lxi; and *Ph. Centralh.*, March, 1903.)

Balsam of Cebur or Tagulaway.—*Cebur* or *Tagulaway Balsam* is prepared in the Philippine Islands by boiling the root and twigs of *Parameria vulneraria* Radl. (Fam. *Apocynaceae*), in cocoa-nut oil, so as to form a yellowish-white, oily liquid, which is used with asserted excellent results for *skin diseases* and *wounds*. (*A. Pharm.*, Nov., 1885.)

Balsam of Lagam. *Lagam Balsam.*—A thick, yellowish, fluorescent liquid, of a peculiar aromatic odor, and bitterish, acrid taste, resembling copaiba. (*A. J. P.*, 1883, p. 368.)

Balsam of Riga. *Riga Balsam. Balsamum Carpathicum. Balsamum Libani.*—This is the product of *Pinus Cembra*, L. (Fam. *Pinaceae*), a large tree growing in the mountainous regions and northern latitudes of Europe and Siberia. The juice exudes from the extremities of the young twigs, and is collected in flasks suspended from them. It is a thin, white fluid, having an odor analogous to that of the juniper, and possessing the ordinary terebinthinate properties. In this country it is very rare; but it is occasionally brought from Riga or Kronstadt in bottles. Keller, of Darmstadt, affirms that Riga Balsam is the product of the ordinary *Pinus palustris* Mill. A similar product, called *Hungarian balsam*, is obtained in the same manner from *Pinus Pumilio* Haenke, growing on the mountains of Switzerland, Austria and Hungary.

Balsam of St. Thome. *Pan Olao. Belam Pu.* A balsam obtained from *Santiriopsis balsamifera* (Oliv.) Engl. (Fam. *Burseraceae*). It is a resinous juice obtained by incisions in the trunk of the tree. It is used as a vulnerary and in diseases of the bladder and bronchi. (*Ap. Ztg.*, 1898.)

Balsam Wood. *Palo Balsamo.*—This is a South American wood, derived from an unknown tree, which is believed to contain guaiacin, and which yields to distillation nearly six parts of a thick viscous aromatic oil. This contains as its chief constituent a crystalline solid of alcoholic character, melting at 91° C. (195.8° F.) and

corresponding closely to the formula $C_{14}H_{24}O$. It has found employment in perfumery. (*Sohim. Rep.*, April and Oct., 1892.)

Balsamorhiza. *Balsamorhiza terebinthinacea* Nutt. (Fam. *Compositae*.) —The root of this plant, obtained from Idaho and Oregon, has a strong, terebinthinate odor, and is used medicinally in the Western States. It contains volatile oil, fixed oil, resin, organic acid, and sugar (Herman T. Kelly, *D. C.*, 1897, 32).

BALSAMUM PERUVIANUM. U. S., Br.

BALSAM OF PERU Bals. Peruv. [Peru Balsam]

“A balsam obtained from *Toluifera Pereirae* (Royle) Baillon (Fam. *Leguminosae*)." U. S. “Balsam of Peru is a viscid balsam exuded from the trunk of *Myroxylon Pereirae*, Klotzsch, after the bark has been beaten and scorched.” *Br.*

Balsamum Peruvianum Nigrum, Balsamum Indicum; Baume des Indes, Baume de Perou noir, Baume de Sonsonate, *Fr.*; Balsamum peruvianum, *P. G.*; Peruvianischer Balsam, Indischer Balsam, Perubalsam, *G.*; Balsamo peruviano, Balsamo del Peru, *It.*; Balsamo del Peru liquido, Balsamo de San Salvador, Balsamo negro, *Sp.*

The origin of Peru balsam has been the subject of considerable investigation (see U. S. D., 19th ed.), and while the U. S. Pharmacopoeia in conjunction with the Swiss Pharmacopoeia ascribes it to *Toluifera Pereirae*, the British authority ascribes it to *Myroxylon Pereirae*. Tschirch, who has given a great deal of attention to the origin of Peru balsam, has come to the conclusion that it is merely a physiological variety of the same tree that yields Balsam of Tolu, and has designated it as *Toluifera Balsamum*, L., var. *phys. Pereirae*.

Toluifera Pereirae is a handsome tree, with a straight, round, lofty stem, a smooth ash-colored bark, and spreading branches at the top. The leaves are alternate, petiolate, and unequally pinnate. The leaflets are from five to eleven, shortly petiolate, oblong, oval-oblong, or ovate, about three inches long by somewhat less than an inch and a half in breadth, rounded at the base, and contracting abruptly at top into an emarginate point. When held up to the light they exhibit, in lines parallel with the primary veins, beautiful rounded and linear pellucid spots. The common and partial petioles and midribs are smooth to the naked eye, but when examined with a microscope are found to be furnished with short hairs. The fruit, including the winged footstalks,

varies from two to four inches in length. At its peduncular extremity it is rounded or slightly tapering; at the top enlarged, rounded, and swollen, with a small point at the side. The mesocarp, or main investment of the fruit, is fibrous, and contains in distinct receptacles a balsamic juice, which is most abundant in two long receptacles or vittae, one upon each side. The yellowish-white beans yielded to Rother (P. J.) xv, 244) two per cent. of coumarin; the husks, a brown, extremely bitter, somewhat acrid resin. A gum-resin exudes in small quantities from the trunk of the tree, which, though containing, besides gum and resin, a small proportion of volatile oil, is distinct from the proper balsam, and yields no cinnamic acid. (Attfeld, P. J., Dec., 1863.) The valuable wood of the tree resembles mahogany.

This tree grows in Central America, in the State of San Salvador, upon the Pacific coast. It is found in the wild forests, singly or in groups, but the trees are owned by individuals. Charles Dorat states that it is never found at a greater height on the mountains than one thousand feet, that it begins to be productive after five years, and continues to yield for thirty years or more, and that the aroma of its flower is perceived at the distance of one hundred yards. (A. J. P., xxxii.) The balsam is collected by the aborigines, on lands reserved to them, within a small district denominated the Balsam Coast, extending from Acajutia to La Libertad. Early in November or December the bark is beaten on four sides of the trunk, so as to separate it from the wood without breaking it, intermediate strips being left sound, in order not to destroy the life of the tree. The bruised bark soon splits, or cuts are made in it. Five or six days after the beating the injured surface is set on fire, and about a week later the bark, if it has not fallen off spontaneously, is removed. The juice now begins to exude freely from the exposed wood, which the natives cover with rags. The latter, when saturated, are boiled in water in large jars, and the liquid allowed to stand, whereupon the water rises to the top, and is poured off, leaving the balsam, which is put into calabashes or bladders. Seven to ten days later a second flow of balsam occurs, and is secured as before. Subsequently the exposed parts are scraped or otherwise wounded, and a third balsam is obtained. These three grades of balsam are said to be known respectively as *Tagauzonte*, *balsam, de trapo*, *balsamo de contrapique*. The balsam is then taken for sale to the neighboring towns, where it is purified by subsidence and straining and put into jars or metallic drums for exportation. The destroyed bark is said to renew itself in two years, so that by care a tree can be worked for a long time; two pounds is stated to be the average

yearly yield. In 1861 the tree was introduced in Ceylon with complete success.

The term Balsam of Peru is a survival of the times when the products of the Spanish colonial coast were assembled at Callao, Peru, for shipment to Europe. This fact has caused Gane and Webster to assert that Balsam of Peru is mis-branded under the Foods and Drugs Act in that it does not come from Peru. (Drug Topics, 1910, p. 4.) It is estimated that the Republic of Salvador exports annually about 130,000 pounds of Balsam of Peru. In spite of this there is a good deal of factitious balsam on the market which consists chiefly of synthetic cinnamein which is often added to exhausted tolu. Riedel reports having found a sample of balsam on the market, which was apparently derived from *Myroxylon punctatum* Klotzsch, and which contained none of the active principles of Balsam of Peru.

A substance called *white balsam* (*Balsamo blanco*) is procured from the fruit. This has been confounded with the balsam of Tolu, but is wholly distinct. It is of a semi-fluid or soft-fluid consistence, somewhat granular, and, on standing, separates into white, resinous crystalline deposit, and a superior, translucent more fluid portion. The odor, though quite distinct from that of the balsams of Tolu and Peru, is not disagreeable. Stenhouse has obtained from it a peculiar resinous body, readily crystallizable, and remarkably indifferent in its chemical affinities, which he denominated *myroxocarpin*. (*P. J.*, x, 290.) Tschirch (*Harze und Harsbehalter*, 1900, p. 166) gives the compound the name myroxoresene, and the formula, C₇H₁₀O. Dorat, however, denies that the white balsam is produced by the same tree, or in the same vicinity.

Another substance obtained from the same tree, and much used in Central America, is a tincture of the fruit made by digesting it in rum. It is called *balsamito* by the inhabitants, and is said to be stimulant, anthelmintic, and diuretic. It is also used as an external application to gangrenous or indolent ulcers, and as a wash to the face to remove freckles. According to Dorat, the balsamito is not the tincture, but an alcoholic extract of the young fruit. Neither this nor the white balsam reaches the markets of this country.

Balsam of Peru was named from its place of exportation, and it was long thought to be a product of Peru. It is now shipped partly from the Pacific coast, and partly from the Balize or other Atlantic ports, whither it is

brought across the country. It was Guibourt who first made known the fact of its exclusive production in Central America. As imported, it is usually in tin canisters, with a whitish scum on its surface, and more or less deposit, which is dissolved with the aid of heat.

Besides the official species, there are others of the genus which possess medicinal virtues, and have been more or less employed. (See 14th ed., *U. S. D.*) The pod of *M. frutescens* Jacq., growing in Trinidad, is popularly used in that island as a carminative, and externally, in the form of a tincture, as a lotion in rheumatic pains, and by incisions in the stem a small quantity of balsamic juice is obtained not distinguishable from balsam of Tolu. (*P. J.*, Sept., 1862, p. 108.) Another species is known in Paraguay under the name of *quino-quino*, the bark of which is used, in powder and decoction, as a remedy in wounds and ulcers, and from the trunk of which a juice is obtained which in its concrete state closely resembles dried balsam of Peru. (*P. J.*, Oct., 1862, p. 183.) A product of *T. peruiferum*, sometimes known as *Brazilian balsam* or as *Oleo-balsam* has been offered for sale as genuine Peru balsam. In bulk it is of a dark brown color, but in thin layers it is dark red. Its odor is smoky, feebly fragrant; its taste slightly pungent, leaving a choking, disagreeable, persistent feeling. It is entirely soluble in ether and in rectified spirits. It also mixes with castor oil in all proportions, and forms with carbon disulphide a clear light brown solution with residue, also a deposit, in its chloroform solution, which becomes a powdery precipitate upon standing. At 17° C. (62.6°F.) its specific gravity is 1.031. Its general constitution is very similar to that of balsam of Peru, containing volatile oil, myroxilin, cinnamic and tannic acids, and resin. (*P. J.*, 3d ser. xi, 818.) It is especially to be distinguished from Peru balsam by its behavior with sulphuric acid. When Peru balsam is treated with sulphuric acid, and cold water poured upon it, a beautiful violet color is imparted to the surface, and the whole mass has a bright shade. The same procedure yields with the oleo-balsam a gray mass. For further information, see *P. J.*, xv, 771.

Properties.—"Balsam of Peru is a viscid liquid of a dark brown color; free from stringiness or stickiness; transparent and reddish-brown in thin layers; of an agreeable, vanilla-like odor and a bitter, acrid taste, with a persistent after-taste. When swallowed it leaves a burning sensation in the throat. It does not harden on exposure to the air. It is soluble in alcohol, chloroform, and glacial acetic acid with not more than a slight opalescence; only partly soluble in ether or petroleum benzin.

Water, when agitated with the Balsam, is acid to litmus. Specific gravity: 1.130 to 1.160 at 25° C. (77° F.). One Gm. of the Balsam forms a clear solution when shaken with a solution of 3 Gm. of hydrated chloral in 2 mls of distilled water (*fixed oils*). Shake about 1 Gm. of the Balsam with 5 mls of purified petroleum benzin, and warm the mixture on a water bath for 10 minutes, adding a sufficient quantity of the solvent to replace the loss by evaporation. On evaporating 2 mls of the benzin solution, no odor of turpentine is noticeable, and when the residue is treated with a few drops of nitric acid, no green or bluish color is produced (*turpentine or rosin*). Weigh accurately about 1 Gm. of the Balsam and dissolve it in 100 mls of alcohol, add 1 mil of phenolphthalein T.S. and titrate the solution with half-normal potassium hydroxide V.S. The acid number thus obtained is not less than 56 nor more than 84. Mix about 3 Gm. of the Balsam, accurately weighed, with 30 mls of sodium hydroxide T.S. and shake the mixture for a few minutes with 60 mls of ether. Then add about 3 Gm. of powdered tragacanth, filter and transfer 50 mls of the ethereal filtrate (representing five-sixths of the weight of the Balsam taken) into a tared, conical flask. Evaporate the ether and dry the residue to constant weight at 100° C. (212° F.). The weight of the residue of cinnamein so obtained is not less than 50 per cent. nor more than 56 per cent. of the weight of the Balsam represented by the 50 mls of ethereal solution taken. Dissolve this residue in 25 mls of alcohol, add 25 mls of half-normal alcoholic potassium hydroxide V.S. and heat the mixture carefully in a flask provided with a reflux condenser, during half an hour on a water bath. Then add 1 mil of phenolphthalein T.S. and titrate the excess of alkali with half-normal hydrochloric acid V.S. The amount of half-normal alcoholic potassium hydroxide V.S. consumed corresponds to a saponification value for the cinnamein of from 235 to 238 (see Part III, Test No. 10)." *U.S.*

" A viscid liquid, in bulk nearly black but in thin layers deep orange-brown or reddish-brown and transparent. Agreeable balsamic odor, taste acrid, leaving when swallowed a burning sensation in the throat. Insoluble in *water*; soluble in *chloroform*. 1 volume is soluble in 1 volume of alcohol (90 per cent.), but on the further addition of 2 or more volumes of the alcohol the mixture becomes turbid. Specific gravity between 1.140 and 1.158. Does not diminish in volume when shaken with an equal bulk of water (absence of ethylic alcohol). When tested by the following method it yields not less than 57 per cent. of cinnamein, the saponification value of which is not less than 235:—Dissolve 1

gramme of the Balsam in 30 millilitres of ether and shake in a separating funnel with two successive quantities of 20 and 10 millilitres of *N/2 solution of sodium hydroxide*. Separate the alkaline solutions, mix and shake with 10 millilitres of ether. Draw off and reject the alkaline solution. Add the second ethereal solution to that previously obtained. Wash the mixed ethereal solutions with two successive quantities of 5 millilitres of *water*. Transfer the ethereal solution thus washed to a tared wide-mouthed flask, evaporate at a gentle heat until the odor of ether has disappeared, add 1 millilitre of *absolute alcohol*, dry at 100° C. (212° F.) for half an hour, and weigh. The weight of the cinnamein thus obtained is not less than 0.57 gramme. To this residue add 20 millilitres of *N/2 alcoholic solution of potassium hydroxide* and 20 millilitres of *alcohol* (90 per cent.). Attach a reflux condenser, boil for half an hour, and titrate back with *N/2 solution of sulphuric acid, solution of phenolphthalein* being used as indicator. Each gramme of the residue thus treated requires not less than 8.4 millilitres of the alkaline solution for complete saponification (corresponding to a saponification value of not less than 235)." *Br.*

Boiling water extracts the acid. The oily liquid which separates on agitating Peru balsam with potassium or sodium hydroxide, called *Peru balsam oil* by Stoize, and *cinnamein* by Fremy, may be separated by fractional distillation into three portions, viz., *benzyl alcohol*, C_7H_8O , passing-over at about 200° C. (392° F.); *benzyl benzoate*, $C_7H_5O_2.C_7H_7$, the principal portion boiling at 303° to 304° C. (577.5°-5790 F.); and benzyl cinnamate, $C_9H_7O_2.C_7H_7$, passing over at about the boiling point of mercury. The crude oil likewise contains small quantities of free cinnamic and benzoic acids, resulting from the decomposition of the benzylic ether by the alkali used in separating it. According to Kraut (*Ann. Ch. Ph.*, cliii, p. 129), the benzyl cinnamate constitutes nearly 60 per cent. of the balsam; but Trog (*A. Pharm.*, 1894, 70-98) states that it is the benzyl benzoate which makes up the bulk of the oily portion and amounts to from 63 to 64 per cent. Tschirch (*loc. cit.*) states that in the sample of Peru balsam investigated by him benzyl benzoate was the main constituent, but small amounts of benzyl cinnamate were also present, and he considers that the relative proportions of the two esters may vary greatly in different samples of the balsam. The odor of the balsam Tschirch considers to be due to the *peruvial*, $C_{13}H_{22}O$, discovered by Thoms.

Peru balsam appears to contain only a single resin, yielding, by analysis, 66.3 to 67.25 per cent. of carbon, and 6.22 to 6.32 per cent. of hydrogen. (Kraut, *loc. cit.*) This resin separated from the alkaline solution of the balsam by hydrochloric acid is brown, has a faint odor of vanilla, and when fused with potash yields protocatechuic acid, together with a little benzoic acid. Tsehirsch has studied this resin and finds it to be the *cinnamic ester* of an alcoholic body called *peru-resino-tannol*, with the formula $C_6H_5.CH.COOC_{18}H_{19}O_4$. The tree also exudes a gum-resin, which, according to Attfield (*P. J.*, 1864, p. 248), contains 77.4 per cent. of a resin, and is non-aromatic, devoid of cinnamic acid, and entirely distinct from balsam of Peru. The leaves of the tree contain a fragrant oil. Like benzoin, balsam of Peru appears to be a pathological product.

The balsam is said to be adulterated in Europe (especially at Bremen) with castor oil, copaiba, Canada turpentine, etc. (*P. J.*, xii, 549), and a factitious substance has been sold in this country for the genuine balsam, prepared by dissolving balsam of Tolu in alcohol. This may be distinguished by its taking fire readily and burning with a blue flame, but a skillfully prepared product known commercially as *Perugen* is furnished, of which K. Enz (1913) states that the only constants of the German Pharmacopoeia available for detection are the acid number, iodine number, isolated cinnamein nitric acid reaction, and behavior in contact with benzin; the other pharmacopoeial constants are of no value. "*Synthetic Balsam of Peru*" (*Ph. Ztg.*, No. 79, 828), is defended by Dr. F. Evers on the ground that it is equivalent to the natural balsam therapeutically and in some respects superior. Caesar and Soretz state that the characteristic odor and taste of the natural balsam are absent in the substitute.

For additional tests, see *Proc. A. Ph. A.*, 1894, 903; also 1895, 866, and *D. C.*, 1898, 60. A method of detecting castor oil, proposed by Wagner, is to expose a small portion of the suspected balsam to distillation until somewhat more than one-half has passed, shake the distillate with baryta water, remove by means of a pipette the layer of oil floating on the surface, and shake this with a concentrated solution of sodium bisulphite. If castor oil be present, the liquid will immediately become a crystalline mass. (*A. J. P.*, xxx, 570.)

A color test to distinguish true Peru Balsam from the factitious variety is as follows: One drop of Peru Balsam is shaken with 5 mils of petroleum

benzin, and to 2.5 mils of this liquid 5 mils of ether is added. Sulphuric acid is then added, drop by drop, until from 10 to 15 drops have been added. Genuine Peru Balsam gives a beautiful violet to cornflower blue color in the lower layer, while the artificial products give either no color or very different shades.

Fluckiger relied upon the specific gravity, which should be between 1.140 and 1.145, and the *lime test*, in which 10 drops of the balsam are shaken with 6 grains (0.4 Gm.) of slaked lime, forming, if there be no adulteration, a soft mixture, which does not harden. *Grote's test* consists in shaking 3 drops of balsam with 2 mils of official ammonia water; if, after standing, the mixture solidifies, rosin or other adulterant is present; benzoin, storax, and certain other substances cannot be detected by this test. (*A. J. P.*, 1881, 302, 361.)

As stated by Trog and others, the percentage of cinnamein should approximate 60. The saponification number should be between 235 and 238.

Uses.—Balsam of Peru is useful internally as a stimulating expectorant in asthma and chronic bronchitis, especially when of tuberculous origin. Although not so agreeable as balsam of Tolu it is much more active. Externally it affords a valuable stimulating dressing in indolent ulcers and local tuberculosis of the skin, bone, larynx, etc. It has also been highly lauded by Malannik (*M. M. W.*; 1912) as a first dressing for military wounds. He asserts that it is not only bactericidal of itself but that it stimulates the local resistance of the tissues and that it exercises a valuable protective action. Extensive erythema has followed its local application. (*Hazen, J. A. M. A.*, 1910, liv.) Internally it is best administered suspended in water by the yolk of egg or acacia.

Dose, from five to fifteen minims (0.3-0.9 mil).

Off. Prep.—Mistura Oleo-Balsamica, *N. F.*

BALSAMUM TOLUTANUM. U. S., Br.

BALSAM OF TOLU Bals. Tolu. [Tolu Balsam]

"A balsam obtained from *Toluifera Balsamum* Linne (Fam. *Leguminosae*)." U. S. "Balsam of Tolu is a solid balsam obtained from

incisions made in the trunk of *Myroxylon toluiferum*, *H. B. and K.*" *Br.*

Balsamum Americanum; Baume de Tolu, Baume de Carthagene, *Fr.*; Balsamum Tolutanum, *P. G.*; Tolubalsam, *G.*; Balsamo Tolutano, Balsamo del Tolu, *It.*; Balsamo de Tolu, *Sp.*

This balsam like balsam of Peru, has been the subject of much controversy. This is not only seen in the distinct sources above given by the U. S. and British Pharmacopoeias, but is rendered more confusing by the fact that the German Pharmacopoeia prescribes "the air hardened balsam of *Myroxylon balsamum* (L.) Harms var. *genuinum* Baillon." In addition to this Tschirch regards the tree yielding balsam of Tolu like that of the tree yielding balsam of Peru, merely physiological varieties of *Toluifera Balsamum* L. Schaer has recently reported on *Myrocarpus Balsam* (*Cabureiba Balsam*, of Piso; *Baume du Perou en coques*, of Guibourt), and concludes that it has intermediate properties between balsam of Tolu and balsam of Peru. It did not contain cinnamic acid and the benzoic acid which he obtained had a melting point from 3° to 4° higher than normal benzoic acid. (*Arch. d. Pharm.*, 1909, p. 176.)

The balsam is said to be produced normally in the tree only in young growing tissues such as the young twigs and leaves, and to be formed in the older tissues only as the result of injuries received. It is procured by making V-shaped incisions in the trunk quite through the bark. The juice is received in small calabash cups, which are inserted in slight excavations beneath the point of the two vertical incisions meeting at the lower end; and Weir has seen as many as twenty cups at a time on one tree. The collectors go from tree to tree, emptying the cups into flasks of raw-hide. In these skin vessels the juice is taken to the different ports on the river, where it is transferred to tin cans. It is brought from Carthagena in calabashes or baked earthen jars, or in tin or glass vessels.

Properties.—As first imported, balsam of Tolu has a soft tenacious consistence, which varies considerably with the temperature. By age it becomes hard and brittle like rosin. It is shining, translucent, of a reddish or yellowish-brown color, a highly fragrant odor, and a warm, somewhat sweetish and pungent, but not disagreeable taste. Exposed to heat, it melts, inflames, and diffuses an agreeable odor while burning. It is entirely soluble in volatile oils. The official description is as follows: "Balsam of Tolu is a yellowish-brown, or brown, plastic solid, becoming brittle when old, dried, or exposed to cold. It is transparent in thin

layers, has a pleasant, aromatic odor, resembling that of vanilla, and a mild aromatic taste. Balsam of Tolu is nearly insoluble in water and in petroleum benzin. It is soluble in alcohol, chloroform, and ether. It is dissolved by solutions of the fixed alkalis, usually leaving an insoluble residue. An alcoholic solution of the Balsam (1 in 20) is acid to litmus. Shake about 1 Gm. of the Balsam with 25 mils of carbon disulphide, allow it to stand for thirty minutes, filter the liquid and evaporate 15 mils of the nitrate to dryness. The residue thus obtained, when dissolved in glacial acetic acid, does not show a green color on the addition of a few drops of sulphuric acid (*rosin*). The remaining portion of the filtrate, when shaken with an equal volume of an aqueous solution of copper acetate (1 in 1000), does not acquire a green color (*rosin or copaiba*). Dissolve about 1 Gm. of the Balsam, accurately weighed, in 50 mils of alcohol, add 1 mil of phenolphthalein T.S. and titrate the solution with half-normal alcoholic potassium hydroxide V.S. The acid number thus obtained is not less than 112 nor more than 168. Now add sufficient half-normal alcoholic potassium hydroxide V.S. to the neutralized liquid to make the total amount of the volumetric alkali solution exactly 20 mils; heat the liquid on a water bath for half an hour, under a reflux condenser, and allow it to cool. Mix this liquid with 200 mils of distilled water, or more if necessary, and titrate the excess of potassium hydroxide with half-normal sulphuric acid V.S.; the total amount of half-normal potassium hydroxide V.S. consumed corresponds to a saponification value of not less than 154 nor more than 220 (see Part III, Test No. 10)." *U. S.*

"A soft, tenacious solid when first imported, becoming harder and finally brittle. Transparent and yellowish-brown in thin films. Pressed between pieces of glass with the aid of heat, and examined with a lens, it exhibits crystals of cinnamic acid. Odor fragrant, especially when warmed; taste aromatic and slightly acid. Soluble in *alcohol* (90 per cent.), the solution being acid to *litmus*. *Acid value* 107.4 to 147.2; *saponification* value 170 to 202. If 5 grammes are gently warmed with three successive portions of 25, 15, and 10 millilitres of *carbon disulphide*, the solution yields, when evaporated to dryness, a distinctly crystalline residue, which, when tested as described under 'Styrax Praeparatus' yields not less than 1.25 grammes of balsamic acids." *Br.*

The carbon disulphide test is based upon Braithwaite's researches upon spurious balsams of Tolu. (See *P. J.*, 1895,145; also 1897, 307.)

Boiling water extracts its acid. Distilled with water it affords a small proportion of volatile oil, and, if the heat be continued, an acid matter sublimes. Hatchett states that when dissolved in the smallest quantity of solution of potassium hydroxide it loses its own characteristic odor and acquires that of the clove pink. G. L. Ulex gives as a test of the purity of the balsam,

that if heated in sulphuric acid it dissolves without disengagement of sulphurous acid, and yields a cherry-red liquid. (*A. Pharm.* Jan., 1853.) A modification of this test is that of R. A. Cripps (*P. J.*, xix, 1888), who states that by a comparative test of the suspected balsam with a pure specimen 1 per cent. of storax or other resinous adulterant can be detected. Thirty grammes of the sample are digested in carbon disulphide for fifteen minutes with gentle warmth, the clear liquid decanted, evaporated to dryness, and dissolved in sulphuric acid. A bright red rose color is produced, remaining rose for a length of time if the balsam be pure, rapidly becoming brown if the balsam has been adulterated. The balsam is a mixture of volatile oil, free acid, and resin. The volatile oil is obtained by distilling the balsam with water, and may amount to a little over 1 per cent. This oil is chiefly *tolene*, $C_{10}H_{16}$, boiling at $170^{\circ} C.$ ($338^{\circ} F.$), and rapidly hardening by absorption of oxygen from the air. The free acid, according to Deville and Scharling, consists of benzoic and cinnamic acids, which statement has been confirmed by Fluckiger. (*Pharmacographia*, 2d ed., 204.) Buse (*Ber. d. Chem. Ges.*, 1876, 833) has shown that the benzylic esters of these two acids are present in the balsam, the benzyl cinnamate in larger amount.

Tschirch (*Harze und Harzbehalter*, 1900, p. 173) found that the ester mixture in Tolu balsam amounted to 7.5 per cent. against 62 to 64 per cent. in Peru balsam. Trommsdorff obtained 88 per cent. of resin, 12 of acid, and only 0.2 of volatile oil. According to Heaver, the balsam yields by distillation about one-eighth of its weight of pure cinnamic acid. The acid distills over in the form of a heavy oil, which condenses into a white crystalline mass. It may be freed from empyreumatic oil by pressure in bibulous paper, and subsequent solution in boiling water, which deposits it in minute colorless crystals upon cooling. (*A. J. P.*, xv, 77.) A later investigation by Tschirch and Oberlander shows that the resinous portion of the balsam consists of *tolu-resino-tannol* in combination with cinnamic and benzoic acids, the latter in small proportions only. It contains, in addition, 7.5 per cent. of an aromatic, acid, oily liquid, composed mainly of benzyl benzoate, with a little benzyl cinnamate and

a trace of vanillin. (*A. Pharm.*, 1894, 599.) A factitious balsam described by R. V. Mattison (*A. J. P.*, 1876, 51) contained 63 per cent. of storax.

Tolu balsam is sometimes adulterated with rosin and pine resins, both of which are readily detected, as they are soluble in carbon disulphide and benzol. The Balsam of Tolu of commerce is sometimes deficient in alcohol-soluble contents. Occasionally, the cans of shipment of tolu contain large pieces of red brick with enough melted balsam poured in to completely cover the bricks and fill the cans.

Uses.—Balsam of Tolu is a feeble stimulant expectorant; the syrup of Tolu is much used, on account of its agreeable flavor, as the basis of cough mixtures. Old and obstinate *catarrhs* are said to be sometimes greatly relieved by the inhalation of the vapor proceeding from an ethereal solution of this balsam. The best form of administration is that of emulsion, made by triturating the balsam with mucilage and loaf sugar, and afterwards with water.

Dose, ten to thirty grains (0.65-2.0 Gm.).

Off. Prep.—Syrupus Tolutanus, *U. S.* (from the tincture), *Br.*; Tinctura Benzoini Composita, *U. S.*, *Br.*; Tinctura Tolutana, *U. S.* *Br.*

Baptisia. *N. F. IV. Wild Indigo. Indigo sauvage*, Fr. *Baptisie*, G.—"The dried roots of *Baptisia tinctoria* (Linne) R. Brown (Fam. *Legu-minosae*), without the presence of more than 10 per cent. of the crown and stem or other foreign matter." *N. F.* This is an indigenous perennial plant, abundant throughout the Eastern United States, in woods and dry barren uplands. The roots are "fleshy, from 0.5 to 4 cm. in thickness, usually cut into elongated cylindrical pieces; the crown from 5 to 8 cm. in thickness, more or less warty and marked by stem scars; outer surface dark-brown; usually longitudinally wrinkled, transversely warty, or the thicker pieces covered with a soft and friable corky layer, bearing few branching rootlets; fracture tough, the fractured surface whitish; bark section radially striate, wood-section inconspicuously radiate, porous. Nearly odorless; the bark bitter and acrid, the wood nearly tasteless. The powdered drug is light-grayish and, when examined with the microscope, shows numerous, rounded, simple, or two-to four-compound starch grains up to 0.016 mm. in diameter, the larger grains sometimes with a cleft through the center; tracheae with bordered pores up to 0.085 mm. in diameter; numerous sclerenchyma cells, long, thick-walled, non-porous, more or less lignified and up to 0.024 mm. in width; fragments of medullary-ray tissue composed of cells with lignified walls and numerous simple pores; groups of parenchyma, many of the cells filled with starch; few epidermal and cork cells with brownish walls. *Baptisia* yields not more than 5 per cent. of ash." *N. F.* It contains a glucoside, baptism, an alkaloid, *baptitoxine*, and a coloring principle which has been used as a substitute for indigo, but which is greatly

inferior. It is not often used in medicine. For further information concerning this drug, see *U. S. D.*, 19th ed., p. 1406 and *A. Pharm.*, 245, 1907, No. 8, 561-572.

Barbados Nuts. *Purging Nuts.* *Physic Nuts.* *Semen Ricini Majoris.* *Pignon d'Inde* (*des Barbados*), *Sentences du Medicinier*, Fr. *Purgirnuss*, *Schwarse Brechnuss*, G.—These are the seeds of *Jatropha Curcas*, L. (Fam. *Euphorbiaceae*), growing in Brazil, the West Indies, and cultivated extensively in all tropical countries. The fruit is a three-locular capsule, containing one seed in each locule, and is about the size of a walnut. The seeds are blackish, oval, 1.5 to 2 cm. long, flat on one side, convex on the other, and the two sides present a slight longitudinal prominence. They yield a fixed oil, an acrid resin, sugar, gum, a fatty acid, gluten, a free acid, and salts. A. Siegel (*Bot. Centralb.*, xlvii, 120) found in the seeds a poisonous principle, *curcin*, which he states is analogous to *ricin*, and places in the class of toxalbumins. The oil, sometimes called *jatropha oil*, may be separated by hot expression, the yield being about 40 per cent. When fresh it is without odor or color, but becomes yellowish and slightly odorous by time. Alcohol does not readily dissolve it. It is colorless, odorless, of sp. gr. 0.91 at 19° C. (66.2° F.), solidifies to buttery consistence at -8° C. (17.6° F.). Bouis believed it to be the glyceride of a peculiar acid, *isocetic acid*, but it is now considered to be a mixture of palmitin and myristin. From three to five of the seeds, slightly roasted and deprived of their envelopes, operate actively as a cathartic, and not infrequently produce nausea and vomiting, with a sense of burning in the stomach. The *oil* purges in the *dose* of five to ten minims (0.3-0.6 mil), and is analogous in its action to croton oil, though less powerful. The cake left after the expression of the oil is an acrid emetocathartic, operating in the *dose* of a few grains. Either of these substances may produce serious consequences in overdoses. The leaves of the plants are rubefacient, and the juice is said to have been usefully employed as a local remedy in piles. (*A. J. P.*, 1893, 335.) The seeds of *Curcas multifidus* (L.) Endl. (*Jatropha multifida* Linn.) have similar properties, and yield a similar oil. This species also grows in Brazil and the West Indies. (See Peckoldt, *A. Pharm.*, 1887, 415.)

Jatropha gossypifolia Linn., of South America, is used as a local application in leprosy and to indolent ulcers, and probably has similar physiological influence to *curcas*. *Jatrophaurens*, L., must be excessively poisonous, as accidental contact of the wrist of a gardener in Kew with a young plant produced such symptoms that for five minutes the man was thought to be dead. (*P. J.*, April, 1872, 863.)

The roots of the *Jatropha cardiophylla* Muell. Arg. are largely employed in Southern Arizona and Mexico for tanning purposes. According to the analysis of Josiah C. Peacock, they contain, when thoroughly dried, over 5 per cent. of tannic acid. (*A. J. P.*, 1900, 432.)

Barringtonia. *Barringtonia speciosa*.—The large Indo-Malayan tree, *Barringtonia speciosa* Forst. (Fam. *Myrtaceae*) contains, according to Maresuw, 3.3 per cent. of barringtonin, a colorless, amorphous glucoside, having the formula $C_{18}H_{28}O_{10}$, and belonging to the saponin group. It is said to be an active cardiac poison. (*S. W. P.*, xli, 1903, pp. 423, 43,5.)

Bassialongfolia L. (Fam. Sapotaceae.)—In this Indian plant, known as *mowrah* by the natives, there has been found a glucoside which was named *mowrin* by its discoverers, Moore, Baker, Young and Sawton. According to these investigators, *mowrin* has a digitalis-like action upon the heart and a saponin-like effect of destroying red blood cells.

Bassora Galls are cultivated in Persia and Asia Minor, and are exported by way of Smyrna for tanning purposes. They come into commerce ground and pressed into the form of bricks. They contain, on an average, 27 per cent. of tannin.

Bassora Gum. Caramania Gum. Hog Gum. India Gum. False Tragacanth. Kutera Gum.— This substance came into commerce originally from the neighborhood of Bassora, on the Gulf of Persia; but is often found mixed with gum brought from other countries, and is said to be the product of the almond and plum trees. It is in irregular pieces, about the same size as tragacanth, brown or yellow, intermediate in the degree of its transparency between gum arabic and tragacanth, inodorous, tasteless, and possessed of the property of yielding a slight sound when broken under the teeth. Only a small portion of it is soluble in water, whether hot or cold. The remainder swells up considerably, though less than tragacanth, and does not, like that substance, form a gelatinous mass, as it consists of independent granules which have little cohesion. The soluble portion is pure gum or *arabin*, and, according to Guerin, constitutes 11.2 per cent. The insoluble portion consists of *bassorin*, associated with a small proportion of saline substances, which yield, when the gum is burnt, 5.6 per cent. of ash. The gum is employed to adulterate tragacanth, and for this purpose is sometimes whitened by means of white lead, which can readily be detected, however. It is frequently used as a filler and thickener in the manufacture of certain food products, as cheap ice creams.

Batiator Root.—The root of the *Vernonia nigritiana* Oliver and Hiern. (Fam. *Compositae*), a widely distributed plant of West Africa, is said to be largely used in Senegal as a febrifuge, emetic, and anti-dysenteric, resembling ipecac somewhat in its therapeutic application. The plant is a composite which climbs to the height of a foot and a half, and yields a root composed of numerous fibers from twenty to thirty centimeters long, slender and grayish-yellow externally, a number of which are united to form an irregular knotty rhizome, unequally spherical at the neck or crown, and covered at this point with silky hairs. The active constituent is a glucoside, *vernonin*, $C_{10}H_{24}O_7$. (Heckel and Schlagden-hauffen, *A. de P.*, Aug., 1888; see also *Zeit. An. Chem.*, 1893, p. 364.) This is a hygroscopic whitish powder, forming a pale yellow solution with water, and only slightly soluble in ether and in chloroform. By the absorption of 2 molecules of water it is split into a resinous body and glucose. Physiological experiments made upon frogs show *vernonin* to be a cardiac poison of the digitalis group; it is also said to act as a paralyzant to the motor nerve trunks. (*P. J.*, June 30, 1888.)

Baycuru Root.—This is the root of a Brazilian plant, probably the *Statice brasiliensis* Boiss. (Fam. *Plumbaginaceae*), which is used by the natives as a discutient in glandular swellings and as an astringent gargle. F. A. Daibe (*A. J. P.*, xiv,

361) believed that he has found in it an alkaloid, *baycurine*, besides volatile oil, gum glucose, etc. O. Symes found in it 12.5 per cent. of tannic acid. (*Newer Mat. Med.*, 51.)

Bdellium.—Under this name have been included various gum resins having little or nothing in common. The commercial Bdelliums are naturally divided into the Indian and the African, but E. M. Holmes, in an elaborate study (*P. J.*, lxi), recognizes five commercial varieties of African Bdellium—namely, 1. Perfumed Bdellium, which is believed to be collected in Northeastern Africa; 2. African Bdellium; 3. Opaque Bdellium; 4. Hotai Bdellium from the Somaliland, and 5. A non-aromatic acrid gum resin. *Perfumed Bdellium*, or *Babaghadi*, closely resembles in appearance *Somali myrrh*, but has a less bitter, more acrid and peculiar taste which distinguishes it at once from myrrh. *African Bdellium*, proper, occurs in hard, roundish pieces, of a pale to dark grayish-brown color with a resinous unstreaked fracture, dotted with glistening points. The odor is said to recall that of cedar wood; the taste is slightly acrid but not bitter. *Opaque Bdellium* is of a pale brown color and has a bitter, slightly acrid taste and cedar-like odor; it occurs in tough, roundish pieces about an inch to an inch and a half in diameter. *Hotai Resin* resembles opaque bdellium, but is distinguished by its lack of odor, its slightly soapy taste, and its brittleness. These four bdelliums of Holmes are for the most part collected in Somaliland. They are the product of different species of *Commiphora*, small trees or large shrubs which suggest in appearance the English hawthorn. The species are by Holmes divided into four groups. (See *P. J.*, lxxii.) According to A. Engler, the resin of *Commiphora roxburghiana* (Stocks) Engl. is the commercial *Gugul*, or *India Bdellium*, which is employed in the East Indies as a remedy for *leprosy*, *rheumatism*, and *syphilis*. Bdellium sometimes cornea mixed with gum arabic and gum Senegal. It is either in small roundish pieces, of a reddish color, semi-transparent, and brittle, with a wax-like fracture, or in large irregular lumps, of a dark brownish-red color, less transparent, somewhat tenacious, and adhering to the teeth when chewed. It has an odor and taste like that of myrrh, but weaker. It is infusible and inflammable, diffusing while it burns a balsamic odor. According to Pelletier, it consists of 59 per cent. of resin, 9.2 of gum, 30.6 of bassorin, and 1.2 of volatile oil, including loss. In medicinal properties it is analogous to myrrh, and was formerly used for the same purposes. In Europe it is still occasionally employed in plasters. The *dose* is from ten to forty grains (0.65-2.6 Gm.).

Bebeeru Bark.—*Nectandrae Cortex*, Br. 1885, is the dried bark of *Nectandra Rodiaei* Hook. (Fam. *Lauraceae*). The *beteeru*, *bibiru* or *sipiri*, as it has been variously named, is a tree sixty feet or more in height, growing in British Guiana and the neighboring regions of South America, and yielding the wood known as *greenheart*.

The bark occurs in large, flat, heavy pieces, from 30 to 60 cm. long, from 10 to 15 cm. broad, and about 6 mm. thick, with a short, granular fracture, of a grayish-brown color on its outer surface and a dark cinnamon color on the inner. It has an intensely bitter, somewhat astringent taste. On microscopical examination it is seen to be composed chiefly of very thick-walled parenchymatous cells. The inner bark contains peculiar short, sharp-pointed, undulate bast fibers. Within the cells dark brown masses (colored greenish-black by ferrous sulphate) may be seen. Analyzed by Maclagan, of Edinburgh, it was found to contain tannic acid of the kind that

precipitates the salts of iron green, resin, gum, sugar, albumen, fibrin, various salts, and two peculiar alkaloids, named respectively *bebeerine*, $C_{19}H_{21}O_3N$, and *sipirine*, the former soluble and the latter insoluble in ether. In the seeds, besides the foregoing principles, Maclagan found 63 per cent. of starch, and a peculiar white, crystalline, volatile acid, which he named *bebeeric acid*. The alkaloids are extracted together from the bark, in the form of impure sulphate, by a process similar to that for preparing quinine sulphate. This preparation was formerly known as the *commercial bebeerine sulphate*. The sulphate, hydrochloride and alkaloid are all used in medicine, the *dose* of either being from one to two grains (0.065-0.13 Gm.). According to Fluckiger (*P. J.*; xi, 193, 1869), pure bebeerine is a white, amorphous powder, whose concentrated aqueous solution is not precipitated by tartar emetic, but affords abundant white precipitates with sodium phosphate, potassium nitrate, iodide, or iodohydrargyrate, mercuric chloride, potassium platino-cyanide, and nitric or iodic acid. Its acetate yields yellow amorphous precipitates with potassium ferrocyanide, potassium ferricyanide, potassium chromate, potassium dichromate, or platinum dichloride. D. B. Dott has confirmed the results of Fluckiger's examination, although he found a larger percentage of alkaloids than the latter did. Owing to the difficulty of obtaining the alkaloids in crystals, it was almost impossible to ascertain the quantity present. (*Y. B. P.*, 1881, 442; 1885, 420.) Bebeerine was asserted by Walz, in 1860, to be identical with buxine, obtained from *Buxus sempervirens*. This statement was confirmed by Fliückiger, who proved that pelosine was identical with both of the above principles. (*P. J.*, xi, 1870, 192.) (Palen gives $C_{19}H_{21}NO_3$ as the formula.)

By treating the mixed alkaloids obtained from the wood with chloroform, Douglas Maclagan and Arthur Gamgee have separated an alkaloid, nectandrine. It is a white powder, amorphous, and intensely bitter. It differs from bebeerine in being much less soluble in ether, and, when treated with strong sulphuric acid and manganese dioxide, in giving rise to a magnificent green, slowly passing into a beautiful violet, and, lastly, in having a higher molecular weight, its formula being $C_{20}H_{23}N_4$. After separating nectandrine from the mixed bases, the authors succeeded in extracting another alkaloid, different from bebeerine, much more soluble in water than nectandrine, but insoluble in chloroform. (*A. J. P.*, 1869, 453.)

Nectandra is reputed to resemble cinchona in its virtues, although much inferior. It has generally been employed in the form of the impure bebeerine sulphate. In some cases of *intermittent* and *remittent* fevers it has apparently exercised a curative effect but it often fails, and cannot be relied on as a substitute for quinine. Bebeerine sulphate has been given in *dysmenorrhea*, *menorrhagia*, and *leucorrhoea*. The dose is from two to five grains (0.13-0.32 Gm.). In malaria from ten to thirty grains (0.66-0.9 Gm.) may be given, in divided doses, between the paroxysms.

Bedeguar. *Fungus Rosarum*.—An excrescence upon the *sweetbrier* or *eglantine*, *Rosa rubiginosa*, and other species of *Rosa*, produced by the puncture of insects, especially by one or more species of *Cynips*. It is of irregular shape, usually roundish, about an inch in diameter, with numerous cells containing larvae. It is nearly odorless, of slightly astringent taste, and was formerly considered a diuretic and anthelmintic. *Dose*, from ten to forty grains (0.65-2.6 Gm.).

BELAE FRUCTUS. Br.

BAEL FRUIT

"Bael Fruit is the fresh half-ripe fruit of *Aegle Marmelos*, Correa,." Br.

Fructus Bael, Bela; Bael fruit, Indian Bael, Bengal Quince; Marmelos de Benguala, Cirifole, Beli; Indische Quitten, Marmelosbeeren, Marmelosfruchte, G.

The so-called *Bengal quince* is a rather large tree (fam. *Rutaceae*) extensively cultivated in India, with an erect stem, few and irregular branches, an ash-colored bark, strong, very sharp, axillary thorns, single or in pairs, leaves and large white flowers, temate. The fruit is a berry of delicious flavor, of about the size of a large orange, with a hard smooth shell, and from ten to fifteen loculi containing besides the compressed, woolly seeds a large quantity of exceedingly tenacious mucilage, which when dried is hard and transparent. l' Fruit about 7 or 8 cm. in diameter, globular, ovoid or pyriform, greyish or yellowish-brown. Outer surface hard, nearly smooth. Eind about three millimetres in diameter, and adherent to a pale-reddish juicy pulp in which are ten to fifteen cells, each containing several woolly seeds. Faint aromatic odor; taste mucilaginous, acidulous, and slightly astringent. Br. The mucilage about the seeds is applied to various purposes in the arts, on account of its viscid properties. The rind is used in dyeing. The flowers are deemed refrigerant by the native physicians. The fresh leaves yield by expression a bitterish and somewhat pungent juice, which, diluted with water, is occasionally used in the early stage of catarrhal and other fevers. The bark of the stem and root is thought to possess febrifuge properties.

The fruit yields its virtues to water by maceration or decoction. Pollock found in it traces of tannic acid, an essential oil, and a vegetable acid. (*M. T. G.*, Feb., 1864.) It also contains mucilage, pectin, sugar and a bitter principle. (*Badakow, Apoth. Zeit.*, 1894, p. 773.)

The difficulty of obtaining bael in England is said to have led to the substitution for it of *mangosteen*, the fruit of *Garcinia Mangostana* L. This is in irregular fragments of the rind, without adhering pulp. The pieces are convex, three or four lines or more in thickness, externally covered with a smooth, deep reddish-brown, easily separable coating,

and internally pale reddish-brown or reddish-yellow, smooth, with projecting vertical lines. (P. J., May, 1867.)

Uses.—Bael fruit has been used in India in the treatment of *diarrhea* and *dysentery* for many years. It is also asserted to have laxative properties. Whether it has any real therapeutic activity is, at present, very doubtful. The *decoction*, two ounces of dried fruit in a pint of water boiled down to four fluidounces, is used in *doses* of one to two fluidounces (30-60 mils) every two to six hours; or the *Liquid Extract of Bael, Br.*, may be given in doses of 1 to 2 fluidrachms (3.75-7.5 mils).

Off. Prep.—Extractum Belae Liquidum, *Br.*

BENZOINUM. U. S., Br.

BENZOIN Benzoin. [Gum Benjamin]

"A balsamic resin obtained from *Styrax Benzoin* Dryander and some other species of *Styrax* (Fam. *Styracaceae*) growing in the East Indies and known in commerce as Sumatra Benzoin and Siam Benzoin." *U. S.* "Benzoin is a resinous solidified balsam obtained from the incised stem of *Styrax Benzoin*, Dryand. Known in commerce as Sumatra benzoin." *Br.*

Resina Benzoe, Asa Dulcis; Gum Benjamin; Benjoin, *Fr.*; Benzoc, *P. G.*; Benzoeharz, *G.*; Benzoino, *It.*; Benjui, *Sp.*

It is generally believed that Siam Benzoin is obtained from *Styrax Benzoin* Dryander. It appears to closely resemble the tree growing in Sumatra, which yields a balsamic resin bearing this name. Tschirch considers that the trees yielding Siam and Sumatra Benzoin are physiological varieties of the same species. (Tschirch, "*Harze*," II. Aufl., p. 195.) Strueff presents a careful morphological paper on the trees of *Styrax Benzoin*, growing in Siam, Sumatra and Java, in *Arch. d. Pharm.*, 1911, p. 10.

Styrax Benzoin, or *Benjamin Tree*, is a tall tree of quick growth, sending off many strong round branches, covered with a whitish downy bark. Its leaves are alternate, entire, oblong, pointed, smooth above and downy beneath. The flowers are in compound, axillary clusters, nearly as long as the leaves, and usually hang, all on the same side, upon short

slender pedicels. The tree is a native of Sumatra, Java, Borneo, and other islands in the vicinity. By wounding the bark near the origin of the lower branches, a juice exudes, which hardens upon exposure and forms the *Sumatra benzoin* of commerce. According to the researches of A. Tschirch (*Journ. Roy. Microscop. Soc.*, 1890), the exudation is purely the result of pathological processes, the plant containing no resin receptacles. The trees, which are either wild or cultivated, are deemed of a proper age to be wounded at six years, when the trunks are usually about seven or eight inches in diameter. The operation is performed annually, and the product on each occasion from one tree never exceeds three pounds. The juice which first flows is the purest, and affords the whitest and most fragrant benzoin.

The tree which yields the Siam benzoin is stated to grow in an extremely circumscribed locality, on the bank of the river Mekong, occurring on high ground in clusters of from fifty to sixty trees. According to E. M. Holmes, its leaves are thinner and less distinctly venated than are those of the true *Styrax Benzoin*. In July and August the Siam trees are notched, and from these notches three months later the hardened benzoin is picked out. According to later studies (*Kew Bulletin*, 1912, p. 391) the Siam benzoin is derived from a new species, *Styrax benzoides* Craib. This view is also held by Hartwich. The benzoin of farther India is probably derived from *Styrax tonkimensis*.

Siam benzoin is usually imported in cubical blocks, which take their form from the wooden boxes in which the soft resin has been packed. It is brittle, with a peculiar, vanilla-like fragrance, but bitter taste. It may be a compact mass, containing more or less numerous opaque white tears embedded in a rich amber-colored translucent resin, mixed to a greater or less extent with bits of bark, wood, etc. In some specimens these tears are exceedingly small, in others almost wanting. The finest variety is composed almost entirely of these tears, loosely agglutinated together. *Sumatra benzoin* is sent into commerce chiefly from Acheen in Sumatra. It differs from the Siam varieties in having a much grayer color; the resin is grayish-brown, the tears are usually fewer than in the finer variety, and the bits of wood, etc., more abundant. The odor differs from, and is less agreeable than, that of Siam benzoin. *Palembang benzoin* resembles Sumatra benzoin, but is somewhat more transparent, and is stated to yield a larger percentage of benzoic acid. It is also asserted that it can be distinguished by its tincture, when dropped into water, not producing milkiness, but a flocculent deposit. *Penang*

benzoin also resembles Sumatra benzoin, but has an odor which is more like that of storax, and it is probably yielded by the *Styrax Benzoin*; possibly it is the product of one of the Sumatran species, *S. subdenticulata* Mig. For an account of the cultivation and collection of benzoin in Sumatra, by L. M. Vonck, see *C. D.*, 1891, 486-488; also *D. C.*, 1891, 258. Ludy made an investigation of the bark and wood of a benzoin tree which was brought from Java by Tschirch. He reached the conclusion that benzoin balsam was produced from the tannin of the bark. (*A. Pharm.*, 1893, 43, 95.) A variety of benzoin known as *Estoraque* or *Benjui*, is produced in Bolivia from the *Styrax Pearcei* Perk. var. *bolivianus*. This has been shown by Wichmann (*S. W. P.*, 1912, p. 237) to be of similar composition to the Asiatic resin. According to this author resins are also collected from a number of other species of *styrax* in South America.

Properties.—Benzoin has a fragrant odor, with very little taste, but when chewed for some time leaves a sense of irritation in the mouth and fauces. It breaks with a resinous fracture, and presents a mottled surface of white and brown or reddish-brown; the white spots being smooth and shining, while the remainder, though sometimes shining and even translucent, is usually more or less rough and porous, and often exhibits impurities. In the inferior kinds the white spots are very few, or entirely wanting. Benzoin is easily pulverized, and, in the process of being powdered, is apt to excite sneezing. Its sp. gr. is from 1.063 to 1.092. The U. S. Pharmacopoeia recognizes both Sumatra and Siam benzoin. The official descriptions of these follow:

"Sumatra Benzoin.—In blocks or lumps of varying size, made up of tears, compacted together with a reddish-brown, reddish-gray, or grayish-brown resinous mass; tears externally yellowish or rusty-brown, milky-white on fresh fracture; hard and brittle at ordinary temperatures, but softened by heat and becoming gritty on chewing; odor aromatic and upon digesting with boiling water suggesting the odor of cinnamic acid or storax; taste aromatic and slightly acrid. Heat a few fragments of Sumatra Benzoin in a test tube; a sublimate is formed consisting of plates and small, rod-like crystals that strongly polarize light. Add carefully an ethereal solution of Sumatra Benzoin to a small quantity of sulphuric acid contained in a porcelain dish; the solution is colored a brownish-red. Not less than 75 per cent. of Sumatra Benzoin dissolves in alcohol; the alcoholic solution, upon the addition of water, becomes milky and is acid to litmus. Sumatra Benzoin does not yield

more than 2.5 per cent. of ash.

"Siam Benzoin.—In pebble-like tears of variable size, compressed, yellowish-brown to rusty-brown externally, milky-white on fracture, separate or very slightly agglutinated; hard and brittle at ordinary temperatures, but softened by heat and becoming plastic on chewing; odor agreeable, balsamic, vanilla-like; taste slightly acrid. Heat a few fragments of Siam Benzoin in a test tube; a sublimate is formed directly above the melted mass consisting of numerous long, rod-shaped crystals, which do not strongly polarize light. Add carefully an ethereal solution of Siam Benzoin to a small quantity of sulphuric acid contained in a porcelain dish; the solution is colored purplish-red. Not less than 90 per cent. of Siam Benzoin dissolves in alcohol; the alcoholic solution upon the addition of water becomes milky and is acid to litmus. Siam Benzoin does not yield more than 2 per cent. of ash. *The tests which follow apply to Sumatra and Siam Benzoin:* Heat gently 1 to 2 Gm. of Benzoin with 15 mils of purified petroleum benzin, and, after cooling, transfer the supernatant liquid to a separatory funnel, wash once with 10 mils of saturated sodium bicarbonate solution and then with water until free from bicarbonate; on the addition of 20 mils of a copper acetate solution (1 in 200) and vigorously shaking the mixture, no green color is noticeable in the petroleum benzin layer (*rosin and foreign resins*). Treat about 1 Gm. of powdered Benzoin with 15 mils of warm carbon disulphide, filter the solution, wash the filter with an additional 5 mils of carbon disulphide and allow the mixed liquids to evaporate spontaneously; not less than 12.5 per cent. of residue remains, which corresponds to the tests for identity under *Acidum Benzoicum*." U. S.

“Hard brittle masses consisting of numerous whitish tears embedded in a greyish-brown trans-Yncen'L -matrix. O^or agreeable, similar to that of storax; taste slightly acrid. When cautiously heated in a dry test-tube it melts and evolves whitish fumes with an irritating odor. When 0.5 gramme is slowly heated to about 40° C. (104° F.) with 10 millilitres of *solution of potassium permanganate* an odor of benzaldehyde is evolved (distinction from Siam benzoin). Not more than 15 per cent. insoluble in *alcohol* (90 per cent.). Ash not more than 5 per cent.

When heated it melts, and emits thick, white, pungent fumes, which excite coughing when inhaled, and consist chiefly of benzoic acid. It is wholly soluble, with the exception of impurities, in alcohol, and is precipitated by water from the solution, rendering the liquid milky. It

yields to boiling water a notable proportion of benzoic acid. Lime water and the alkaline solutions partially dissolve it, forming benzoates, from which the acid may be precipitated by the addition of other acids. Its chief constituents are resin and benzoic acid, and it therefore belongs to the balsams. The white tears and the brownish connecting medium are said by Stoize to contain nearly the same proportion of acid, which, according to Bucholz, is 12.5 per cent., to Stoize, 19.8 per cent. In a more recent examination by Kopp, the white tears were found to contain from 8 to 10 per cent. of acid, and the brown 15 per cent. (*J. P. C.*, 3e ser., iv, 46.) The resin is of three kinds, one extracted with the benzoic acid by a boiling solution of potassium carbonate in excess, another dissolved by ether from the residue, and the third affected by neither of these solvents. Besides benzoic acid and resin, the balsam contains a little extractive and traces of volatile oil. Benzoin retards the oxidation of fatty matters, and thus tends to prevent rancidity.

The percentage of soluble matter required to be present by the U. S. Pharm. in benzoin is very high, and if rigidly enforced by the customs would exclude Sumatra benzoin in all but its very finest varieties. Robt. C. Pursel and Willard Graham obtained from five commercial varieties of Sumatra benzoin, in the American market, an average of 86 per cent. of soluble matter. (*Proc. Pennsylvania Pharm. Assoc.*, 1902.) John Barclay, in England, found the average of ten samples to be 69.9 per cent. (*P. J.*, Jan., 1903.)

It appears from various researches that benzoin, besides its own characteristic acid, often contains also cinnamic acid, which is found more especially in the white tears. Indeed, Hermann Aschoff obtained from some benzoin of Sumatra a pure cinnamic acid, without any benzoic; and Kolbe and Lautermann, upon examining a specimen of the tears, discovered what they at first supposed to be a peculiar acid, but which on further investigation proved to be a mixture of cinnamic and benzoic acids. H. Beckurts and W. Brueche confirm the statement that Siam benzoin contains no cinnamic acid, which is usually present in Sumatra benzoin. They found the specific gravity from 1.120 to 1.171; ash from 0.05 to 2.38 per cent.; portion insoluble in alcohol from 2.1 to 9 per cent. On the other hand, Tschirch and Ludy (*A. Pharm.*, 1893, 500) extracted benzoic acid from Siam benzoin by the wet process. They found Sumatra benzoin to contain esters which yielded by saponification 32.9 per cent. of cinnamic acid, the proportion of esters being *benzoresinol cinnamate*, 7.4 per cent., and *resinotannol*

cinnamate, 92.6 per cent., at least 75 per cent. of Sumatra benzoin consisting of cinnamates yielding from 20 to 24 per cent. of cinnamic acid. (See also *A. Pharm.*, 1893, 461; *A. J. P.*, 1893, 223; and *J. P. C.*, 1894, 172.) In a later research they found that Siam benzoin did not contain cinnamic acid, either free or in combination as ester. Besides some free benzoic acid and vanillin it contains only esters of benzoic acid. These, on saponification, yielded 38.2 per cent. of *benzole acid*, 56.7 per cent. of *isoresinotannol*, and 5.1 per cent. of *benzoresinol*. (Tschirch, *Harze und Harsbehalter*, 1900, p. 155.) Benzoin may be rapidly tested for cinnamic acid by heating a small quantity with a little soda and water and warming the filtrate with potassium permanganate, when the odor of bitter almond will be developed. (*A. Pharm.*, 1892, ccxxx.)

Aschoff recommends the following method of detecting cinnamic acid. Boil the benzoin with milk of lime, filter, decompose with hydrochloric acid, and add either potassium dichromate with sulphuric acid, or potassium permanganate, when, if cinnamic acid be present, the odor of oil of bitter almond will be perceived.

According to T. T. Cocking and J. D. Kettle (*Tr. Br. Ph. Conf.*, 1914, 357), the important analytical data to be considered in valuing benzoin are (1) the percentage soluble in 90 per cent. alcohol, and (2) the quantity of aromatic acids present, both free and combined. Methods of obtaining these factors are given in detail and also tables giving the results of such examinations of a number of commercial samples. Reinitzer (*A. Pharm.*, cclii) has made an exhaustive study of *Siam benzoin*, in which he contradicts some of the previously published statements of Tschireh and Ludy. He claims that the resinotannol of these authors does not exist in the drug, but is an oxidation product created during the analysis.

Rump (1878) treated Siam benzoin with caustic lime, precipitated the benzoic acid with hydrochloric acid, and agitated the liquid with ether. The latter on evaporating afforded a mixture of benzoic acid and *vanillin*, $C_8H_8O_3$. Subjected to dry distillation, benzoin affords as the chief product benzoic acid, together with empyreumatic products, among which Berthelot has proved the presence (in Siam benzoin) of *styrol*, C_8H_8 . The latter was also obtained in 1874 by Theegarten from Sumatra benzoin by distilling it with water. (*Ber. d. Chem. Ges.*, 1874, p. 727.)

Sumatra benzoin is sometimes heavily adulterated with stony debris, sand and bark. Schneider reports finding as much as 75 per cent. of bark in a commercial article.

Uses.—Benzoin is stimulant and expectorant, and was formerly employed in pectoral affections, but, except as an ingredient of the compound tincture of benzoin, it has fallen into disuse. Trousseau and Pidoux recommend strongly its inhalation in *chronic laryngitis*. Either the air of the chamber may be impregnated with its vapor by placing a small portion upon some live coals, or the patient may inhale the vapor of boiling water to which the balsam has been added. It is occasionally employed in pharmacy for the preparation of benzoic acid; the milky liquor resulting from the addition of water to its alcoholic solution is sometimes used as a cosmetic, under the impression that it renders the skin soft. A tincture has been strongly recommended in *anal fissure*. In the East Indies, the balsam is burnt by the Hindus as a perfume in their temples of worship.

Dose, fifteen to thirty grains (1-2 G-m.).

Off. Prep.—Adeps Benzoinatus, *U. S. (Br.)*; Tinctura Eenzoini, *U. S.*; Tinctura Benzoini Composita, *U. S., Br.*; Sevum Benzoatum, *Br. (N. F.)*; Unguentum Picis Compositum (from Tincture), *N. F.*

BERBERIS. Br.

BERBERIS

"Berberis is the dried stem of *Berberis aris-tata*, DC." *Br.* "The rhizome and roots or species of the section *Odostemon* Rafinesque of the genus *Berberis* Linne (Fam. *Berberidaceae*), without the presence of more than 5 per cent. of the overground parts of the plant or other foreign matter. Berberis without the bark should be rejected." *N. F.*

Oregon grape root; Nepaul Barberry, Barberry; Epine-vinette, Vinettier, Ecorce de Racine de Berberides, *Fr.*; Faueraach, Gemeiner Sauerdorn, Berberitze, Berberitzen-(Saurach-) Wurzelrinde, *G.*; Berbero, *It., Sp.*

The genus *Berberis* (Fam. *Berberidaceae*) is a large one, comprising shrubs or trees which are widely distributed throughout temperate regions and in the mountains of the tropics. There are three well-defined medicinal groups:

(1) The Rocky Mountain group, including *Berberis Aquifolium*, which yields the Oregon Grape Root.

(2) The Asiatic group, which includes *B. aristata* DC., a shrub indigenous to India and Ceylon, and is recognized by the British Pharmacopoeia.

(3) The European group, which includes the common Barberry (*B. vulgaris* L.), which is naturalized in New England. According to Dragendorff (*Die Heilpflanzen*), about forty different species of berberis have been used in medicine.

Berberis aristata, which furnishes the Berberis of the British Pharmacopoeia, is a shrub indigenous to the temperate Himalayas, extending from Bhutan to Kanawar, the Nilgiri Hills, Ceylon. It is erect and branching, the leaves being evergreen, obovate or oblong entire, sometimes possessing spinose teeth. The flowers are yellow and occur in compound, often corymbose racemes. The stigmas are distinguished by being small and subglobose. The berries are few-seeded and taper into a short style. Several varieties of this species are recognized, viz., *floribunda* and *micrantha*. The type *B. aristata* closely resembles *B. asiatica* Roxb., *B. Lycium* Royle and *B. vulgaris* L., and consequently are mistaken throughout India. The same vernacular names are frequently applied to each of these plants and the same medicinal properties attributed to all.

The berberis of the British Pharmacopoeia occurs "in undulating pieces from two and a half to five centimetres in diameter. Cork orange-brown, removed in places showing the subjacent darker brown cortex; marked with slightly wavy longitudinal striae and occasional shallow transverse depressions. Transverse section shows a narrow brown cork; a broad, dark brown bast traversed by conspicuous yellow medullary rays; a bright yellow wood composed of numerous narrow vascular rays, containing many vessels, separated by narrow paler medullary rays. Slight odor; taste bitter." *Br.*

For a description of the bark of *B. aristata* DC., by Hartwick, see *Ph. Rev.*, 1896, 232.

"Cylindrical, more or less knotty, strongly branched, usually cut into

pieces of varying length and up to 45 mm. in diameter; externally light yellowish-brown, longitudinally wrinkled and short scaly; fracture hard and tough; bark 1 mm. in thickness, easily separable into layers; wood yellow, the color more pronounced upon wetting, distinctly radiate, and showing rings of growth; pith of rhizome small, sometimes ex-central. Slightly odorous; taste distinctive, very bitter; on chewing it tinges the saliva yellow. The powder is yellowish-brown; composed chiefly of fragments of wood fibers associated with a few tracheae and medullary rays; wood fibers yellowish, scarcely giving any reaction with phloroglucinol T.S. and hydrochloric acid, and with large, simple, transverse pores; trachea chiefly with bordered pores, occasionally reticulate; medullary rays one to twelve cells wide, and in very long rows; starch grains simple or two- to three-compound, the individual grains being irregularly spherical, from 0.003 to 0.01 mm. in diameter, and occasionally larger. *Berberis* yields not more than 5 per cent. of ash." *N. F.*

The *N. F. IV* recognizes, under the title *Berberis*, " the rhizome and roots of species of the section *Odostemon* Rafinesque, of the genus *Berberis*." This section corresponds to the genus *Mahonia* of Nuttall, and includes *B. Aquifolium* and *B. Nervosa*.

Berberis Aquifolium Pursh., *Berberis*, U. S. VIII, *Oregon Grape Root*, *Rocky Mountain Grape*, *California Barberry*, *Holly-leaf Barberry*, *Trailing Mahonia*.

The *Oregon grape* is a tall shrub, about six to seven feet high, with evergreen, coriaceous, bright and shining leaves, and having numerous small, yellowish-green flowers in the early Spring, and later clusters of purple berries containing an acid pulp. It is a native in woods from Colorado to the Pacific Ocean, especially abundant in Oregon and Northern California. The root, which was formerly official, occurs in pieces about a foot long, one-fourth of an inch thick, of a brownish exterior, but yellowish within, yielding a bright lemon-colored bitter powder. The rhizome was officially described as 1(in mere or less knotty irregular pieces of varying length and from 3 to 20 Mm. in diameter; bark from 1/2 to 2 Mm. thick; wood yellowish, distinctly radiate with narrow medullary rays, hard and tough; rhizome with a small pith; odor distinct; taste strongly bitter. Pieces without the bark should be rejected." *U. S. VIII.*

Rusby believes that a large part of the ber-beris collected in Oregon is obtained from *B. Nervosa*. (*Ph. Era*, 1909, p. 633.)

Nepaul Barberry—*Berberis vulgaris* L. (Barberry). *B. vulgaris* is a native of Europe, but grows wild in waste ground in the eastern parts of New England, and is sometimes cultivated in gardens on account of its berries. It is a spreading shrub, from four to six feet or more in height, with thorny branches, a light gray bark and a fine yellow wood.

The *berries* of *B. vulgaris*, which grow in loose bunches, are oblong and of a red color, have a grateful, sour, astringent taste, and contain malic and citric acids. They are refrigerant, astringent, and antiscorbutic, and are used in Europe, in the form of drink, in *febrile diseases* and *diarrheas*. An agreeable syrup is prepared from the juice, and the berries are sometimes preserved for the table.

The bark of the root of *B. vulgaris* L. was formerly included in the secondary list of the U. S. Pharmacopoeia, under the name of *Berberis*. The *root* and *inner bark* have been used for dyeing yellow. The bark of the root is grayish on the outside, yellow within, very bitter, and stains the saliva when chewed. Brandes found in 100 parts of the root 6.63 of bitter, yellow extractive (impure berberine), 1.55 of brown coloring matter, 0.35 of gum, 0.20 of starch, 0.10 of cerin, 0.07 of stearin, 0.03 of chlorophyll, 0.55 of a sub-resin, 55.40 of lignin, and 35.00 of water.

Lycium of the ancients, highly valued as a local application in affections of the eye and eyelids, and used for various other purposes, is supposed to be the medicine still used in India for the same affections, under the name of *rusot* or *ruswut*. According to Royle, extracts from various species of berberis enter into this substance, which, combined with opium and alum, was much used in ophthalmia. (*P. J.*, Dec., 1865.)

Algerita Root, which has been used by Mexicans and old settlers in Western Texas, is derived from *Berberis trifoliatus* Moricand [*Odostemon trifoliatus* (Moric.) Heller], The shrub grows in Western Texas and New Mexico and extends into Mexico. The root contains, according to Hart (*A. J. P.*, 1916, p. 301) 1.3 per cent. of berberine and 0.1 per cent. of associated alkaloids. Hydrastine is absent. Infusions of algerita root are used for *eye sores*, while chewing the roots is considered reliable as a corrective for *sore mouths*. Injections of an infusion have been used for *gonorrhoea*.

Hesse found in berberis root four alkaloids besides *berberine* (see *Hydrastis*), the mother liquor from berberine hydrochloride when precipitated with sodium hydroxide yielded to ether three alkaloids, a fourth, which is amorphous, remaining undissolved. One of the alkaloids in the ethereal solution crystallized from alcohol in small tabular crystals, and is named by the author *berbamine*. It has the composition $C_{18}H_{19}NO_3 + 2H_2O$. (Ber. d. Chem. Ges., 19, 3190.) To a second alkaloid the name of *oxyacanthine* has been applied.

For additional information concerning the constituents of berberis berries and root, see *U. S. D.*, 19th ed., p. 1412.

B. aquifolium contains the alkaloids *berberine*, $C_{20}H_{17}NO_4$; *oxyacanthine*, $C_{18}H_{19}NO_3$; and *berbamine*, $C_{18}H_{19}NO_3$, together with phytosterin, gum, fat, resin and wax. Berberine and oxyacanthine were isolated by H. B. Parsons (*N. R.*, 1882, 83), the percentage of the former is said to be 2.35 and of the latter 2.82. Jungk and Stubbe investigated the alkaloids from berberis, and found that the three alkaloids in *B. aquifolium* are identical with those found in *B. vulgaris*. Rudel examined and described these alkaloids. (*J. C. S.*, 1892, 641.) Gordin and Merrell (*Proc. A. Ph. A.*, 1901, 228) objected to the method of Gaze (*Chem. Ch.*, 1890, 590) for making berberine from acetone-berberine.

Uses.—The various species of *Berberis* appear to have similar medical properties. The alkaloid berberine is physiologically very feeble. (See *Hydrastis*.) Antiperiodic properties have been attributed to it, and T. Lascarato (*La Grece medicate*, 1899, No. 2) affirms that it has a specific action upon the spleen which renders it very valuable in the treatment of malarial *splenic enlargement*, and that it is so powerful in producing contraction that when the spleen is softened large doses may produce splenic rupture, with *fatal hemorrhage*. The crude drug probably has no real medicinal effect, except that of a bitter tonic and mild laxative. It is by some believed to have an especial tendency towards the liver and hence is used in *jaundice* and *chronic hepatitis*. It is also stated to have alterative powers and has been employed in syphilis and scrofula.

Off. Prep.—Tinctura Berberidis, *Br.*; Fluid-extractum Berberidis, *N. F.*

BETEL. Br.

BETEL

"Betel consists of the dried leaves of Piper Betle, Linn." Br.

Betel, Betle, Pawn, or Pinang are popular Oriental names for *Piper Betle* L. and *P. Siriboa* L., the leaves of which are used by the Malays as a masticatory. The leaves are usually admixed with scrapings of the Areca nut and shell lime. The Betel plants are indigenous throughout the entire Indian-Malay region and cultivated in Madagascar, Bourbon and West Indies. The plants are climbing shrubs and trained upon trellises and poles in shady but hot places. The leaves are picked while green, pressed together by means of stones and dried. The Betel leaves of the British Pharmacopoeia are described as follows: "About fifteen centimetres long, broadly ovate, acuminate, obliquely cordate at base; thin and brittle, upper surface glossy, five or seven conspicuous lateral veins. Mesophyll contains abundant oil-cells filled with brown oleo-resin. Taste warm, aromatic, bitter. As found in commerce the leaves are frequently tied up or stitched together into packets." Br.

The warm aromatic taste of the betel leaves is due to an essential oil known as *betel oil*. This is of a color varying from clear yellow to dark brown and of aromatic, somewhat creosote-like, odor and burning sharp taste. The specific gravity ranges from 0.958 to 1.044, the lighter oil being that obtained from the fresh leaves. The alcoholic solution of the oil gives a greenish to bluish-green color with ferric chloride.

The betel oil from Siam contains *cadinene* and a characteristic phenol named *betelphenol*, iso-meric with eugenol; the oil from Java contains in addition to the betelphenol, *chavicol* and a *sesquiterpene*; while the Manila oil contains betelphenol as the sole phenolic constituent. (Gildemeister and Hoffmann, *Die Aetherische Oele*, Berlin, 1899.)

Uses.—The essential oil of betel is an active local stimulant and has been used in *doses* of one to two minims (0.06-0.12 mil) in the treatment of various respiratory *catarrhs*, and as a local application, either by gargle or inhalation, in *diphtheria*. It is said that the juice of four leaves is equivalent in power to one drop of the oil. In India betel leaves are used locally to a considerable extent for the purpose of counter-irritation and applied to the mammary glands for the purpose of suppressing the

secretion of milk in mammary abscesses. The essential oil has been given internally in doses of from one to two minims (0.06-0.12 mil).

Betonica. *Betonica officinalis*, L. *Wood Betony*. —A perennial European labiate herb, feebly aromatic and astringent. Its root has been considered emetic and purgative.

Betula. *Betula alba* L. *Paper, Canoe or European White Birch. Bouleau, Fr. Birke, G.* (Fam. *Betulaceae*.)—Various parts of this tree have been applied to medicinal uses. The young shoots and leaves secrete a resinous substance, having acid properties, which, combined with alkalies, is said to produce the effects of a tonic laxative. (*J. P. C.*, xxvi, 208.) The *inner bark*, which is bitterish and astringent, has been employed in *intermittent fever*. The epidermis is separable into thin layers, which may be employed as a substitute for oiled paper, and applied to various economical uses. The bark contains *betulin*, or *betula camphor*, which Hausemann (*Ann. Ch. Ph.*, 182, 368) has shown to be a diatomic alcohol, as it forms a diacetate. Its formula is $C_{36}H_{60}O_3$, fusing point $258^{\circ} C.$ ($496.4^{\circ} F.$). When oxidized it yields *betulinic acid*, $C_{36}H_{54}O_6$, and *betulinamaric acid*, $C_{36}H_{52}O_{16}$. When the bark is distilled, it yields an empyreumatic oil known variously as *dagget*, *oleum rusci*, *oleum betulinum*, *oleum muscoviticum*, *oleum fagi*, and *oil of birch tar*. This is a thick, brownish-black liquid, sp. gr. 0.955, having the odor of Russia leather, in the preparation of which it is employed. This oil has been found very useful as a local application in *chronic eczema* and other *skin diseases* in strengths varying between 1 and 20 per cent. Its medicinal properties closely resemble, if they be not identical with, those of oil of cade. (See *Oleum Cadini*, Part I.) Dutch and German *oil of birch* are quite different from the Russian oil. (See *P. J.*; xv, 769.) The National Formulary IV has introduced a rectified oil of birch. See *Oil of Birch Tar*. The *leaves* of birch, which have a peculiar, aromatic, agreeable odor, and a bitter taste, have been employed, in the form of infusion, in *gout*, *rheumatism*, and *dropsy*. Active diuretic properties are claimed for birch leaves and attributed to the *betulorentinic acid* in them. An alcoholic extract has been used in daily *doses* of from twenty-five to fifty grains (1.6-3.2 Gm.). When the stem of the tree is wounded a saccharine *juice* flows out which is considered useful in complaints of the kidneys and bladder, and is susceptible, with yeast, of the vinous fermentation. A beer, wine, spirit, and vinegar are prepared from it in some parts of Europe. *Tinctura Rusci* is made, according to Hager, as follows: Ol. Rusci 10, Alcohol, Aether, of each 15, Ol. Lavandulae, Ol. Rosmarini, Ol. Rutae, of each 0.4 part; filter. (*A. J. P.*, 1881.)

Bichetia. *Bichetia officinalis*. *Murere Juice* is extracted in Brazil from the incised bark of this plant; it is a thick reddish liquid, sp. gr. 1.100, and is said to contain an alkaloid and to be useful in *rheumatism* and *syphilis*. The *dose* of the juice is one fluidrachm (3.75 mils) in water; in large doses it is drastic.

Bidens. *Bidens bipinnata*, L. *Spanish Needles*. —An indigenous composite plant, of which the root and seeds are popularly used as emmenagogues, and by the eclectics in *laryngeal* and *bronchial diseases*.

Bistort. *Snakeweed. Bistorte, Couleuvrine, Fr. Weissenknoterich, Natterwurz,*

G.—This is the rhizome of *Polygonum Bistorta*, L. (Fam. *Polygonaceae*), a perennial herbaceous plant, growing in Europe and the north of Asia. The rhizome is cylindrical, somewhat flattened, about 1 to 2 cm. in thickness, marked with annular or transverse wrinkles, furnished with numerous rootlets, and folded or bent upon itself, so as to give it the tortuous appearance from which its name was derived. Externally it is dark purplish or blackish-brown. The fracture is nearly smooth, reddish or purple, the taste being astringent. It contains much tannin, some gallic acid and gum, and a large proportion of starch. H. K. Bowman found 21 per cent. of tannin in bistort root. (A. J. P., 1869, 193.) Its medicinal properties are like those of kino, but it is less efficient. It may be employed in powder, decoction, or extract. The *dose* of the powder is twenty or thirty grains (1.3-2.0 Gm.).

Besides the bistort, some other plants belonging to the genus *Polygonum* have been used as medicines. Among these are *P. aviculare*, L., or *knot weed*, a mild astringent, formerly employed as a vulnerary and styptic; *P. Persicaria*, L., or *lady's thumb*, of a feebly astringent saline taste, and at one time considered antiseptic; and *P. Hydropiper*, L., common *smartweed*, or *water-pepper*, the leaves of which have a burning and biting taste, inflame the skin when rubbed upon it, and are esteemed diuretic, and have been used with asserted success in *amenorrhea* and other *uterine disorders*. Its irritant and also medicinal properties are due to an acid, *polygonic acid*, discovered by C. J. Rademaker. *Polygonum Hydropiper* has been used by Krawkoff (*Russki Vratch*, 1912) in the treatment of internal hemorrhages, especially of the uterus. He administered from thirty to forty drops of a fluidextract of the leaves. (A. J. P., xliii, 490.) The *water-pepper* or *smartweed* of this country—*P. acre* H. B. K.—which grows abundantly in moist places, possesses properties similar to those of the European water-pepper, and is occasionally used as a detergent in chronic ulcers, and internally in *gravel*. B. Woodward found that the dried plant contains 18 per cent. of tannin, and used a saturated tincture with great advantage in *diarrhea* and *dysentery*, in *doses* of from twenty to sixty minims (1.3-3.75 mils). Aughey finds that *P. amphibium*, L., is readily cultivated, with a yield of from three to six tons to the acre, that the roots contain 21.75 per cent., the stems 17.1 per cent., of tannic acid, and urges the growth of it for tanning purposes. (*N. R.*, 1876, 75.)

Fagopyrum esculentum Moench is common *buckwheat*. The leaves of this plant have been found by Ed. Schunck to contain a crystallizable coloring principle, identical with the *rutin* or *rutic acid* previously discovered by Weiss in the leaves of the common rue, and probably, with the *ilixanthin* of Moldenhaus, existing in the leaves of *Ilex Aquifolium* L., or the common holly. Buckwheat leaves yielded to Schunck somewhat more than one part of rutin in a thousand. (*Chem. Gaz.*, No. 399, 201.)

From *P. cuspidatum* L. has been separated a glucoside, *polygonin*, and also *emodin*. (P. J., Feb., 189,5.) The bark of the rhizome has been recommended by Goris and Crete (*Bull. Sci. Pharmacol.*, 1907) as a laxative. The leaves of the *P. dumetorium* are, according to Tunmann (*Ph. Centralh.*, 1906), also practically useful as a laxative.

Various species of the genus *Polygonum* are used for the production of dye-stuffs; thus, indigo is obtained largely in China, Japan, and in some parts of Russia, from the leaves of *P. tinctorium* Ait., and is said also to be yielded by those of *P. aviculare* and

P. barbatum, L.; while in India, China, and Japan the roots of the *P. cuspidatum* are employed for making a yellow dye. (*J. Chem. S.*, Dec., 1895.)

Blepharis. *Blepharis capensis*. (Fam. *Acanthaceae*.)—This plant is said to be physiologically very active and useful in the treatment of anthrax. (*P. J.*, lx, p. 140.)

Blue Flag. *N. F. IV.* (U. S. P. 1890.) *Iris Versicolor*.—"The dried rhizome of *Iris versicolor* Linne (Fam. *Iridaceae*), without the presence of more than 5 per cent. of the roots and leaf bases." y. F. In all the species belonging to this genus, so far examined, the roots are more or less acrid, and possessed of cathartic and emetic properties. In Europe, *Iris foetidissima* L., *I. florentina* L., *I. germanica* L., *I. pseudoacorus* L., and *I. tuberosa* L. have at various times been admitted into use, and the unpeeled roots of *I. germanica* are still sold in the Indian bazaars under the name of *Irisia*. *Iris versicolor* L., or blue flag, is found in all parts of the United States, flourishing in low wet places in meadows. The flowers afford a fine blue infusion, which serves as a test for acids and alkalis. The recent root is without odor, and has a nauseous, acrid taste, which is imparted to water by decoction, and still more perfectly to alcohol, the acrimony as well as medicinal activity is impaired by age. If cut, when fresh, into slices, dried at the temperature of about 37.8 ° G. (100° F.), then powdered and kept in bottles excluded from the air, the root retains its virtues unimpaired for a considerable time (Andrews). It is described as follows in the National Formulary IV:

"Rhizome frequently branched, up to 10 cm. in length and 2 cm. in thickness, usually cut into longitudinal pieces; outer surface grayish-brown to purplish-brown, somewhat annulate, the upper surface with markings of leaf bases, the lower with numerous root scars and remnants; fracture short, the broken surface pale purplish-brown and exhibiting a central stele with whitish fibro-vascular bundles distributed throughout, a distinct endodermis, and cortex. Odor slight, not distinctive; taste acrid, nauseous. The powder is light purplish-brown and, when examined under the microscope, exhibits numerous resin cells filled with yellow to brown resin; starch grains few, or, in some specimens, abundant, simple, or two-to four-compound, the simple grains being spherical or elliptical, up to 0.022 mm. in diameter; calcium oxalate in prisms, up to 0.35 mm. in length; tracheae with spiral or reticulate markings or with bordered pores; sclerenchymatous fibers few, lignified and with oblique pores. Blue flag yields not more than 7 per cent. of ash." *N. F.*

D. W. Cressler found in this plant starch, gum, tannin, sugar, and acid resin, fixed oil, and indications of an alkaloid. (*A. J. P.*, 1881, p. 602.)

Blue flag is a cathartic and emetic, said to have been used by the Southern Indians, and may be given in doses of from ten to twenty grains (0.65-1.3 Gm.). *Iridin*, or *irisin*, of the eclectics, is an oleoresin obtained by precipitating a tincture of the root with water, and mixing the precipitate with an equal weight of some absorbent powder. Wm. E. Jenks (*A. J. P.*, 1881, p. 601) prepares the oleoresin of iris by exhausting the root with alcohol, sp. gr. 0.835, and distilling off the alcohol. (See also a paper on the constituents of the oleoresin by W. L. Cliffe, *A. J. P.*, 1884, p. 616.) The so-called irisin is undoubtedly purgative and is generally believed to have a very decided action upon

the liver. Power and Salvay (*A. J. P.*, 1911, 14) isolated *isophthalic acid*, $C_6K_4(CO_2H)_2$. It may be given in pill in the dose of from three to four grains (0.20-0.26 Gm.).

The Pharmacopoeia formerly recognized a solid extract (*Extractum Iridis*), made by the following process: "Iris, in No. 60 powder, *one thousand grammes* [or 35 ounces av., 120 grains]; Alcohol, *a sufficient quantity*. Moisten the powder with *four hundred mils* [or 13 fluidounces, 252 minims] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Alcohol, until *three thousand mils* [or 101 fluidounces, 3 $\frac{1}{2}$ fluidrachms] of tincture are obtained, or the Iris is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence." *U. S.*, 1890. The *dose* of the extract of iris is one to two grains (0.065-0.13 Gm.).

A fluidextract is official in the N. F. (see Part III).

Blumea. *Blumea lacera* DC. (Fam. *Compositae*.)—From this plant, which is used in India as an insect powder, Dymock has obtained a light yellow volatile oil. It has a sp. gr. of 0.9144 at 26.7° C. (80° F.), and an extraordinary rotating power, 1 mm. turning the ray 66° to the left.

Bocconia.—It is probable that various species of this papaveraceous genus have active medicinal properties. *B. arborea* Watson, of Mexico, has been found by Elliott to contain two alkaloids, one of which is probably *sanguinarine*; and the leaves of other species are used in South America as an abortifacient and purgative. (See Rusby, *Bull. Pharm.*, 1891.) Murrill and Schlotterbeck (*Proc. A. Ph. A.*, 1900, p. 128) examined all parts of *Bocconia cordata*, and isolated protopine, homo-chelidonine, chelerythrine and sanguinarine.

Boldo. *N. F. IV. Boldo Leaves.*—It is described by the N. F. as "the leaves of *Boldu Boldus* (Molina) Lyons (Fam. *Monimiaceae*), without the presence of more than 2 per cent. of stems or other foreign matter. Broadly ovate or oval, from 3 to 7 cm. in length and from 1 to 4 cm. in breadth, the base varying from rounded to very slightly indented, the summit rounded or slightly notched, the margin entire and sharply revolute; thick, coriaceous, rigid and brittle, from pale-green to brownish-green, papillose, roughened on both surfaces, the principal veins coarsely reticulate, impressed above, sharply prominent underneath; the petiole stout and rigid, from 1 to 5 mm. in length, reticulate. Odor peculiar; when crushed very strong, disagreeable, and somewhat like that of oil of chenopodium; taste bitter, warm and pungent, camphoraceous and slightly terebinthinate. Under the microscope a transverse section shows a well-marked hypodermis from which develop papilla-like excrescences, each crowned, with a group of radiating, one-celled, thick-walled hairs; on the lower surface stomata numerous and hairs somewhat smaller, mesophyll with numerous oil secretion cells. Boldo yields not more than 10 per cent. of ash." This

plant is an evergreen shrub, frequenting the meadows of the Andes in Chili, where its yellowish-green fruit is eaten, its bark used in tanning, and its wood is employed in charcoal making. The leaves contain an aromatic, volatile oil, of which they yield, on distillation, about 2 per cent. The oil boils between 175° and 250° C. (347° and 482° F.) and gives a green coloration with ferric chloride; it contains terpene and oxygenated bodies which have not as yet been investigated. For chemistry of the *Oil of Boldo*, see *Schim. Rep.*, Oct., 1907, p. 19. They have found that the oil is chemically related to the Oil of *Chenopodium*. A peculiar alkaloid, *boldine*, has been found in them by Bourgoïn and Verne (*J. P. C.*, 4e ser., xvi, 191), and a glucoside, boldo-glucin, $C_{30}H_{52}O_8$, a thick syrupy liquid, by P. Chapoteaut. (*C. R. A. S.*, xcvi, 1052.) According to Sigismond Pascaletti (*Terapia Moderna*, 1891), boldine when injected hypodermically paralyzes both the motor and sensory nerves, and also attacks the muscle fibers. When given internally in toxic dose it produces great excitement, with exaggeration of the reflexes and of the respiratory movements, increased diuresis, cramps, disorder of coordination, convulsions, and finally death from centric respiratory paralysis, the heart continuing to beat long after the arrest of respiration, finally stopping in diastole. Boldine has in recent years come into wide use in veterinary medicine as a remedy for *jaundice*. It has also been used in man in the treatment of hepatic affections, given in doses of one one-hundredth to one-twentieth of a grain (0.0006-0.003 Gm.) in conjunction with calomel. Boldoglucin is said to act on the lower animals as a narcotic, and has been given by Rene Juranviller in *doses* of one to three grains (0.06-0.2 Gm.) in diseases of the liver. Fifteen minims (0.9 mil) of the oil of boldo cause in man some warmth in the epigastrium; thirty minims (1.8 mils), much gastric irritation, with pain and vomiting, and passage of urine smelling strongly of the oil. Dujardin-Beaumetz finds the oil useful in *genito-urinary inflammations* in *doses* of five drops (0.25 mil) [B. G. T., March, 1875], in diseases of which character the drug has long been employed in South America. (*Ibid.*, lxxxvi, 165.) In France boldo has been employed as a tonic in *chronic hepatic torpor* and in *hepatitis*, and Fedeli (*Il Policlinico*, 1907) reports favorable results in the treatment of *cholelithiasis*. Eight minims (0.5 mil) of a 20 per cent. tincture or four minims (0.25 mil) of the *N. F.* fluidextract may be considered as the commencing *dose*, increased *pro re nato*. Large doses are apt to vomit and purge.

According to A. T. De Rochebrune (*Toxicol. Africaine*, i, 1897), the tree *Monimia rotundifolia*, of Australia, contains an abundant volatile oil, an alkaloid, and a glucoside, which are very similar to, if they are not identical with, those obtained from the *Boldo*, and may be substituted for the latter in therapeutics.

Bonduc Seeds.—These are seeds derived from several species of the genus *Caesalpinia* (Fam. *Leguminosae*), which are used in India as febrifuges, tonics, and antiperiodics. Heckel and Schlagdenhauffen have discovered in them a bitter principle (*C. R. A. S.*, ciii, 89), probably identical with that previously isolated by Flickiger. (*Pharmacographia*, 2d ed., 212.)

Borago. *Borago officinalis*, L. *Borage*. *Bourrache*, Fr. *Borasch*, *Boretsch*, G. (Fam. *Boraginaceae*.)—This European annual abounds in mucilage, and the stems and leaves contain potassium nitrate with other salts. To these constituents the plant

owes its feeble medicinal properties. An infusion of the leaves and flowers is employed as a demulcent, refrigerant, and gently diaphoretic drink. The expressed juice of the stems and leaves is also given in the dose of from two to four nuidounces (60-120 mils).

Bowdichia. *Bowdichiavirgilioides* H. B. K. (Fam. *Legum-inosae*.)—Under the name of *Sucupira*, the hard, yellow, very bitter bark yielded by this tree is employed in Venezuela and Brazil in fevers and rheumatism. Petit has found it in a mydriatic alkaloid. (*P. J.*, June, 1885.)

Bragantia. *Bragantia Wallichii*. (Fam. *Aristolochiaceae*.)—The roots of this shrub of India contain an alkaloid allied to *aristolochine*, a soft resin, a resinous acid, and a substance related to dulcite. [*P. J.*, 1894, 231.)

Brassica.—In China the oil of *Brassica sinensis*, or *petsai*, is used for lighting, and is said also to be purgative, and useful in *skin diseases*, while the Japanese employ the yellow oil of *B. Campestris*, L., under the name of *aburana*, for culinary and lighting purposes. (*A. J. P.*, June, 1885.)

Brazil Nuts. *Cream Nuts.* *Butter Nuts* (not to be confused with the nuts similarly named and obtained from *Juglans cinera* L.). *Para Nuts.* *Chataigne du Bresil*, Fr. *Paranuss*, G.—These are edible nuts imported from Brazil, and sometimes employed in making cream syrups for giving flavor to carbonic acid water. In Brazil an expressed oil is obtained from them, which is said to be used for burning, making ointments, and adulterating copaiba. The nuts are the product of *Bertholletia excelsa* Humb. et Bpl. and *B. nobilis* Miers, a large and beautiful tree of the Fam. *Myrtaceae*, growing over extensive regions in South America. Cornwinder has found in the kernel of the nut 65.CO per cent. of oil, and 15.31 per cent. of nitrogenous matter. (*P. J.*, Aug., 1873.) Hugo Kuhl obtained from the seeds an average fat-content of 62.73 per cent., with 2.59 per cent. of nitrogen, corresponding to 16.20 per cent. of proteins. (*P. Zeit.*, 1909, No. 6, 58.)

Brazil Wood.—A red dye-wood, the product of different species of *Caesalpinia*, growing in the West Indies and South America. Two varieties are known in commerce—1, the proper Brazil wood, said to be derived from *Caesalpinia echinata* Lam., and sometimes called *Pernambuco* or *Fernambuco wood*, from the province of Brazil, where it is collected; 2, the *brasiletto*, produced by *C. brasilensis*, L., and *C. Crista*, L., which grow in Jamaica and other parts of the West Indies. The former is the most highly valued. The *Nicaragua* or *peach wood* is also analogous to the brasiletto, and is said by Bancroft to be derived from a species of *Caesalpinia*. It is produced in the East Indies. Brazil wood is nearly inodorous, has a slightly sweetish taste, stains the saliva red, and imparts its coloring matter to water. It was formerly used in medicine, but has been abandoned as inert. In pharmacy it serves to color tinctures, etc., but its chief use is in dyeing. A red lake is prepared from it, and it is an ingredient in a red ink. Its dyeing properties are due to a cry stall izable coloring principle, named *brazilin* or *brasilin*, $C_{16}H_{14}O_5$. This, as usually obtained, is of a sulphur-yellow color, which it preserves in the dark, but in the sunlight, to which it is

remarkably sensitive, changes to a reddish hue after a few minutes' exposure, and also more slowly in diffused daylight. The principle should, therefore, be kept in perfectly opaque vessels. It is now stated that when absolutely pure it is colorless, and becomes red on exposure to the air. The change is due to the formation of *brasilein*, $C_{16}H_{22}O_5$, which can be prepared from the brasilin by a variety of methods, such as oxidation by nitrous acid, by alcoholic iodine solution, etc. Brasilin is sparingly soluble in water, yielding a sweet and almost colorless solution which is not changed by acids, but is deeply reddened by alkalis. In alcohol and ether it is somewhat more soluble than in water, giving a light yellow solution. Brasilin and hematoxylin (from logwood) are now recognized as related, each being derived from the pyrone nucleus $C_5H_4O_2$, from which the two groups, the xanthone group and the flavone group, are also taken. The coloring principles of most dye-woods are now referred to this source. (Kupe, *Die Chemie der natürllichen Farbstoffe*, Braunschweig, 1900.)

Brea Gum.—This substance, which has been proposed as a substitute for gum arabic, is believed to be derived from *Caesalpinia praecox*, a Brazilian tree. It occurs in stalactitic pieces or oval reddish-yellow tears, isolated or agglomerated. It forms with water a viscous, pale reddish-yellow mucilage, of acid reaction, which may be partially decolorized by heating with a few drops of hydrochloric acid. It is said to contain 77 per cent. of arabin.

Bryonia. *N. F. IV. Bryony.*—The N. F. describes it as " the dried root of *Bryonia alba*, Linne or of *Bryonia dioica* Jacquin (Fam. *Cucurbitaceae*), without the presence of more than 5 per cent. of foreign matter. Usually in circular or elliptical slices, obtained by cutting the root more or less transversely, from 1.5 to 10 cm. in breadth and from 3 to 15 mm. in thickness; the edges light gray or yellowish, rough and striate, the cut surface white or faintly yellow, showing a thin cortex and a wood with numerous projecting, collateral fibro-vascular bundles arranged in concentric zones; fracture short and mealy, whitish internally. Odor faint but distinct and characteristic; taste bitter and nauseous. The powdered drug is of a light yellow color and, when examined under the microscope, shows simple, rounded, or two- or more compound, starch grains from 0.004 to 0.024 mm. in diameter, frequently with a central cleft, tracheae from 0.035 to 0.25 mm. in width, reticulate or with bordered pores, and large yellow cork cells. Add sulphuric acid to the powdered drug; it becomes reddish-brown and then brownish-purple. *Bryonia* yields not more than 8 per cent. of ash."

The peasants are said sometimes to hollow out the top of the root, and to employ the juice which collects in the cavity as a drastic purge. (Merat and De Lens.) The berries are also purgative, and are used in dyeing. *B. americana* Lam. and *B. africana* Thumb, are respectively used in the West Indies and Africa as hydragogue cathartics in *dropsy*. The berries of the European *black bryony* (*Tamus communis* L.) are said to be an irritant poison, and Coutagne has found that their tincture causes in animals paralysis and convulsions. (See *Rep. de Pharm.*, Nov., 1884; also P. J., Jan., 1903.)

Bryonia contains a glucoside, *bryonin*, $C_{48}H_{80}O_{19}$, and a peculiar resin called *bryoresin*. According to Power and Moore (*Tr. Chem. Soc.*, 1911, xciv), bryonin is a

mixture of a glucoside and an alkaloid, neither of which is physiologically active. The activity of the plant resides in its resin. Bryonin occurs as a brownish-yellow amorphous powder of bitter taste, soluble in water and alcohol. It is used as a cathartic in hepatic congestion and in conditions following acute infectious diseases. *Dose*, one-sixtieth of a grain (0,001 Gm.) every two hours.

Bryonia is an active irritant hydragogue cathartic. In a number of cases it has produced serious or even fatal poisoning. Vomiting and purging have been commonly present, but in some cases there has been no diarrhea. Giddiness, delirium, and dilated pupils, coupled with fall of the bodily temperature, imperceptible pulse, cold perspiration, and other manifestations of collapse, are the usual symptoms. Eighty minims (5 mils) of the homeopathic tincture caused very serious but not fatal poisoning. (For cases, see *P. J.*, 1858, p. 542; *L. L.*, May 9, 1868; *B. M. J.*, 1883, ii, 1067; *T. G.*, ii, 35; also *Woodman and Tidy.*) The fresh root is highly irritant, and is said, when bruised and applied to the skin, to be capable of producing vesication. The medicine was well known to the ancients, and has been employed as a hydragogue cathartic in *dropsy*. *Dose*, ten to thirty grains (0.65-2.0 Gm.). The tincture is official in the N. F. (see Part III).

BUCHU. U. S. (Br.)

BUCHU

"The dried leaves of *Barosma betulina* (Thunberg) Bartling and Wendland, known in commerce as Short Buchu; or of *Barosma serratifolia* (Curtis) Willdenow, known in commerce as Long Buchu (Fam. *Rutaceae*), without the presence or admixture of more than 10 per cent. of stems or other foreign matter." *U. S.* "Buchu Leaves are the dried leaves of *Barosma betulina*, Bart. and Wendl." *Br.*

Buchu Folia, *Br.*; Folia Bucco, Folia Diosmsae s. Barosmae; Feuilles de Bucco (Booko, Buchu), *Fr.*; Buckublatter, Bucco-blatter, *G.*

The leaves of the official and other *Barosmas* and of some *Agathosmas*, are collected by the Hottentots, who value them on account of their odor, and under the name of *bookoo* or *buchu*, rub them, in the state of powder, upon their greased bodies.

Buchu leaves are not recognized except in the U. S. and British Pharmacopoeias. The definitions for this drug do not show any great stability, at one time the "short" buchu being official and then again both the "short" and the "long" buchus are included in one definition. This latter is a mistake as the oils in the several buchus are quite distinct. The drug was exploited in the 70's in the United States by

Humboldt who was one of the most eccentric and fantastic exploiters of proprietary medicines. (See *A. J. P.*, 1916, p. 23.) The medicinal species of *Barosma* are all erect, slender shrubs with opposite leaves, dotted with conspicuous pellucid oil glands, smooth, angular, purplish branches, often of a purplish color, "white flowers, and a fruit of five erect carpels. They are chiefly distinguished by their leaves.

Barosma betulina is a small shrubby plant indigenous to Cape Colony. The leaves are collected while the plant is in flower and fruit, then dried and shipped to London. *B. serratifolia* is a well developed shrub growing in the mountains of the Southwest of Cape Colony. The leaves usually command a higher price and are only employed when the supplies of short buchu are reduced. The exports of buchu from South America in 1908 were 243,742 pounds, in 1912, 223,000 pounds, in 1913, 163,000 pounds, and in 1914 about 75,000 pounds. According to Schimmel and Co., the buchu plant thrives best in a very sandy soil, but it is rather difficult to cultivate as the cuttings do not root readily. The buchu of commerce always contains more or less foreign material, such as stems, twigs and old worthless leaves, and the U. S. Pharmacopoeia has wisely limited the amount of such admixture to 10 per cent.

The non-official species, which have been seen in European markets occasionally, are said to be used in South Africa as substitutes for the official buchu; they are:

Barosma crenulata (L.) Hook.—The leaves are opposite, ovate or obovate, acute, serrated and glandular at the edge, coriaceous, and full of small pellucid dots on the under surface. The flowers are white or of a reddish tint, and, stand solitarily at the end of short, lateral leafy shoots. C. J. S. Thompson has found that the leaves of *B. serratifolia* yield only 3.45 per cent. of resin and 1 per cent. of volatile oil, while those of *B. crenulata* yield 3.75 per cent. of resin and 1.6 per cent. of volatile oil, and those of *B. betulina* give 4.25 per cent. of resin and 1.45 per cent. of volatile oil; so that *B. serratifolia* would seem to be the least active of the species. (*P. J.*, xxi, 1890.)

Barosma Eckloniana Barth., a plant which has been considered to be only a variety of *B. crenulata*, has leaves which are rounded at the base, shorter and proportionately wider than those of *B. crenulata*, and also grow upon pubescent shoots.

The leaves of *Barosma venusta* which are said to have appeared in the London markets, are readily distinguished by their being very much smaller than those of *B. betulina*, which they otherwise resemble.

Barosma pulchellum (L.) Bartl. and Wendl.— The leaves closely resemble those of the *B. betulina*, being ovate instead of obovate, that is, they are wider at the base. Their odor is quite different, strongly recalling that of citronella, and Schimmel and Company have demonstrated the presence in them of citronellal.

Under the name of *Karoo buchu*, in 1904 the leaves of the *Diosma succulenta* L., var. *Bergiana* H. and S., appeared in London; they are small and heath-like, thick, obtuse, and slightly recurved, and yielded to C. E. Sage (C. D., lxxv, 506, 787) a small semi-solid volatile oil having the odor of peppermint. Recently a new buchu has appeared on the market, the leaves resembling very closely those of *Barosma scoparia* E. and Z. (*Perf. & Ess. Oil Rec.*, 1914, p. 375.)

Buchu is subject to many adulterations both by the leaves of other species of the genus as well as more distantly related leaves. The most important of these adulterations are as follows: *Psoralea obliqua* E. Mey, or *P. bracteata* (*P. J.*; 1910, pp. 69 and 464), and *Empleurum serulatum* Ait. The leaves of the latter are lanceolate or narrowly linear, about 4 cm. in length, yellowish-green and very acute at the summit. They furthermore do not contain any oil canals at the base of the teeth. (For description of many other adulterants, see Holmes, *P. J.*, 1910, lxxxv, p. 464.)

Properties.—Buchu leaves are officially described as follows:

"Short Buchu.—Rhomboidally oval or obovate; from 9 to 25 mm. in length and from 4 to 13 mm. in breadth; summit obtuse, and recurved; margin somewhat serrate or finely dentate with an oil gland at the base of each tooth; the base more or less wedge-shaped; color varying from vivid green to yellowish-green, occasionally a few olive-gray leaves; glandular-punctate; both surfaces papillose; under surface longitudinally striate; texture coriaceous; petiole 1 mm. in length; odor and taste characteristic, aromatic and mint-like.

"Long Buchu.—Linear-lanceolate, from 2.5 to 4 cm. in length and from 4 to 6 mm. in breadth; summit somewhat rounded or truncate with an

oil gland at the apex; margin sharply serrate and glandular; otherwise resembling Short Buchu.

"Stems in both Short and Long Buchu about 1 mm. in diameter, yellowish-green or brownish-red, cylindrical, longitudinally furrowed, with prominent leaf-scars nearly opposite to each other giving the stems a jointed character. The yield of ash does not exceed 4 per cent." *U. S.*

"From twelve to twenty millimetres long, rhomboid-obovate, dull yellowish-green, rigid, cartilaginous when slightly moist. Surface glabrous, bearing small scattered prominences; margin usually sharply denticulate, apex blunt and recurved. Oil glands visible in the leaf, especially near the margin. Transverse section exhibits in epidermis cells containing yellow sphere-crystals; inner walls of these cells thick and rich in mucilage. Odor and taste strong and characteristic." *Br.*

The leaves of *B. crenulata* constitute the *short buchu* or *round buchu*, while those of *B. serratifolia* are the *long buchu* of commerce. The leaves of *B. crenulata* are at present comparatively infrequent in commerce, the parcels usually consisting of those of one of the other species almost unmixed. The species can be recognized by the characters already given. The leaves of the *Empleurum serrulatum* sometimes occur mixed with buchu leaves occasionally constituting the bulk of the parcel. They are to be distinguished by their acrid taste and peculiar odor and by being longer and narrower than any buchu leaf, with a sharp-pointed apex, parallel sides, and coarse denticulation. Further, according to Holmes, when the leaf of a *Barosma* is held up to the light the lateral veins appear straighter, longer, and more strongly developed than in the leaves of the *Empleurum*. John C. Umney (*P. J.*, March, 1895) finds that the leaves of the latter contain 0.64 per cent. of a peculiar volatile oil. There is no reason to believe that they possess the therapeutical properties of buchu. Holmes enumerated a number of plants used in South Africa as substitutes. (See *P. J.*; 1900, 70.)

Fluckiger obtained from *B. betulina* 1.56 per cent. of volatile oil, which had the odor of peppermint rather than of buchu, and deviated the plane of polarization considerably to the left. On exposure to cold it furnished a camphor, which, after resolution in alcohol, crystallized in needle-shaped forms. After repeated purification in this manner, the crystals of *Barosma camphor*, or *diosphenol*, $C_{10}H_{16}O_2$, have a peppermint odor; they fuse at 85° C. (185° F.) and begin to sublime at

110° C. (230° F.). After fusion they again solidify only at 50° C. (122° F.). Barosma camphor is abundantly soluble in carbon disulphide. The crude oil from which the camphor had been separated had a boiling point of about 200° C. (392° F.), quickly rising to 210° C. (410° F.), or even higher. The oil which distilled between these temperatures, rectified over sodium, gave approximately the formula C₁₀H₁₆O. (*Pharmacographia*, 2d ed., p. 109.) Spica examined *B. crenulata* and found the volatile oil to differ from that obtained by Fluckiger from *B. betulina*; the solid body was similar to diosphenol, but upon analysis gave the figures C₁₀H₁₆O₂, and hence is regarded by Spica as an oxycamphor. The liquid portion was a greenish-yellow oil, having a pleasant odor and a pungent, peppermint-like taste; by fractioning, it was separated into a portion isomeric with borneol, resembling thymol in odor and taste, to which the name of *dioscamphor* was given. A substance extracted by alcohol from the residue after the removal of the oil Spica named diosmin. (*P. J.*, 1885, p. 106.) The results of Spica were confirmed by Shimoyama (*A. J. P.*, 1888, p. 624), who made several simple derivatives of diosphenol and then prepared from it, by prolonged digestion with alcoholic potash, coolie acid, C₁₀H₁₈O₃ + H₂O, forming white crystalline needles, melting at 96° to 97° C. (204.8°-206.6° F.), and a compound to which he gave the name diolalcohol. Wayne's experiments (*A. J. P.*, 1876, p. 19) appear to indicate that the oil also contains a substance capable of being converted into salicylic acid. J. M. Maisch believed that buchu leaves do not contain salicylic acid, although the stearopten of the oil gives a blackish color with ferric chloride. (*A. J. P.*, July, 1881.) The yield of ash varies, according to the researches of H. W. Jones (*P. J.*, ix, 673), from 4.69 to 4.40 in *B. betulina*, 4.32 to 5.39 in *B. crenulata*, 5.03 to 5.22 in *B. serratifolia*; the ash itself was remarkable as containing a great deal of manganese. The short leaved buchu was found by P. W. Bedford to yield an average of 1.21 per cent. of volatile oil; while the long leaved, though more highly valued in the market, gave only 0.66 per cent., showing its great inferiority in strength. (*Proc. A. Ph. A.*, 1863, p. 211.)

Uses.—Buchu, originally employed by the Hottentots, has long since come into general use. Its activity depends upon the volatile oil, which is eliminated by the kidneys. Under its action there is no marked increase in the amount of the urine, hence the remedy is of no value in *dropsies*, but the oil affects very decidedly the mucous membrane of the genito-urinary tract. The remedy is useful in diseases of the urinary organs,

such as *gravel, chronic catarrh of the bladder, morbid irritation of the bladder and urethra; diseases of the prostate, and retention or incontinence of urine* from a loss of tone in the parts concerned in its evacuation. It should be given when the inflammation is not severe, but when it is in that condition of chronicity requiring oil of turpentine, tincture of cantharides, or other stimulant diuretics. An infusion (one ounce in a pint of boiling water) may be given in the dose of one to two fluid-ounces (30-60 mls), but the best preparation is the fluidextract.

Dose, one-half to one drachm (2.0-3.9 Gm.).

Off. Prep.—Fluidextractum Buchu, U. S.; Infusum Buchu, Br.; Tinctura Buchu, Br.; Elixir Buchu (from Fluidextract), N. F.; Elixir Buchu Compositum (from Compound Fluidextract), N. F.; Elixir Buchu et Potassii Acetatis (from Elixir of Buchu), N. F.; Fluidextractum Buchu Compositum, N. F.

Burgundy Pitch. *Pix Burgundica. Poise de Bourgogne, Poix des Vosges, Poix jaune, Fr. Cod. Poix blanche, Fr. Burgundisches Pech, Burgunder Hars. Wasserhars, G. Pece di Borgogna, It. Pez de Borgona, Sp.*—Under the name of *Pix Burgundica* was formerly recognized both by the British (1898) and by the U. S. (1890) Pharmacopoeias, "the resinous exudation obtained from the stem of the *Picea excelsa* Link., melted and strained." Br., 1898.

Picea abies (L.) Karst. or *P. excelsa* Link. (Fam. *Pinaceae*), commonly known as Norway spruce, is a lofty tree, rising sometimes one hundred and fifty feet in height, with a trunk from three to five feet in diameter. The leaves, standing thickly upon the branches, are short, obscurely four-cornered, often curved, of a dusky green color, and shining on the upper surface. The male aments are purple and axillary, the female of the same color, but usually terminal. The fruit is in pendent, purple, nearly cylindrical strobiles, the scales of which are oval, pointed, and ragged at the edges. This tree is a native of Europe and Northern Asia, and is cultivated in the United States as a shade tree. Commercially Burgundy pitch is derived not only from the Norway spruce, but also from the *Abies picea* or European silver fir tree. To obtain the pitch, portions of the bark are removed so as to lay bare the wood, or perpendicular grooved channels are cut, and the flakes of concrete resinous matter which form upon the surface of the wound, having been detached by iron instruments, are melted with water in large boilers, and then strained through coarse cloths. It is called Burgundy pitch from the province of that name in the east of France, although whether it was ever produced in that province is uncertain. It is chiefly collected in Finland, the Schwarzwald, Austria, and the Bernese Alps. A factitious Burgundy pitch is made by melting together common pitch, rosin, and turpentine, and agitating the mixture with water, which gives it the requisite yellow color. Its odor is different from that of the genuine. Hanbury gives as a test of true Burgundy pitch that it is almost entirely soluble in twice its weight of glacial acetic acid while the factitious article similarly treated

forms a turbid mixture quickly separating into a thick oily liquid above and a bright solution below.

The resinous exudation from *Pinussylvestris* is sometimes offered as Burgundy pitch, but Hirsch-sohn (*Ph. Z. R.*, xxiv) states that it is possible to distinguish the resin of *Picea excelsa* by its being only partially soluble in ether, chloroform, and solutions of salts of ammonium, sodium carbonate, and borax, which dissolve completely the resin of *Pinussylvestris*. The resin of *Picea excelsa* is also precipitated by the addition of water from its sulphuric acid solution in red violet flakes, while *Pinussylvestris* resin precipitates white.

As brought to this country. Burgundy pitch is generally mixed with impurities, which require that it should be melted and strained before being used. In its pure state, according to the U. S. P., 1890, it is "hard, yet gradually taking the form of the vessel in which it is kept; brittle, with a shining, conchoidal fracture, opaque or translucent, reddish-brown or yellowish-brown, odor agreeably terebinthinate; taste aromatic, sweetish, not bitter. It is almost entirely soluble in glacial acetic acid, or in boiling alcohol, and partly soluble in cold alcohol." U. S., 1890. It is very fusible, and at the heat of the body softens and becomes adhesive. It differs from turpentine in containing a smaller proportion of volatile oil. Instead of the sylvic acid of ordinary rosin, it contains an isomeric acid, which has been called pinwric acid, melting at 148° to 149° C. (298.4°-300.2° F.), difficultly soluble in cold but readily soluble in boiling alcohol, and also soluble in ether. According to Perrenoud, its formula is C₄₀H₅₄O₄, but Vesterberg (*Ber. d. Ghent. Ges.*, 1885, p. 3331) showed it to be a mixture, and has since (*Ibid.*, 1886, p. 2167, and 1887, p. 3248) prepared from it two isomeric crystalline acids, a *dextropimaric acid* and a *laevopimaric acid*, both of the formula C₂₀H₃₀O₂; with these is mixed a varying amount of an amorphous resin acid known as *pinic acid*.

Applied to the skin, in the shape of a plaster, Burgundy pitch acts as a gentle rubefacient, producing a slight inflammation without separating the cuticle. Sometimes it excites a papillary or vesicular eruption, and we have known it to act as a violent irritant, giving rise to severe pain, swelling, and redness, followed by vesication and even ulceration. It is used chiefly in chronic *rheumatic pains*, and in chronic affections of the chest or abdomen, which call for a gentle but long-continued revulsion of the skin.

Burra Gookeroo or *Burra Gokhroo*.—Under this name, in India, the fruit and sometimes the whole plant of the *Tribulusterrestris* L. (Fam. *Zygophyllaceae*) is used as a diuretic and aphrodisiac. The carpels have been commended in London as a remedy in *nocturnal emissions*; dose of fluidextract, from twenty minims to one fluidrachm (1.3-3.75 mils).

BUTEAE GUMMI. Br.

BUTEA CUM [Bengal Kino]

"Butea Gum is the inspissated juice obtained from incisions in the stem of *Butea frondosa*, Roxb." *Br.*

For description and uses, see under butea seeds.

BUTEAE SEMINA. Br.

BUTEA SEEDS

"Butea Seeds are the seeds of *Butea frondosa*, Koxb." *Br.*

The *Sacred Tree*, *Butea frondosa* (Fam. *Leguminosae*), enters largely into the religious rites of the Hindoos. Its red flowers are offered at the bloody sacrifice of the goddess Kali. Its leaf with three spreading leaflets is supposed to represent the Hindoo deity, and furnishes platters used when the Hindoo boy becomes of age.

Butea gum, which has sometimes been mistaken for African kino, is the concrete juice of the *Butea frondosa* Roxb., or *Dhak-tree* of Hindostan, and also to some extent of *B. superba*. The juice flows from natural fissures, and from wounds made in the bark of the tree, and quickly hardens. It is in small elongated tears, or irregular angular masses, less in size than a grain of barley, apparently black and opaque, but translucent and of a ruby-red color when examined in small fragments by transmitted light; in some specimens the tears are much paler than described, and of a very beautiful ruby tint. Many of the tears have small portions of bark adhering to them. They are very brittle, and readily pulverizable, yielding a reddish powder. They are very astringent to the taste, do not adhere to the teeth when chewed, and tinge the saliva red. The solubilities and reactions of this product to water, alcohol, and other chemical reagents are nearly the same as those of ordinary kino. When freed from impurities, consisting of from 15 to 25 per cent. of wood, bark, and sand, etc., it contains, according to E. Solly, 73.26 per cent. of tannin, 5.05 of soluble extractive, and 21.67 of gum and other soluble substances. It is used in the arts in India, and might undoubtedly be employed as kino in medicine. It is, however, very seldom imported into England, and never, at present, into this country. Pereira found a quantity in an old drug store in London, and sent a portion to Guibourt, from which that writer drew up his description of African kino. It is possible that the kino which formerly reached us, full

of small pieces of wood, bark, etc., may have been the *Butea gum*.

Butea gum occurs in " small irregular shining fragments, very dark ruby color, thinnest flakes transparent when examined by transmitted light. Partially soluble in *water*; about 40 per cent. soluble in hot *alcohol* (90 per cent.), the solution being scarcely colored. No odor; taste astringent. Free from corky or woody particles. On keeping, the fragments may become dull and blackish." *Br.*

It is said (Hanbury) to yield 1.8 per cent. of ash and 13.5 per cent. of water, and to be composed of about equal parts of kino-tannic acid and a soluble mucilaginous substance. On dry distillation it yields pyrocatechin, which, according to Eisafel, does not preexist in it. " In India and the Eastern Divisions of the Empire, *Butea Gum* may be employed in making the official preparations for which kino (distinguished in commerce as East Indian, Malabar, Madras, or Cochin kino) is directed to be used." *Br.*

The British Pharmacopoeia describes the seeds as "flat, reniform, from twenty-five to thirty-eight millimetres long, sixteen to twenty-five millimetres wide, and one and a half to two millimetres thick. Testa thin, glossy, veined, wrinkled, dark reddish-brown. Cotyledons large, leafy, yellow. Faint odor; taste slightly acrid." *Br.*

For a description of the seeds of *B. frondosa*, see Ph. Rev., 1896, 232.

Uses.—*Butea Gum* is used for the same purposes and in the same doses as kino. The seeds have been used by the native practitioners in India as vermifuges against both the *tape worm* and the *round worm*. According to the *Pharmacographica Indica*, the infusion of three seeds exercises a laxative effect. Before being used, the seeds should be soaked in water and the integument carefully removed. The powdered dried kernels may be given in doses of ten to twenty grains (0.65-1.3 Gm.).

Off. Prep.—Pulvis *Butea* Seminum, *Br.*

Buxus. *Buxus sempervirens* L. *Evergreen Box*. (Fam. *Buxaceae*.)—This evergreen shrub is too well known to require description. Though much cultivated in this country as an ornamental plant, it is a native of Europe and Western Asia.

The wood is considered diaphoretic in its native countries, and is used in decoction in *rheumatism*, *secondary syphilis*, etc. The leaves, which have a peculiar odor and a

bitter and disagreeable taste, are said to be purgative in the *dose* of a drachm. A volatile oil distilled from the wood has been given in *epilepsy*. A tincture formerly enjoyed some reputation as an antiperiodic. (Merat and De Lens.) The alkaloid *buxine*, which has been discovered in the leaves of this tree, is identical with the bebeerine of nectandra bark. (See p. 1274; also P. J., Oct., 1869, 194.) Pavia obtained a second alkaloid from *Buxus sempervirens*, which was investigated by Pavesi and Rotondi. (Jahres-berichte, 1874, 903.) They named it parabuxine, and ascribed to it the formula $C_{22}H_{48}N_2O$. Bar-baglia (*A. J. P.*, 1885, 145) described still another alkaloid, parabuxinidine. It crystallizes in thin, colorless prisms, is insoluble in water, soluble in ether, freely soluble in alcohol, and colors turmeric paper deep red.

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Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Cabbage-Tree Bark. *Ecorce de Geoffre*, Fr. *Kohlbaumrinde*, *Wurmrinde*, G.—The bark of *Vouacapoua inermis*, Swz. [*Andira inermis* H. B. K.] This is a leguminous tree, with a stem rising to a considerable height, branched towards the top, and covered with a smooth gray bark. The tree is a native of Jamaica, and other West India islands. The bark, which is the part used, is in long pieces, thick, fibrous, externally of a brown-ish-ash color, scaly, and covered with lichens, internally yellowish, of a resinous fracture, a disagreeable odor, and a sweetish, mucilaginous bitterish taste. Huttenschmidt obtained from it a crystallizable, bitter alkaloid and named it *jamaicine*. Two grains (0.13 Gm.) of it produced violent purging in pigeons.

On the continent of Europe the bark of *Vouacapoua retusa* Poir, which grows in Surinam, has also been used. It is considered more powerfully vermifuge and less liable to produce injurious effects. It has a grayish epidermis, beneath which it is reddish-brown, laminated, compact, and very tenacious, and, when cut transversely, exhibits a shining and variegated surface. In the dried state it is inodorous, but has an austere bitter taste. The powder is of a pale cinnamon color.

Cabbage-tree bark is cathartic, and, in large doses, prone to occasion vomiting, fever, and delirium. It is said that these effects are more liable to result if cold water be drunk during its operation, and may be relieved by the use of warm water, castor oil, or a vegetable acid. In the West Indies it is esteemed a powerful vermifuge, and is much employed for expelling *lumbrici*; but it is dangerous if incautiously administered, and instances of death from its use have occurred. It is almost unknown in this country. The usual form of administration is that of decoction, though the medicine is also given in powder, syrup, and extract. The dose of the powder is from twenty to thirty grains (1.3-2.0 Gm.) ; of the extract three grains (0.2 Gm.).

Theodore Peckoldt says of the wood of an allied species, *Vouacoupoua Anthelmia* (Veil.) O. Ktze, that the workmen engaged in sawing it are prone to be affected with inflammation of the eyes, constriction of the throat, excessive thirst, a bitter, burning taste, a troublesome itching over the body, and sometimes eruptions on the skin. By treating a concentrated decoction of the wood with calcium hydroxide, then filtering after forty-eight hours, evaporating to the consistence of syrup, and exhausting the residue with alcohol, Peckoldt obtained a yellowish-brown coloring matter which he called *andirin*. (This name has also been given to a glucoside said to have been found

in *Vouacapoua inermis*. See *A. J. P.*, 1885, 558.) Peckoldt also obtained a peculiar resin by treating the wood with alcohol, filtering, distilling off most of the alcohol, and then precipitating by water. The resin is inodorous, of a bitter, acrid taste, soluble in alcohol, and but partially soluble in ether. This resin, and especially the portion soluble in ether, gives its irritating properties to the sawdust. (*Chem. Cb.*, Nov. 17, 1858.)

Cactus Grandiflorus. *N. F. IV. Night Blooming Cereus.*—Cardiac stimulant properties have been attributed to two Cacti—namely, *Cereus Bonplandii* Parm. and *Cereus grandiflorus* Miller (*Cactus grandiflorus* L. *Night-blooming Cereus. Cierge a grandes fleurs*, Fr. *Konigin der Nacht*, G.). Of these the latter only is now used in practical medicine. It is a native of tropical America, often cultivated in hot houses for the interest in its very fragrant night-opening white flowers. The *N. F.* drug is "the fresh succulent stems of the wild growing *Cactus grandiflorus* Linne (*Cereus grandiflorus* Miller) (Fam. *Cactaceae*). As found in-commerce, *Cactus Grandiflorus* is usually preserved in alcohol and the amount of alcohol present should be stated on the label. It occurs in pieces of varying length, from 1.5 to 4 cm. in diameter, and from five to seven angled. On the angles at intervals of about 2 cm. are tufts of from nine to twelve spines, each about 2 mm. in length, and three slender flexuous spines about 1 cm. in length; at irregular intervals are branched roots. It has a strong, herby odor; taste acidulous and mucilaginous. The transverse section shows a central cylinder about 3 mm. in diameter and a spongy parenchyma containing large crystals and raphides of calcium oxalate." *N. F. IV.* Due to the difficulty in obtaining this drug commercially the larger drug houses arrange for its collection and preservation for their own manufacturing. F. W. Sultan (*A. J. P.*, 1891, 424) believed that he had found in it an alkaloid, *cactine*, but the existence of this alkaloid is extremely doubtful.

It has long been used in tropical America in the treatment of *dropsy*. It was first brought into notice as a cardiac remedy by Eubini, of Naples. According to Myers (*N. Y. M. J.*, June, 1891), it elevates the arterial tension by increasing the muscular energy of the heart, and by contracting the arterioles through the vasomotor centers. Considerable clinical testimony has been given to the value of cactus as a cardiac regulator in functional disorders of the heart connected with *neurasthenia*, *Graves's disease*, *tobacco toxemia*, and allied affections. On the other hand, Hatcher and Bailey (*J. A. M. A.*, 1911, lvi, p. 26), experimenting with carefully identified specimens of the *Cactus grandiflorus*, as well as commercial preparations purporting to be of this drug, were unable to recognize any action upon the circulation, even when given in enormous doses.

Sharp could obtain from the drug only resins which were inactive, and concludes that it is inert. (*Pract.*, Sept., 1894.) The usual dose of the fluid extract is from five to ten minims (0.3-0.6 mil).

From *Cereus Caespitosus* Engl. and A. Gray, Heyl separated an alkaloid, *pectenine*, which, according to Heffter (*A. Pharm.*, 1901, ccxxxix, s. 462), produced both in cold and warm blooded animals tetanic convulsions with heightened reflexes. According to the experiments of Mogilewa, the alkaloid acts upon the isolated frog's heart as a

depressant.

From *Cereus pilocereus* (?), Heyl separated the alkaloid *pilocereine*, which Hefftner found to produce in frogs central paralysis with great cardiac depression, and in warm blooded animals to kill by cardiac arrest.

Anthelmintic properties have been ascribed to *Cereus flagelliformis* Miller and to *C. divaricatus* (Lam.) DC.

Cacur.—This is a small gourd which, while still unripe, is used by the Kaffirs as an emetic, and which, according to Oliver, is yielded by the *Cucumis myriocarpus* Naud. (Fam. *Cucurbitaceae*.) G. A. Atkinson (*A. J. P.*, 1887) obtained from it a neutral resinous body, *myriocarpin*, and found that twenty grains (1.3 Gm.) of the fresh pulp produced in man nausea and slight purgation. (*Ed. M. J.*, July, 1886.)

Cahinca. *David's Root. Radix Caincae. Cainga*, Fr. *Kainkawursel*, G.—This medicine attracted at one time considerable attention. The name of *Cahinca* or *cainca* was adopted from the language of the Brazilian Indians. The Portuguese of Brazil call the medicine *raiz pretta*, or *black root*. When first noticed in Europe, it was supposed to be derived from the *Chiococca racemosa* (Fam. *Rubiaceae*), which was known to botanists as an inhabitant of the West Indies. But Martins, in his work on *Materia Medica Brasiliensis*, describes two other species of *Chiococca*, *C. anguifuga* Mart. and *C. densifolia* Mart., both of which are now known as *C. brachiata* Ruiz and Pav., which afford roots having the properties of the root ascribed to *C. racemosa*. A. Richard, however, received from Brazil specimens of *C. racemosa* as the Cahinca plant.

A specimen brought to Philadelphia consisted of cylindrical pieces, from 1 to 2 cm. thick somewhat bent or contorted, slightly wrinkled longitudinally, and more or less roughened, internally ligneous, externally covered with a thin, brittle, reddish-brown bark, having a light brown or brownish ash-colored epidermis. The cortical portion, which was of a resinous character, had a bitter disagreeable, somewhat acrid and astringent taste; the ligneous part was quite tasteless. The virtues of the root reside almost exclusively in its bark. They are extracted by water and alcohol. Four distinct principles were discovered in it by Pelletier and Caventou—

(1) a crystallizable, bitter substance, believed to be the active principle, and called *cahincic acid*, $C_{40}H_{64}O_{18}$ (also called *caincic acid* and *caincin*);

(2) a green, fatty matter of a nauseous odor;

(3) a yellow coloring matter; and

(4) a colored viscid substance. Rochleder and Hiasiwetz found also caffe-tannic acid. Cahincic acid is white, without odor, of a taste at first scarcely perceptible, but afterwards extremely bitter and slightly astringent, slightly soluble in water, but readily soluble in alcohol, permanent in the air, and unaltered at 100° C. (212° F.). It reddens vegetable blues, and unites with the alkalies, but does not form crystallizable salts. It is thought to exist in the root as calcium subcahinate. When treated with diluted hydrochloric acid it is decomposed into glucose and other products, of which is

obtained at first *chiococcaic acid*, $C_{28}H_{42}O_7$ (thought by some to be identical with *quinovic acid*), and later, by boiling with alcoholic hydrochloric acid, *caincetin*, $C_{22}H_{34}O_3$.

Cahinca is tonic, diuretic, purgative, emetic, and is capable of producing serious gastro-intestinal irritation. In Brazil it has long been used by the natives as a remedy for the *bites of serpents*, also in *rheumatism* and in *dropsy*. Dose, of the powdered bark, from twenty grains to a drachm (1.3-3.9 Gm.); of the aqueous or spirituous extract, from ten to twenty grains (0.65-1.3 Gm.).

Calamus. *U. S. VIII. Sweet Flag. Radix Calami Aromatic'1. Radix Acori. Sweet Sedge {Cane, Rush, Root or Myrtle}. Myrtle-flag (Grass or Sedge). Acore Vrai, Fr. Cod. Acore Odorant, Fr. Rhizoma Calami, P. G. Kalmus, Kalmus-wursel, G. Calamo aromatico, It., Sp.—*" The un-peeled, dried rhizome of *Acorus Calamus* Linne (Fam. *Araceae*)."
U. S. VIII. The sweet flag, or Calamus, has a perennial, horizontal, jointed, somewhat compressed rhizome, from half an inch to an inch thick, sometimes several feet in length, sending off numerous round and yellowish or whitish roots from its lower surface, and groups of brown fibers resembling coarse hair from its joints, internally white and spongy, externally whitish with a tinge of green, variegated with triangular leaf scars of light brown and rose color. The leaves are all radical, sheathing at the base, very long and sword-shaped. The scape or flower stem resembles the leaves, but is longer, and from one side, near the middle of its length, sends out a cylindrical spadix, tapering at each end, about two inches in length, and crowded with greenish-yellow flowers. The fruit is an oblong capsule, divided into three locules, and containing numerous oval seeds.

This plant grows abundantly in the wet places throughout the United States, Europe, Western and Southern Asia. The leaves as well as the rhizome have an aromatic odor; but the rhizome only is employed. It should be collected late in the autumn, or in the spring. After removal from the ground, the rhizomes are washed, freed from their roots, and dried with a moderate heat. Most of the commercial article has the outer portions of the cortex removed. By drying they lose nearly one-half their diameter, but are improved in odor and taste.

Calamus was officially described as follows: "Rhizome 1 to 2 cm. thick, usually in longitudinally split pieces of various lengths; when entire, cylindraceous and somewhat vertically flattened, externally reddish-brown, somewhat annulate from remnants of leaf-sheaths; upper surface with triangular leaf-scars, the lower surface with circular pitted scars of roots; fracture short, showing numerous oil cells and scattered fibro-vascular bundles, the latter crowded within the endodermis; odor aromatic; taste pungent and bitter." *U. S. VIII.*

The odor of Calamus is strong and fragrant; its taste warm, bitterish, pungent, and aromatic. Its active principles are taken up by boiling water. From 100 parts of the fresh root of the European plant, Trommsdorf obtained 0.1 of volatile oil. The volatile oil is contained in all portions of the plant, the leaves yielding to distillation, according to the analysis of Schimmel & Co., 0.2 per cent., the fresh root 1.5 to 3.5 per cent.,

the dried German root 0.8, and the Japan root as much as 5 per cent.

The oil is at first yellow, but ultimately becomes red, and has the odor and taste of Calamus. Kurbatow (*Ann. Ch. Ph.*, vol. 173, p. 4) examined oil of Calamus, and found that the portion boiling below 170° C. (338° F.) yielded, after treatment with sodium, a terpene, C₁₀H₁₆, having a sp. gr. .8793 at 0° C. (32° P.), and having a boiling point of 158° C. (316.4° F.). The extractive matter has an acrid and sweetish taste. H. Thomas (*A. Pharm.*, 1886, p. 465; *P. J.*, 1886, p. 1085) obtained from Calamus rhizomes a bitter glucoside, *acorin*, in the form of a clear, thick, yellow liquid, having a neutral reaction and having the formula C₃₆H₆₀O₆, splitting into oil of Calamus and sugar. By oxidation *acoretin*, a neutral resin, is formed, and from the extract remaining after the acorin is removed Thomas obtained an alkaloid which he named *calamine*. Calamus is sometimes attacked by worms, and deteriorates on keeping.

Uses.—Calamus is a feeble aromatic and as such is used, especially in domestic practice, in India and to some extent in other portions of the world. The volatile oil is largely used in perfumery, and the powdered root itself is esteemed in Ceylon and India as a vermifuge and an insecticide. *Dose*, in substance, fifteen to thirty grains (0.9-1.9 Gm.); of infusion (an ounce to one pint of boiling water), one to two wineglassfuls (60-120 mils).

The *fluidextract*, which was formerly official, *Fluidextractum Calami U. S. VIII*, was made as follows: "Calamus, in No. 40 powder, *one thousand grammes* [or 35 ounces av., 120 grains]; Alcohol, Water, each a *sufficient quantity*, to make *one thousand mils* [or 33 fluidounces, 6½ fluidrachms]. Mix *seven hundred and fifty mils* [or 25 fluidounces, 173 minims] of alcohol with *two hundred and fifty mils* [or 8 fluidounces, 218 minims] of water, and, having moistened the powder with *three hundred and fifty mils* [or 11 fluid-ounces, 401 minims] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close to the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the Calamus is exhausted. Reserve the first *nine hundred mils* [or 30 fluidounces, 208 minims] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° C. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough menstruum to make the fluidextract measure one thousand mils [or 33 fluidounces, 6½ fluidrachms]." *U. S. VIII*. *Dose*, from fifteen to thirty minims (0.9-1.9 mils).

Calendula. *N. F. IV. (U. S. VIII.) Marigold. Mary-bud. Holligold. Flours de Tous les mois, Souci, Fr. Ringelbume, Todtenblwne. Gold-blumen, G. Calendula, Sp.*—"The dried ligulate florets of *Calendula officinalis* Linne (Fam. *Compositae*), without the presence of more than 2 per cent. of other parts of the plant or other foreign matter." *N. F.*

The *N. F.* drug is described as in "florets from 15 to 25 mm. in length, yellow- or orange-colored, one to three-toothed, four- to five-veined, margin nearly entire, the

short hairy tube occasionally enclosing the remnants of a filiform style and bifid stigma. Odor slight, somewhat heavy; taste slightly bitter, faintly saline. The powdered drug is light yellow to orange-yellow and, when examined under the microscope, exhibits a few characteristic, non-glandular hairs, consisting of a double row of thin-walled, more or less collapsed cells, with a one- or two-celled summit, and up to about 0.8 mm. in length; elongated epidermal cells with thin, somewhat wavy walls, a striated surface, and containing irregular chromo-plasts and oil-like globules, the latter coalescing when mounted in hydrated chloral T.S.; pollen grains, more or less spherical, with numerous spiniae projections, three pored, and up to 0.04 mm. in diameter; tracheae about 0.009 mm. in width with spiral and annular markings; prisms or rosette aggregates of calcium oxalate from 0.002 to 0.004 mm. in diameter. *Calendula* yields not more than 11 per cent. of ash." *N. F.* The odor is much stronger in the fresh than in the dry flowers, and on exposure to light, the orange-red or yellow color fades. Among its constituents are a bitter principle, and an amorphous substance called *calendulin* (discovered by Geiger most abundantly in the flowers), considered by Berzelius as analogous to bassorin, though soluble in alcohol. *French* or *African Marigold*, so called, is very frequently substituted for the official drug. It is the *Tagetes patula* L., and *T. erecta* Linn., both of Mexico. The flowers are readily distinguished by the scales of the involucre being united to form a tube, and by the slender, flattish achenes being crowned with a few chaffy or awned scales. The broadly strap-shaped ray-florets are toothed, and of a light or deep orange color sometimes striped with red. Latour and Magnier de la Source isolated from African marigold a yellow crystalline substance, *quercetagetin*, which Perkin examined and gave the composition $C_{15}H_{10}O_8$. (P. J., 1902, 294.)

In the days of therapeutic darkness *calendula* was thought to be medicinally active, but it has no virtues beyond that of a feeble aromatic. Both the leaves and the flowers were used; but the latter were preferred, and were usually administered in the recent state in the form of tea. Dose, from fifteen to sixty grains (0.9-3.9 Gm.) See *Tinctura. Calendulae, N. F.* (Part III).

Cali Nuts.—These nuts, which come from the west coast of Africa, are the seeds of a papilionaceous plant, either a species of *Mucuna* or *Dioclea*, and have a more circular shape than Calabar beans, but otherwise agree with the latter in essential external characters. They contain an alkaloid which is said to be chemically and physiologically closely allied to physostigmine. (Merck, *Chem. Cb.*, 1887.)

Calliandrein.—A glucoside (probably a saponin) obtained from *Calliandra grandiflora* Benth. (Fam. Legummosce), a Mexican shrub. It is a white, odorless powder soluble in water, the solution forming a heavy froth on shaking. It possesses antipyretic properties, having been administered with asserted good results in *intermittent fever*. Dose, one grain (0.065 Gm.).

Calotropis. *Br. Add. Mudar.*—The dried root-bark of *Calotropis procera* R. Brown (*Asclepias procera* L.) and of *Calotropis gigantea* R. Brown freed from the outer corky layer. These asclepiadaceous plants are natives of Hindostan, but have become widely naturalized in various parts of the East and West Indies. Their milky juice is a

violent local irritant, which, when taken internally, acts as an emeto-cathartic and may produce a fatal gastro-enteritis. In India it has long been used not only for suicidal purposes but to kill newly-born female infants, and is also applied to the womb to cause abortion.

The root-bark occurs in short, more or less quilled pieces having a thickness of from one-tenth to one-fifth of an inch (two to five millimeters) and a width of not more than one and a half inches (thirty-seven millimeters). It is covered with a soft, grayish-buff, strongly furrowed and reticulated, easily separated periderm. The fracture is short and mealy; the taste bitter and acrid. According to C. J. H. Warden and L. A. Waddel, *calotropis* contains an acid resin, a crystalline, colorless substance, *madaralban*, an amber-colored viscid body, *madarfluavil*, and caoutchouc. (P. J., 1885, 165.) Lewin (A. E. P. P., 1913, lxxi, 142) has found a neutral principle (*calotropin*) which is a very active poison of the digitalis type.

Calotropis has been very largely used as a local remedy in Hindostan in *elephantiasis* and *leprosy*, and is asserted by John Morton (*Indian Medical Record*, viii, 1895) to act with extraordinary efficiency upon chronic *eczema*. It has also been employed internally as a remedy in *diarrhea* and *dysentery*; also with less probability of usefulness in *syphilis* and *rheumatism*. Dose, of powder, from three to twelve grains (0.2-0.78 Gm.), three times a day, gradually increased until it affects the system.

Tincture of Calotropis. Tinctura Calotropis, Br. Add., two ounces to a pint (alcohol 6 per cent.), is given in doses of one-half to one nui-drachm (1.8-3.75 mils).

Calycanthus. *Calycanthus floridus* L.—This is a shrub of the fam. *Calycanthaceae*, from six to eight feet high, which inhabits the low, shady woods along the mountains of Georgia and North Carolina, and also Tennessee, where it is known as *sweetshrub* or *Carolina allspice*. The whole plant is aromatic, having, when crushed, the odor of strawberries. According to R. G. Eccles, the seeds contain a fixed oil, and an alkaloid, *calycanthine*. H. W. Wiley (A. J. P., 1890, 96) found in the seeds over 47 per cent. of oil and 4.25 per cent. of alkaloid. H. M. Gordin made an extensive investigation of calycanthine and its salts. (*Proc. A. Ph. A.*, 1905, 224.) According to Cushny (A. I. P. T., 1905, xv, p. 487) calycanthine has the empiric formula of $C_{11}H_{14}N_2$. When injected into the lower animals it causes muscular weakness, by an action upon the peripheral motor nerves, associated with increased reflexes, and, in the higher mammals, with convulsions similar to those seen in picrotoxin poisoning. The alkaloid also exercises a powerfully depressant action upon the heart muscle. More recently, a second alkaloid, *isocalycanthine*, has been described by Gordin. (*Proc. A. Ph. A.*, 1908 and 1909, 889.) This alkaloid, according to the experiments of MacGuigan and Hess (*J. P. Ex. T.*, 1912, iii), is very similar in its physiological properties to calycanthine. It is asserted that the shrub is important as a source of poisoning to cattle and sheep. *Calycanthus* has been used as an antiperiodic. The *dose* of the fluidextract is thirty to sixty minims (1.9-3.75 mils).

CALUMBA. U. S. (Br.)

CALUMBA Calumb, [Colombo, Columba, Colombo]

"The dried root of *Jateorrhiza palmata* (Lamarck) Miers (Fam. *Menispermaceae*)." U.S. "Calumba Root is the root of *Jateorrhiza Columba*, Miers, cut in transverse slices and dried." Br.

Calumbae Radix, Br.; Calumba Root; Radix Colombo; Colomba, U. S. 1850; Racine de Colombo, Fr. Cod.; Colombo, Fr.; Radix Colombo, P. G.; Kolonsbowurzel, G.; Colombo, It.; Colombo, Raiz de Colombo, Sp.; Kalumbo, Port.; Calumb, Mozambique.

Calumba is official in nearly all pharmacopoeias. The difference in botanical origin as given in the definition in the U. S. and British Pharmacopoeias is merely one of synonymy, as *J. palmata* (Lamarck) Miers is merely another name for *J. Columba* Miers. There is considerable confusion in the spelling of both the generic and specific names: *Jateorrhiza* is spelled by most of the European Pharmacopoeias *Jatrorrhiza*. In the same way the specific name is usually given as Calwnba and not Columba.

Jateorrhiza palmata is a dioecious climbing plant, with a perennial root consisting of several fascieulated, fusiform tuberous portions. The stems are twining, cylindrical, hairy and simple in the staminate plant, being branched in the Distillate plant. The leaves, which stand on rounded, glandular, hairy footstalks, are alternate, distant, cordate, with three, five, or seven entire, acuminate, wavy, somewhat hairy lobes, and as many nerves, each running into one of the lobes. The flowers are small and inconspicuous, and arranged in solitary axillary racemes, which in the staminate plant are compound, in the pistillate simple, and in both plants are shorter than the leaves.

The Calumba plant is indigenous to Mozambique, on the southeastern coast of Africa, where it grows wild in great abundance in the thick forests extending from the sea many miles into the interior. It is more particularly abundant in the region between the Zambezi and Rovuma. (*Ap. Ztg.*, 1912, p. 147.) The root is dug up in March, when dry weather prevails. From the base of the root numerous fusiform offsets proceed, less fibrous and woody than the parent stock. These offsets are separated and cut into transverse slices, which are dried in the shade. The old root is rejected.

The plant is said to be cultivated both in Africa and the East Indies for the sake of its root, which under the name of *Calumb* is used in dyeing.

Calumba is sent from the Portuguese dominions in Southeastern Africa into India, from whence it goes into general commerce. At one time, when thought to be a product of Ceylon, it was supposed to have derived its name from Columbo, a city of that island, but a much more probable derivation is from the African name of the root above given. (See Lloyd's history of Colombo root, *West. Drug.*, 1898, 8.)

Properties.—It is officially described in the U. S. P. as " in circular or oval disks attaining a diameter of 9 cm. and seldom exceeding 2 mm. in thickness, or in longitudinal or in oblique slices attaining a length of 30 cm., a breadth of 35 mm. and a thickness of 16 mm.; externally brown and roughly wrinkled; cut surface varying from yellowish-brown to grayish-yellow, the transverse slices distinctly radiate in the outer portion and with a dark cambium; central portion often depressed; fracture short, mealy; odor slight; taste slightly aromatic, very bitter. The powder is greenish-brown to grayish-yellow; starch grains numerous, mostly single, occasionally 2- to 3-compound, the individual grains from 0.003 to 0.085 mm. in the long diameter, ovoid, ellipsoidal, frequently very irregular, slightly lamellated, with an ex-central linear x-shaped or branching cleft; stone cells few with irregularly thickened, strongly lignified, coarsely porous walls and containing one or more prisms of calcium oxalate from 0.01 to 0.03 mm. in length, or numerous sphenoidal micro-crystals; fragments with trachea? few, the latter with reticulate thickenings or bordered pores, and associated with wood-fibers having long, oblique, slit-like pores. Calumba yields not more than 8 per cent. of ash." *U. S.*

The drug is described in the British Pharmacopoeia as follows: " Cork thin, brownish and wrinkled; cortex thick, yellowish and separated by a dark line from the greyish wood, in which the parenchymatous tissue is largely developed and the vessels arranged in narrow elongated groups. In the cortex, in transverse section, numerous isolated sclerenchymatous cells, with yellow, irregularly thickened walls enclosing small prismatic crystals of calcium oxalate; in the wood, vessels with yellow reticulated walls. The parenchymatous cells of both wood and cortex filled with starch grains, which are irregularly ovoid in outline, from 20 to 70 microns in length, and exhibit a conspicuous, excentric, radiate or cleft hilum." *Br.*

Along with the disks are sometimes a few cylindrical pieces an inch or two in length. The cortical portion is thick, of a bright yellow, slightly greenish color internally, but covered with a brownish, wrinkled epidermis. The interior or medullary portion, which is readily distinguishable from the cortical, is light, spongy, yellowish, usually more or less shrunk, so that the pieces are thinnest in the centre; and is often marked with concentric circles and radiating lines. Those pieces are to be preferred which have the brightest color, are most compact and uniform, and least worm eaten.

The odor of calumba is slightly aromatic. The taste is very bitter, that of the cortical much more so than that of the central portion, which is somewhat mucilaginous. The root is easily pulverized. The powder is greenish, becoming browner with age, and deepening when moistened. As it attracts moisture from the air, and is apt to undergo decomposition, it should be prepared in small quantities.

The crude drug, as well as the powder, is liable to be attacked by insects if kept for any length of time. This can be guarded against by thoroughly drying the drug, keeping it in a dry place, and adding either carbon tetrachloride or chloroform. According to the U. S. P. microscopical description, it is inferred that the calcium oxalate crystals occur only in the stone cells. Tunmann (*Ph. Zentrbl.*, 1906, p. 1069) asserts that the crystals are distributed throughout the woody portion of the root as well as in the bark, and outlines a method for readily demonstrating their presence.

Adulterations.—Formerly the high price of calumba led to its frequent adulteration, especially, it is said, with the roots of the *white bryony*, and of *Frasera carolinensis* or *American calumba*, and with the stem of *Coscinium fenestratum*, the *columbo wood* or *false columbo* of Ceylon. According to Stoize of Halle, the American calumba can be readily detected by the fact that while the tincture of true calumba is not affected by ferric sulphate or sesqui-chloride, and yields with tincture of galls a dirty precipitate, the tincture of *Frasera* be. comes dark green with the former and is not affected by the latter reagent. *Coscinium fenestratum*, a bitter tonic used in Ceylon, is at once to be distinguished by its being a stem, not a root, and is said not to have appeared upon the market for many years. At present, owing to its great cheapness, calumba root seems to be very rarely adulterated (see *P. J.*, 1901, 502,

and Dec., 1904), although a specimen of calumba yielded, on incineration, 16 per cent. of ash. Holmes believes that the fictitious drug is the overground portion of *Jateorrhiza palmata*, while Wardleworth believed that the drug is a product of *Tinospora Bakis* (A. Rich.) Miers which is used in Senegal as an anti-periodic.

Chemistry.—Planche analyzed calumba in 1811, and found it to contain a nitrogenous substance, probably albumen, in large quantity, a bitter yellow substance not precipitated by metallic salts, and one-third of its weight of starch. He obtained also a small proportion of volatile oil, salts of calcium and potassium, ferric oxide, and silica. Wittstock, of Berlin, afterwards isolated a principle, which he called columbin. This crystallizes in beautiful transparent quadrilateral prisms of the formula $C_{21}H_{22}O_7$, is without odor, and is extremely bitter. It is but very slightly soluble in water, more soluble in alcohol, ether, or chloroform, and imparts to these fluids a strongly bitter taste. It is more soluble in boiling alcohol, which deposits it upon cooling. The best solvent is diluted acetic acid. It is taken up by alkaline solutions, from which it is precipitated by acids. It is obtained by exhausting calumba by means of alcohol of the sp. gr. 0.835, distilling off three-quarters of the alcohol, allowing the residue to stand for some days until crystals are deposited, and lastly treating these crystals with alcohol and animal charcoal. The mother waters still contain a considerable quantity of columbin, which may be separated by evaporating with coarsely powdered glass to dryness, exhausting the residue with ether, distilling off the ether, treating the residue with boiling acetic acid, and evaporating the solution to crystallization.

P. E. Alessandri (*L'Orosi*, v, 1; *P. J.*, 1882, p. 995) isolated *columbine* (which he considers an alkaloid) by the following process: An infusion of calumba is made with a 3 per cent. solution of oxalic acid; the yellow bitter liquid is neutralized with ammonia and evaporated to one-third its bulk; it is, when cooled, treated with ether, separated, and the ethereal solution on evaporation yields pure white calumbine. Alessandri obtained what he called berberine from calumba by neutralizing a cold infusion, made with diluted oxalic acid (3 per cent.), with baryta; the precipitate which is produced is separated. The liquid is heated, allowed to stand for twenty-four hours to allow the barium oxalate to deposit, filtered, and then a current of carbonic acid is passed through to remove barium oxide. It is then treated by shaking the ammoniacal liquid with ether as in Alessandria process for calumbine (see above), and, after the

etheral layer is separated, the aqueous liquid is evaporated to dryness. *Columbic acid* may be obtained from the precipitate produced by the addition of barium oxide to the oxalic acid infusion. Bocchiola (*Y. B. P.*, 1891, p. 162) states that the older roots contain more of the active principles than the younger ones. He found that the inner and the outer portions of ealumba also vary in their constituents;

thus in the woody or inner part he found the following percentages: calumbine 1.90, berberine 0.72, ether extract 0.80, alcoholic extract 3.86, diluted alcoholic extract 17.80, ash 6. In the cortical or outer part he found calumbine 1.42, berberine 1.43, ether extract 0.70, alcoholic extract 3.89, diluted alcoholic extract 17.96, ash 5. He assigns to columbin the formula $C_{21}H_{24}O_7$, and to columbic acid $C_{21}H_{22}O_6$. (*Zeit. Oest. Apoth. Ver.*, 1896, No. 1, 8-14.) Gordin questioned the presence of berberine in calumba and Gadamer, Feist and Gunzel proved the absence of berberine and stated that ealumba contains *calumbamine*, $C_{21}H_{22}O_5N.OH$, *jateorrhizine*, $C_{20}H_{20}O_5N.OH$, and probably *palmatine*, $C_{22}H_{24}O_5N.OH$, the last formula not having been positively proved. (*A. Pharm.*, 1907, No. 8, 586.) Haensel (P. J., 1904, 216) obtained from calumba a volatile oil which exists in very small quantities (0.00568 per cent). It has a peculiar odor and bitter taste.

There can be little doubt that both columbin and the alkaloids contribute to the remedial effects of ealumba. The virtues of the root are extracted by boiling water and by alcohol. Precipitates are produced with the infusion and tincture by infusion of galls, and by solutions of lead acetate and subacetate, but the bitterness is not affected.

Uses.—Biberfeld (*Z. E. P. T.*, 1909, vii) has shown that all the alkaloids of ealumba root are depressant to the central nervous system and especially to the respiratory center; palmatine indeed exceeds morphine in its respiratory toxicity; columbamine and jateorrhizine increases intestinal tonus. Despite these findings, however, it is improbable that ealumba has any medical virtue aside from that of a mild bitter, free from astringency. It is useful in functional atonic conditions of the digestive organs, especially with other tonics, aromatics, or cathartics. A favorite remedy of the late George B. Wood for the cure of a disposition to the accumulation of *flatus* in the bowel was an infusion made with half an ounce of ealumba, half an ounce of ginger, a drachm of senna, and a pint of boiling water, and given in doses of a wine-glassful three

times a day. By the natives of Mozambique it is used in *dysentery* and various other diseases.

Dose, of the powder, from ten to thirty grains (0.65-2.0 G-m.), which may be repeated three or four times a day.

Off. Prep.—Fluidextractum Calumbse, *N. F.*; Infusum Calumbae, *Br.*; Tinctura Calumbae, *U. S.*, *Br.*

CalystegiaSolandella.—This plant—a member of the *Convolvulaceous* family—has lately come into vogue as a constipation remedy. A compound tincture of solandella has been used with some success, but whether this can be attributed to the calystegia or to other ingredients is not known.

Cam Wood.—A red dye-wood, procured from the *Baphia nitida* Lodd., a leguminous tree, growing on the western coast of Africa. The wood is usually kept in the shops in the ground state. It yields its coloring matter scarcely at all to cold water, slightly to boiling water, and readily to alcohol and alkaline solutions. The coloring matter is thought to be identical with *santalin*, $C_{15}H_{14}O_5$.

CAMBOGIA. U. S.

GAMBOGE Cambog. [Pipe Gamboge]

"A gum-resin obtained from *Garcinia Hanburii* Hooker filius (Fam. *Guttiferae*)." U. S.

Cambogia, *Br.* 1898; Gambogia, *U. S. Pharm.* 1870; Gummi-resina guttae (s. gutti), Gutta Gamba, Cambodia; Gommegutte, *Fr. Cod.*; Gutte, *Fr.*; Gutti, *P. G.*; Gummigutt, *G.*; Gumma gotta, *It.*; Gutagamba, Goma gutta, *Sp.*

Under the name of *Cambogia Indica*, *Indian Gamboge*, the British Addendum formerly recognized a gum-resin obtained from the *Garcinia Morella* Desrouss. Several plants belonging to the family of *Guttiferae*, growing in the equatorial regions, yield on incision a yellow opaque juice, which hardens on exposure and bears a close resemblance to gamboge; but it is only from a particular tree, growing in Siam, that the official gum-resin is procured. According to observations of Baildon and Jamie, gamboge is obtained exclusively from the province of Cambodia, the plant not being found in any other part of Siam nor in Cochin China. (*J. P. C.*, Juillet, 1874.) Several years since, Christison received from Singapore specimens of the gamboge plant cultivated in that island, and derived from Siam, which proved to be a *Garcinia*, differing

from the *G. elliptica* of Wallieh chiefly in having its male flowers upon pedicels. Subsequently Hanbury obtained from the same source numerous specimens of the same plant, and was enabled to confirm the statement of Christison; but he also found that the plant approached very near to the *Garcinia Morella* of Desrousseaux, from which it could be distinguished only by its pedicellate flowers. These specimens were afterwards submitted to the inspection of Thwaites in Ceylon, who is perfectly familiar with the Garcinias of that island, and were pronounced by him to belong to a variety of *G. Morella*, scarcely differing from the Ceylon plant, except in having pedicelled instead of sessile flowers; for these two varieties the names of *G. Morella*, var. *sessile*, and *G. Morella*, var. *pedicellata*, were proposed. Sir Joseph Hooker, however, determined (Journ. Linn. Soc., xiv, 485) that the var. *pedicellata* is a distinct species, differing from *G. Morella* in having not only its flowers pedicellate, but also its leaves more ovate and much larger, and its fruit larger; he very properly gave it the specific name of *Hanburii* to commemorate the contributions of the late Mr. Hanbury to pharmaceutical science; and his connection with the history of the present plant. According to the researches of Beckett, *G. Hanburii* is confined to the islands and sea coast of the Gulf of Siam, where it is known as "Ton Rong," and where it grows to the height of fifty feet, with a diameter of twelve inches.

It is doubtful if all of the Gamboge of commerce is obtained from *Garcinia Hanburii*. Some of it is probably obtained from *G. Morella* Desr. and *G. Roxburghii* Engler, plants growing in Canara; *G. Wightii* T. Anders, a plant of Southern Farther India; *G. tetrandia* Wall., *G. Gaudichaudii* Planch, et Triana growing in Cochin China and *G. pictoria* (Roxb.) EngL, a plant found in Ceylon and Farther India.

Ceylon gamboge, derived from *G. pictoria*, Roxb., is procured by incisions, or by cutting away a portion of the bark, and scraping off the juice which exudes. The specimens sent to Christison were in flatfish or round masses, eight or nine inches in diameter, apparently composed of aggregated irregular tears, with cavities which are lined with a grayish and brownish powdery incrustation. It resembled coarse gamboge, and was identical in composition. In Ceylon it is used as a pigment and purgative. (Christison.) *New Caledonian Gamboge*, derived from *Garcinia collina* Vieil, is described by Heckel and Schlagdenhauffen as very similar in its appearance and reactions to ordinary gamboge; its color is, however, deep orange. A white crystalline compound, which

when heated beyond 235° C. (455° F.) produced pyrocatechin, was found in it, and marked the point of difference between it and other varieties of gamboge. (*Rep. de Pharm.*, 1893, 193.)

Gamboge is said to be procured in Siam by breaking off the leaves and shoots of the tree; the juice, which is contained in ducts or latex vessels in the bark, issues in drops, and, being received in suitable vessels, gradually thickens, and at length becomes solid. Jamie, of Singapore, states that incising the trunk and larger branches is often practised. The juice is frequently received into the hollow joints of the bamboo, and the water expelled by mild continuous heat. In this way the so-called pipe gamboge is formed, the contraction during drying causing the cylinders to be hollow. According to Beckett, Siam gamboge is obtained only from trees of not less than ten years of age and during the rainy months, from June to October, by cutting long, spiral grooves into the bark and collecting in hollow bamboos the sap which trickles down in a viscous stream. (*Kew Bulletin*, 1895.)

The name *gummi gutta*, by which gamboge is generally known on the continent of Europe, probably originated from the circumstance that the juice escapes from the plant by drops. The official title was undoubtedly derived from the province of Cambodia, in which the gum-resin is collected. Gamboge was first brought to Europe by the Dutch, about the middle of the seventeenth century. We import it from Canton and Calcutta, whither it is carried by the native or resident merchants. There is no difference in the appearance or character of the drug as brought from these two ports—an evidence that it is originally derived from the same place.

Varieties.—The best gamboge is in cylindrical rolls, from two to five centimeters in diameter, sometimes hollow in the centre, sometimes flattened, often folded double, or agglutinated in masses so that the original form is not always easily distinguishable. The pieces sometimes appear as if rolled, but are in general striated longitudinally from the impression made by the inner surface of the bamboo. They are externally of a dull orange color, which is occasionally displaced by greenish stains, or concealed by the bright yellow powder of the drug, slightly adhering to the surface. In this form the drug is sometimes called *pipe gamboge*. Another variety is imported under the name of *cake* or *lump gamboge*. It is in irregular masses weighing a kilo or more, often mixed with sticks and other impurities, containing many air-cells,

less dense, less uniform in texture, and less brittle than the former variety, and breaking with a dull and splintery instead of a shining and conchoidal fracture. The worst specimens of this variety, as well as of the cylindrical, are sometimes called by the druggists *coarse gamboge*. They differ, however, from the preceding only in containing a greater amount of impurities. Indeed, it would appear from the experiments of Christison, that all the commercial varieties of this drug have a common origin, and that cake or lump gamboge differs from the cylindrical only in the circumstance that the latter is the pure concrete juice, while to the former, farinaceous matter and other impurities have been added for the purpose of adulteration. The inferior kinds of gamboge may be known by their greater hardness and coarser fracture; by the brownish or grayish color of their broken surface, which is often marked with black spots; by their obvious impurities, and by the green color which their decoction, after cooling, gives with tincture of iodine (starch). When pure, the gum-resin is completely dissolved by the successive action of ether and water, so that the amount of residue left by any specimen treated in the manner just spoken of indicates approximately the measure of the adulteration.

Properties.—The official description is as follows: "In hard, brittle, cylindrical pieces, usually hollow in the center, from 2 to 5 cm. in diameter, from 10 to 20 cm in length, externally grayish-orange-brown, longitudinally striate; fracture conchoidal, smooth, orange-red: odorless ; taste very acrid. When rubbed with water it yields a yellow emulsion which becomes darker and almost transparent upon the addition of ammonia water. The emulsion turns green upon the addition of iodine T.S. (starch). The powder is bright yellow, containing few or no starch grains. When mounted in hydrated chloral T.S. and examined under the microscope the particles, for the most part, slowly dissolve, leaving scattered fragments of vegetable tissues. Not less than 65 per cent. of Gamboge is soluble in alcohol. Gamboge yields not more than 2 per cent. of ash." *U. S.*

From the brilliancy of its color, gamboge is highly esteemed as a pigment. It has no odor, and little taste, but, after remaining a short time in the mouth, produces an acrid sensation in the fauces. Its sp. gr. is 1.221. "When *solution of iodine* is added to a cooled aqueous decoction, the color should not become distinctly green (absence of more than a trace of starch), When incinerated it should not yield more than 3 per cent. of ash." *Br.* 1898. It is a gum-resin, without volatile oil.

Christison has shown that the proportion of gum and resin varies in different specimens even of the purest drug. In one experiment, out of 100.8 parts he obtained 74.2 of resin, 21.8 of gum, and 4.8 of water. The gum is quite soluble in water, and of the variety denominated arabin. Fluckiger, however, says that the gum is not identical with gum arabic, as its solution does not redden litmus, and is not precipitated by neutral lead acetate, nor by ferric chloride, nor by sodium silicate or bib orate. By fusing purified gamboge resin with potassium hydroxide, Hiasiwetz and Earth (*Ann. Ch. Ph.*, 138, 61) obtained acetic and other acids of the same series, together with *phloroglucin*, $C_6H_3(OH)_3$, *pyrotartaric acid*, $C_5H_8O_4$, and *isouvitinic acid*, $COOH.C_6H_4.CH_2COOH$. Sassarini found gamboge to contain the following constituents: 1. Gum analogous to arabin. 2. Volatile oil, consisting of ter-pene and a camphor. 3. Isouvitinic and acetic acids. 4. A phenol ester. 5. Resin. 6. Methyl alcohol and some higher homologues. 7. A liquid having a fruity odor resembling aldehyde or acetone. He believes phloroglucin found by others to be a decomposition product. (*Ann. di Chim. Farm.*, 1897.) Gamboge is readily and entirely diffusible in water, forming a yellow opaque emulsion, from which the resin is very slowly deposited. It yields its resinous ingredient to alcohol, forming a golden-yellow tincture, which is rendered opaque and bright yellow by the addition of water. Its solution in ammoniated alcohol is not disturbed by water. Ether dissolves about four-fifths of it, taking up only the resin. It is wholly taken up by alkaline solutions, from which it is partially precipitated by the acids. The strong acids dissolve it; the solution when diluted deposits a yellow sediment. The color, acrimony, and medicinal power of gamboge are thought to reside in the resin. Hirschsohn gives a method for detecting gamboge in mixtures in *Ph. Z. R.*, xxiv. (*A. J. P.*, 1885.)

Uses.—Gamboge is a powerful, drastic, hydragogue cathartic, so very apt to produce nausea and vomiting and much griping when given in the full dose that it is almost never employed except in combination with other cathartics. In large quantities it is capable of causing fatal effects, and death has resulted from a drachm. The full dose is from two to six grains (0.13-0.4 Gm.), which in cases of *tenia* has been raised to ten or fifteen grains (0.65-1.0 Gm.). It may be given in pill or emulsion, or dissolved in an alkaline solution. In the dose of five grains (0.32 Gm.) the resin is said to produce copious watery stools, with little or no uneasiness. If this be the case, it is probable that, as it exists in the gum-resin, its purgative property is somewhat modified by the other ingredients.

Dose, two grains (0.13 Gm.).

Off. Prep.—*Pilulas Catharticae Compositae, U.S.*

Canada Pitch. *Pix Canadensis. U. S. 1880. Hemlock Pitch.*—The *Tsugacanadensis* (L.) Carr, *Hemlock* or *Hemlock Spruce* of the United States and Canada, when of full growth, is often seventy or eighty feet high, with a trunk of two or three feet in diameter, and of nearly uniform dimensions for two-thirds of its length. Its leaves are scattered, short, linear, obtuse, from 8 to 13 mm. in length, whitened beneath and appearing as two-ranked. The strobiles are ovate, little longer than the leaves, terminal and pendulous.

The tree is abundant in Canada, Nova Scotia, and the more northern parts of New England, and is found in the elevated and mountainous regions of the Middle States. Its bark is much used for tanning, an extract being made for the purpose. The tree contains much less juice than some other of the Pinaceae, and very little flows from incisions made into its trunk. But in the trees which have attained their full growth, and are about to, or have begun to, decay, the juice exudes spontaneously, and hardens upon the bark, in consequence of the partial evaporation or oxidation of its volatile oil. The bark thus incrustated is stripped from the tree, broken into pieces, and boiled in water. The pitch melts, rises to the surface, is skimmed off, and is still further purified by a second boiling in water. Hemlock pitch is hard, brittle, quite opaque, of a dark reddish-brown color, becoming still darker by exposure to the air, of a weak peculiar odor, and scarcely any taste. It softens and becomes adhesive with a moderate heat, and even at ordinary temperatures takes the form of the vessel containing it, and melts at 92.2° C. (198° F.).

The constituents of this pitch are resin and a minute proportion of volatile oil. It is sometimes known by the incorrect name of 'hemlock gum. Canada pitch is a gentle rubefacient, closely analogous to Burgundy pitch in its properties, and employed for precisely the same purposes. It is, however, more readily softened by heat, and is sometimes almost too soft for convenient application at the temperature of the body. A volatile oil obtained from *Tsugacanadensis*, and called *oil of spruce* or *oil of hemlock*, has been employed to & considerable extent in veterinary liniments. It has also been used as an abortifacient, with the effect of endangering the life of the woman. (J. S. Paige, *N. Y. M. J.*, viii, 184.)

W. Zinn (*M. M. W.*, Oct., 1902) reports a case of stupor and involuntary evacuation of urine, and collapse with subsequent psychic disturbance, as produced by the inhalation for many hours of the emanations from branches of *Pseudotsugata scifolia* (Lamb.) Britton (*P. Douglassi* Car.).

The U. S. Pharmacopoeia of 1880 gave the following directions for preparing the *Hemlock* or *Canada Pitch Plaster* (*Emplastrum, Picis Canadensis, U. S., 1880*) : "Canada Pitch, *ninety parts* [or nine ounces av.]; Yellow Wax, *ten parts* [or one ounce, av.], to make *one hundred parts* [or ten ounces av.]. Melt them together, strain the

mixture, and stir constantly until it thickens on Cooling." *U. S.*, 1880.

Canary Seed. *Fructus (Semen) Canariense, Semence de Canarie, Fr. Kamariensamen, G.*—The seeds of *Phalariscanariensis* L., an annual grass originally from the Canary Islands, but now growing wild in Europe and the United States. The seeds are ovate, somewhat compressed, about 5 mm. long, shining and of a light yellowish-gray color externally, and light within. Their chief constituent is starch, and they are used chiefly as bird seed.

Canchalagua.—This plant, *Erythraea venusta* A. Gray (Fam. *Gentianaceae*), found on our Pacific coast, is a valuable bitter tonic and stomachic. (*Ph. Rec.*, 1887, 363.) *Erythraea australis* R. Br. is said to be similarly used in Australia. (*P. J.*, xix.)

Canella. *N. F. IV.*—The *N. F.* describes it as "the dried inner bark of *Canella Winterana* (Linne) Gaertner (Fam. *Canellaceae*). In quills usually from 1 to 3 dm. in length and from 1 to 4 cm. in thickness, occasionally two or three times this size, or in irregular fragments of quills, from 1.5 to 5 mm. in thickness and 2 to 3 cm. in width, the outer periderm mostly removed; outer surface light brownish-yellow or pale orange-brown, more or less scaly, with a very few shallow fissures, often more or less reticulate with slight ridges; inner surface paler, somewhat smooth, but showing coarse, longitudinal striae; fracture short and sharp, pale yellow, with an irregular, slightly darker band just inside of the center. Odor slight (Unless the bark is heated, then aromatic, resembling that of cinnamon; taste aromatic, warm, somewhat bitter and mucilaginous. The powdered drug is light brown to brownish-red and, when examined under the microscope, exhibits numerous, isodiametric, thick-walled stone cells about 0.075 mm. in diameter, the walls with simple or branching pores; calcium oxalate in rosette aggregates up to 0.05 mm. in diameter; starch grains simple or two-to three-compound up to 0.02 mm. in diameter; oil cells with suberized walls numerous. Canella yields not more than 7 per cent. of ash." *N. F.* It was formerly recognized by the *U. S.* and *Br. Pharmacopoeias*. The tree is a native of Florida and the Bahama and West India Islands. The bark of the branches, which is the part employed in medicine, is loosened and deprived of its epidermis by beating. After removal from the tree it is dried in the shade. It enters commerce solely from the Bahamas, where it is known as *cinnamon bark*, or as *white wood bark*. At first it was considered to be a variety of cinnamon bark and was at one time confused with Winter's bark. Boiling water extracts nearly one-fourth of its weight; but the infusion, though bitter, has comparatively little of the warmth and pungency of the bark. It yields all its virtues to alcohol, forming a bright yellow tincture, which is rendered milky by the addition of water. Canella bark yields from distillation from 0.75 to 1.25 per cent. of a volatile oil, having an odor resembling that of a mixture of cajeput and clove. It contains benzoyl eugenol; 1-pinene; cineol and caryophyllene. The bark yielded to Fluckiger 0.74 per cent. of oil. According to John P. Prey, it contains volatile oil, 1.28 per cent.; resin, 8.2 per cent.; mannite, 8 per cent.; ash, 8.9 per cent.; also starch, bitter principle, albumen, and cellulose. (*A. J. P.*, 1884, 1.) Canella has been sometimes confounded with Winter's bark, from which, however, it differs widely. (See *Wintera*.) It is a mild, aromatic tonic, very acceptable to the stomach, and especially as an addition to tonic or purgative medicines. It is scarcely ever prescribed except in

combination. Its best known compound is the famous *Pulvis Aloe et Canellae* (see Part III), commonly known as *Hiera Picra*, literally "Sacred Bitters," from the esteem in which it was once held. In the West Indies it is employed by the negroes as a condiment and as an antiscorbutic. *Dose*, ten to forty grains (0.65-2.6 Gm.).

Cangoura.—An evergreen creeper, *Bouea oblongifolia* (Fam. *Anacardiaceae*), from the seeds of which the natives of Salvador are said to produce a paste which is a violent nerve poison, producing in some cases delirium lasting as long as eight days. (*Nouv. Rem.*; April, 1892.)

CANNABIS. U. S. (Br.)

CANNABIS Cannab. [Indian Hemp Cannabis Indica U. S. VIII, Guaza, Ganjah]

"The dried flowering tops of the pistillate plants of *Cannabis sativa* Linne, or of the variety *indica* Lamarck (Fam. *Moraceae*), freed from the thicker stems and large foliage leaves and without the presence or admixture of more than 10 per cent. of fruits or other foreign matter. Cannabis, made into a fluidextract in which *one hundred mils* represent *one hundred grammes* of the drug, when assayed biologically, produces incoordination when administered to dogs in a dose of not more than 0.03 mil of fluidextract per kilogramme of body weight." *U. S.* "Indian Hemp consists of the dried flowering or fruiting tops of the pistillate plant of *Cannabis sativa*, Linn., grown in India; from which the resin has not been removed." *Br.*

Cannabis Indicae, *Br.*; Hemp, Indian Hemp; Herba Cannabis ludicae; Chanvre, *Fr.* *Cod.*; Chanvre de l'Inde, *Fr.*; Indischer Hanf, *G.*; Cañamo, *Sp.*

For many years the official cannabis was restricted to the drug which was used for centuries in India. The reason for this was that the Indian cannabis was more uniformly active. Recently the Indian Government has placed a high tax on every pound of the drug grown. The result has been that other markets have been sought and the hemp plant has been grown in other parts of Asia, Africa and America. While of course, much of this material is not equal to that grown in India yet the fact that it can be grown, as shown by experiments in the United States (see Hamilton, *J. A. Ph. A.*, 1913, ii; 1915, iv, 389) of a very high quality has caused the framers of the U. S. Pharmacopoeia to permit the use of a cannabis, no matter where it may be grown, provided it comes up to the biological standard as given in the definition. Physiologically active *cannabis* is obtained at the present time not only from India, but Africa,

Turkey, Turkestan, Asia Minor, Italy, Spain and the United States.

The *Cannabis sativa*, or hemp plant, is an annual, from four to eight feet or more in height, with an erect, branching, angular stem. The leaves are alternate or opposite, and digitate, with five to seven linear-lanceolate, coarsely serrated segments. The stipules are subulate. The flowers are axillary; the staminate in long, branched, drooping racemes; the pistillate in erect, simple spikes. The stamens are five, with long pendulous anthers; the pistils two, with long, filiform, glandular stigmas. The fruit is ovate and one-seeded. The whole plant is covered with a fine pubescence, scarcely visible to the naked eye, and somewhat viscid to the touch. The hemp plant of India has been considered by some as a distinct species, and named *Cannabis indica*; but the most observant botanists, upon comparing it without cultivated plant, have been unable to discover any specific difference. It is now, therefore, regarded merely as a variety, and is distinguished by the epithet *indica*. Pereira states that in the female plant the flowers are somewhat more crowded than in the common hemp, but that the male plants in the two varieties are in all respects the same.

C. sativa is a native of the Caucasus, Persia, and the hilly regions in Northern India. It is cultivated in many parts of Europe and Asia, and largely in our Western States. It is from the Indian variety exclusively that the medicine was formerly obtained, the heat of the climate in Hindostan apparently favoring the development of its active principle. H. C. Wood, many years ago, obtained a parcel of the male plant of *C. americana* (*C. sativa*) from Kentucky, made an alcoholic extract of the leaves and tops, and, upon trying it on the system, found it effective in less than a grain, and, having inadvertently taken too large a dose, experienced effects which left no doubt of the powers of the medicine, and of the identity of its influence with that of the Indian plant. (*Proc. Am. Philos. Soc.*, vol. xi, p. 226.) The results obtained by H. C. Wood have been confirmed by a number of observers.

The fruits or "so-called" seeds, though not now official, have been used in medicine. They are from three to five millimeters long and about two millimeters broad, roundish-ovate, somewhat compressed, of a shining ash-gray color, and of a disagreeable, oily, sweetish taste. For a comprehensive monograph on the morphology of cannabis fruits, as well as their history and chemical composition, see Tsehirsch, "*Handbuch der Pharmakognosie*" p. 555. They yield by expression about 20 per cent. of

a fixed oil, "which has the drying property, and is used in the arts. They contain also uncrystallizable sugar and albumen, and when rubbed with water form an emulsion, which may be used advantageously in inflammations of the mucous membrane, though without narcotic properties. The seeds are much used as food for birds, as they are fond of them. They are generally believed to be in no degree poisonous; but Michaud relates the case of a child in whom serious symptoms of narcotic poisoning occurred after taking a certain quantity of them. It is probable that some of the fruit eaten by the child was unripe, as in this state it would be more likely to partake of the peculiar qualities of the plant. (*Ann. Ther.*, 1860.)

In Hindostan, Persia, and other parts of the East, hemp has long been habitually employed as an intoxicating agent. The parts are the tops of the plant, and a resinous product obtained from it. *Bhang* is the selected, dried and powdered leaves. *Ganjah* or *gunjah* is the tops of cultivated female plants, cut directly after flowering, and formed into round or flat bundles from two to four feet long by three inches in diameter. It is stated that in the province of Bengal great care is taken to eradicate the male plants from the fields before fertilization of the female, and that thereby the yield and quality of the resin is greatly increased. In Bombay this matter is commonly neglected, so that Bengal ganjah is much superior to Bombay ganjah. It is recognized in India that ganjah rapidly deteriorates on keeping, that which is one year old being not more than one-quarter as potent as the fresh drug, while two-year-old ganjah is practically inert and is required by the Indian government to be burned in the presence of excise officers. It is probable, however, that much old ganjah finds its way into the markets of the world. All importations of ganjah or hemp from India should be made directly after the harvesting of the new crop in April or May, and the extract should be prepared at once and kept in hermetically sealed jars. There is on the surface of the plant a resinous exudation to which it owes its stickiness. According to Hooper (*P. J.*, 1909, 1xxxii, 347) only small amounts of charas are raised in India, that which is being consumed there being mostly imported. The method of collection in Baluchistan is to gently rub the dried plant between carpets. The dust which comes off contains the active principle and is known as "rup." The second shaking produces an inferior variety, known as "tah-galim/" and the third shaking is known as "ganja." In Nepal the plant is squeezed between the palms of the hands, and the resin scraped off from the hands. These balls, and also masses formed out of resin

mechanically separated from the hemp plant are called *charas* or *churrus*. This is the *hashish* or *hasheesh* of the Arabs.

Hashish is also produced in considerable quantities in Persia by rolling and rubbing the flowers, stalks and leaves of hemp on rough woolen carpets and subsequently scraping off with a knife and making into balls or sticks the adherent resinous substance. The carpets are afterwards washed with water and the extract obtained by evaporation sold at a low price. The dose for smoking of the best hashish is said to be one-fourth to one grain (0.016-0.065 Gm.). The fanatics are affirmed to be generally hashish devotees.

The dealing in hashish in India is said to be a Government monopoly, and a very heavy license is required for the right to even purchase it in quantity. The importation of it into Egypt is so strongly interdicted that the mere possession of it is a penal offense; H. C. Wood found it, however, readily procurable. It is said to be brought into the country in pigs' bladders, in the Indo-European steamers, and thrown out at night during the passage into the Suez canal, to be picked up by the boats of confederates. Notwithstanding the Governmental interdiction, it is largely used by smoking in Egypt, as an intoxicant. The statement of W. E. Dixon (*B. M. J.*, Nov., 1899) that the inhalations of hemp smoke produces great exhilaration and causes muscular fatigue to disappear for the time being is undoubtedly correct, but his further belief that the habit is not apt to grow upon the hemp votary is more doubtful.

Momea or *mimea* is a hemp preparation said to be made in Thibet with human fat. From ganjah the Messrs. Smith, of Edinburgh, obtained a purer resin by the following process: Bruised ganjah is digested, first in successive portions of warm water, until the expressed liquid comes away colorless; and afterwards for two days, with a moderate heat, in a solution of sodium carbonate, containing one part of the salt for two of the dried herb. It is then expressed, washed, dried, and exhausted by percolation with alcohol. The tincture, after being agitated with milk of lime containing one part of the earth for twelve of the ganjah used, is filtered; the lime is precipitated by sulphuric acid; the filtered liquor is agitated with animal charcoal, and again filtered; most of the alcohol is distilled off, and to the residue twice its weight of water is added; the liquor is then allowed to evaporate gradually; and, finally, the resin is washed with fresh water until it ceases to impart a sour or bitter taste to the liquid, and is then dried in thin layers. Thus obtained, it retains the

odor and taste of gunjah, which yields from 6 to 7 per cent. of it.

Properties.—Fresh hemp has a peculiar narcotic odor, which is said to be capable of producing vertigo, headache, and a species of intoxication. It is much less in the dried tops, which have a feeble bitterish taste. According to Royle, *churrus* is, when pure, of a blackish-gray, blackish-green, or dirty olive color, of a fragrant and narcotic odor, and a slightly warm, bitterish, and acrid taste. Cannabis is officially described as " in dark green or greenish-brown and more or less agglutinated fragments, consisting of the short stems with their leaf-like bracts and pistillate flowers, some of the latter being replaced with more or less developed fruits; stems cylindrical, of varying length, not more than 3 mm. in diameter, longitudinally furrowed, light green to light brown, strigose-pubescent; leaves digitately compound; leaflets, when soaked in water and spread out, linear-lanceolate, nearly sessile, margin deeply serrate, bracts ovate, pubescent, each enclosing one or two pistillate flowers, or more or less developed fruits; calyx dark green, pubescent and somewhat folded around the ovary or fruit; styles two, filiform and pubescent; ovary with a single campylotropous ovule; fruit light green to light brown, broadly ellipsoidal, about 3.5 mm. in length, finely wrinkled and slightly reticulated; odor agreeably aromatic; taste characteristic. The powder is dark green, giving a strong effervescence on the addition of dilute hydrochloric acid; numerous sharp pointed fragments of upper portion of non-glandular hairs and fragments of bracts and leaves showing yellowish-brown laticiferous vessels, rosette aggregates of calcium oxalate from 0.005 to 0.025 mm. in diameter; non-glandular hairs unicellular, with a very slender pointed apex and a considerably enlarged base containing, usually in the lumen, some calcium carbonate; glandular hairs of two kinds, one with a short, one-celled stalk and the other with a multicellular, long, tongue-shaped stalk, the glandular portion being globular and consisting of from 8 to 16 cells, fragments of fruits with palisade-like, non-lignified sclerenchymatous cells, walls yellowish-brown, finely porous, the lumina usually containing air; tissues of embryo and endosperm with numerous oil globules and aleurone grains, the latter from 0.005 to 0.01 mm. in diameter and consisting of large crystalloids and globoids. The yield of alcohol extractive is not less than 8 per cent. and the alcoholic solution is of a bright green color. Cannabis yields not more than 15 per cent of ash." *U. S.*

The British Pharmacopoeia describes Indian cannabis as follows:

"In compressed, rough, dusky-green masses, consisting of the branched upper part of the stem, bearing leaves and pistillate flowers or fruits, matted together by a resinous secretion. Upper leaves simple, alternate, 1-3 partite; lower leaves opposite and digitate, consisting of five to seven linear-lanceolate leaflets with distantly serrate margins. Fruit one-seeded and supported by an ovate-lanceolate bract. Both leaves and bracts bear external oleo-resin glands and one-celled curved hairs, the bases of which are enlarged and contain cystoliths. Strong, characteristic odor; taste slight. When a mixture of 10 grammes of finely powdered Indian Hemp and 100 millilitres of *alcohol* (90 per cent.) is shaken occasionally during twenty-four hours and then filtered, 20 millilitres of the filtrate, evaporated in a flat-bottomed dish, yield a residue weighing, when dried at 100° C. (212° F.), not less than 0.250 gramme. Ash not more than 15 per cent." *Br.*

For a histological description of the leaf by A. R. L. Dohme, see *Proc. A. Ph. A.*, 1897, 569. The Cannabis of the market may consist of fruiting tops and stems and occasionally the staminate tops are admixed with it.

Hooper (*P. J.*, lxxxi, p. 80) describes a method for the chemical standardization of cannabis indica based upon its iodine value. He finds that the alcoholic extract of old samples has a lower iodine value than that from recent specimens, and there is more or less constancy of relation between the age and the iodine value.

Indian churrus or hasheesh is a hard resinous mass of a greenish-gray color, containing much gritty earth, and, as it occurs in Egypt, of a feeble, hemp-like odor and taste. Schlesinger found in the leaves a bitter substance, chlorophyll, green resinous extractive, coloring matter, gummy extract, extractive, albumen, lignin, and salts. The plant also contains volatile oil in very small proportion, which probably has narcotic properties. The resin obtained by T. & H. Smith of Edinburgh, in 1846, has been thought to be the active principle, and received the name of *cannabin*. By repeated distillation of the same portion of water from relatively large quantities of hemp renewed at each distillation, M. J. Personne obtained a volatile oil, of a stupefying odor, and an action on the system such as to dispose him to think that it was the active principle of the plant. As the water distilled was strongly alkaline, he supposed that his volatile principle might be a new alkaloid; but the alkaline reaction was found to depend on ammonia; and the liquid

obtained proved to be a volatile oil, lighter than water, of a deep amber color, a strong odor of hemp, and composed of two distinct oils, one colorless, with the formula $C_{18}H_{22}$, the other a hydride of the first, $C_{18}H_{22}$, which was solid, and separates from alcohol in plate-like crystals. For the former Personne proposes the name of *cannabene*. It is affirmed that when this is inhaled, or taken into the stomach, a singular excitement is felt throughout the system, followed by a depression, sometimes amounting to syncope, with hallucinations which are generally disagreeable, but an action on the whole slighter and more fugitive than that of the resin. The various substances of alkaloidal nature that have been described by different investigators as found in Indian hemp are now recognized as due to decomposition products of *choline*, which was identified as present by Jahns. (*P. J.*, 1887, xvii, 1049.) Cannabindon, $C_8H_{12}O$, is a dark red syrupy liquid obtained by Kobert (*Chem. Ztg.*, 1894, 741) from *Cannabis Indica*; it is soluble in alcohol, ether and oils; it is affirmed to be narcotic in doses of from half a grain to two grains (0.032-0.13 Gm.). As a result of a reinvestigation of charras (churrus) from Indian hemp, Wood, Spivey, and Easterfield (*J. Chem. S.*, vol. Ixix, 539) have found the following principles: 1, a terpene, boiling between 150° and 180° C. (302° and 356° F.); 2, a sesquiterpene, boiling at 258° to 259° C. (496.4° - 498.2° F.); 3, a crystalline paraffin of probable formula $C_{22}H_{44}$, melting at 63.5° C. (146.3° F.); and 4, a red oil, boiling at 265° to 270° C. (509° - 518° F.) under a pressure of 20 mm., to which they give the name *cannabinol*, and the formula $C_{18}H_{24}O_2$. This latter constituent they consider the only active ingredient. It is probably the same substance as the dark red syrup of Kobert, mentioned above under the name cannabindon. The authors found that cannabinol readily underwent superficial oxidation, at the same time losing its toxic activity. Famulener and Lyons (*A. Pharm.*, 1904) believe that the only reliable preparation of cannabis is a fluidextract made from the *fresh* drug. I. Roux (*A. Pharm.*, 1887) has experimented upon extracts made by treating purified extract of hemp with petroleum benzin and ether. The ether extract produced insignificant results. The petroleum extract was excitant and convulsant. The alcoholic extract was a feeble narcotic. The resin "cannabin" of which *cannabinol* is the chief constituent, appears to be active. Frankel (*A. E. P. P.*, 1903, p. 266) claims to have isolated the active principle of hashish as a pure and chemically well defined body. It has the formula $C_{21}H_{30}O_2$, and is a phenol-aldehyde. It is of a pale yellow color and of a thick consistency. When heated it becomes quite

fluid and distils at 215° C. (419° F.), under a pressure of 0.5 mm. It oxidizes in the air, acquiring a brown tint. It responds to Millon's reaction, and can be acetylated, showing thus its phenol character. Frankel proposes that the name *cannabinol* be given to it and that the term *pseudo-cannabinol* be given to the inactive substance of Wood, Spivey and Easterfield.

Assay.—"Prepare a fluidextract and proceed as directed below." *U. S.*

Attempts have been made to apply physiological tests to the standardization of *cannabis indica*. Up to the present no means have been suggested for determining the relative potency of different samples of *cannabis indica*, the physiological test simply demonstrating that the drug possesses a certain indefinite amount of physiological action. This test is carried out upon dogs in the following manner: It is advisable to use the same animal for repeated tests, because the individual susceptibility of the dog varies so greatly, and the experimenter gradually learns the degree of reaction to be expected from a certain dog. A tincture of the specimen to be tested is either evaporated into a soft extract and given in the form of a pill or mixed with an inert absorbing powder and enclosed in a capsule; it must not be given hypodermically. The symptoms caused by *cannabis indica* in the dog recall those of alcoholism in the human being. There is at first a slight loss of control in the hind legs so that the animal staggers as he walks, later the ataxia becomes so marked that the dog is unable to stand up without leaning against some object, and about this time begins to show distinct drowsiness, and may eventually pass into a heavy sleep.

The details of assay as directed by the U.S. are as follows: " The assay of *Cannabis* and its preparations has been made a requirement and is based upon the fact that this drug produces certain symptoms of muscular incoordination. The method consists of ascertaining the dose of the preparation to be tested which will produce these symptoms of incoordination in dogs and then adjusting its strength by comparison with a standard preparation.

"*Dogs*.—The animals differ considerably in susceptibility to the drug and therefore it is best to make preliminary tests upon several dogs with average-sized doses and select from among them the animals which react easily to the drug. As a rule, fox terriers serve very-well for the purpose, but any dog may prove satisfactory. It is best to provide at least

two dogs for each assay, but if many samples are to be examined more dog's will be needed. The dogs should be at least one year old and in normal health and must be kept under the best sanitary conditions. They may be used repeatedly for the purpose but not at shorter intervals than three days. Each series of tests should be conducted by the same person, who should be perfectly familiar with the peculiarities of each animal in order that he may recognize more certainly deviations from the normal. While the tests are being made the animals should be kept in a perfectly quiet room, free from-disturbance and separated so that they cannot see each other.

"Preparation of the Drug.—The drug may be given most conveniently in the form of the fluidextract which is administered in gelatin capsules, or the extract made into soft pills may be used; but whichever form is chosen the same should be used for both the standard and the preparation that is to be tested.

“Before administration the animal should not be fed for twenty-four hours in order to hasten absorption. The head of the animal being held, its mouth is opened and the capsule or pill is placed upon the back of the tongue. Usually the drug is easily swallowed when given in this way, but this may be facilitated by giving the animal a small amount of water to drink.

"Assay.—An average dose of the known or standard preparation is given to one of the dogs and a like dose of the preparation to be standardized is given the second dog. After one hour both dogs are observed very carefully for symptoms of muscular incoordination. The incoordination is manifested differently in different animals, but in small doses it shows itself most frequently in slight swaying, when the animal is standing quietly, or in some ataxia when it runs about. The observation should be made frequently during the second hour following the administration of the drug.

"The results obtained from the first test should be confirmed after an interval of not less than three days by repeating the administration, but reversing the order, that is, giving the known strength drug to the dog which received that of unknown strength before and vice versa.

"In subsequent tests which are carried out, the dose of the preparation of unknown strength is modified so as to produce similar symptoms to

those produced by the standard. If the preparation to be tested is below the standard in strength, its dose must be increased, or if it is above strength its dose is lessened until equivalent doses of the two are found. Dogs may be used over long periods of time, even for some years, but occasionally they have to be discarded, as in some cases they seem to learn the effects of the drug and so refuse to stand up. A certain degree of tolerance is sometimes gained which necessitates larger doses.

"Standard.—As there is no chemical substance of definite composition which can be adopted as a standard, a Fluidextract of Cannabis or an extract which has been carefully prepared and suitably preserved may be utilized for this purpose. A standard Fluidextract will produce incoordination when administered to dogs in the dose of 0.03 mil for each kilogramme of body weight of dog. When administered in the form of the Extract a dose of 0.004 Gm. for each kilogramme of body weight of dog should produce similar symptoms, and the requirement for a standard tincture is a dose of 0.3 mil for each kilogramme of body weight of dog." *U. S. IX.*

Uses.—Aside from a slight local irritant effect the action of cannabis seems to be limited almost exclusively to the higher nerve centers. In man this is first manifested by a peculiar delirium which is accompanied with exaltation of the imaginative function and later by a remarkable loss of the sense of time. The delirium is often accompanied with motor weakness and diminished reflexes and generally followed by drowsiness. In the dog the earliest manifestation of the drug's action is a slight degree of restlessness which is soon followed by disturbances of equilibrium and later weakness of the legs and drowsiness.

Cannabis is used in medicine to relieve pain, to encourage sleep, and to soothe restlessness. Its action upon the nerve centers resembles opium, although much less certain, but it does not have the deleterious effect on the secretions. As a somnifacient it is rarely sufficient by itself, but may at times aid the hypnotic effect of other drugs. For its analgesic action it is used especially in pains of neuralgic origin, such as migraine, but is occasionally of service in other types. As a general nerve sedative it is used in *hysteria*, *mental depression*, *neurasthenia*, and the like. It has also been used in a number of other conditions, such as *tetanus* and *uterine hemorrhage*, but with less evidence of benefit. One of the great hindrances to the wider use of this drug is its extreme variability. Formerly many of the preparations of cannabis were inert before they

left the manufacturers' hands, and the present requirements of the U. S. P. that the drug be tested upon dogs to insure its activity is an important step in the right direction. But even granted an active preparation when manufactured, so rapidly does the drug deteriorate that by the time the drug reaches the patient it has lost a large proportion of its activity. The only way of determining the dose of an individual preparation is to give it in ascending quantities until some effect is produced. The fluid extract is perhaps as useful a preparation as any; one may start with two or three minims of this three times a day, increasing one minim every dose until some effect is produced. According to C. R. Marshall (*L. L.*, 1897, i, also *J. A. M. A.*, Oct., 1898) the deterioration of cannabis is due to the oxidation of cannabinol, which he has found to act upon dogs and cats as the crude drug.

Dose, of cannabis, one to three grains (0.065-0.2 Gm.).

Off. Prep.—*Extractum Cannabis, U. S. (Br.)*; *Fluidextractum Cannabis, U. S.*; *Tinctura Cannabis (from Extract), U. S. (Br.)*; *Collodium Salicylici Composita (from Fluidextract), N. F.*; *Mistura Chlorali et Potassii Bromidi Composita (from Extract), N. F.*; *Mistura Chloroforma et Morphinae Composita (from Tincture), N. F.*

Capparis. *Capparis spinosa* L. *Caper-bush*. (Fam. *Capparidaceae*.)—A low, trailing shrub, growing in the south of Europe and north of Africa. The buds of unexpanded flowers, treated with salt and vinegar, form a highly esteemed pickle, which has an acrid, burning taste, and is considered useful in scurvy. The dried bark of the root was formerly official. It is in pieces partially or wholly quilled, about one-third of an inch in mean diameter, transversely wrinkled, grayish externally, whitish within, inodorous, and of a bitterish, somewhat acrid, and aromatic taste. It contains rucic acid and a volatile substance of garlic-like odor. It is considered diuretic, and was formerly used in amenorrhea and chronic rheumatism.

Capsella. *Capsella Bursa-pastoris* (L.) Medic. *Shepherd's purse*. *Bourse a Pasteur*, *Molette*, Fr. *Hirtentaschlein*, G. (Fam. *Cruciferae*.)—This very common weed in the United States, naturalized from Europe, is bitter and pungent, yields on distillation a volatile oil identical with oil of mustard, and, according to E. Bombelon, contains an alkaloid, *bursine*. (See *A. J. P.*, 1888; also *Provincial Med. Journ.*, 1858.) It has been used as an antiscorbutic, also in *hematuria*, and in other *hemorrhages*, *amenorrhea* and *dropsy*. From two to four fluidounces (60-120 mils) of the fresh expressed juice may be given at a *dose*; or from one-fourth to one-half fluidrachm (0.9-1.8 mils) of the fluidextract of the dried plant.

Capulincullo.—This drug, derived from the *Rhamnus Humboldtianus* Roem. and Schult. (Fam. *Rhamnaceae*) of Mexico, is said to be a violent poison, acting like curare.

A non-toxic, non-drying fixed oil, tasteless and odorless, is obtained in considerable quantities from the fruit of the tree.

Cardamine. *Cardamine pratensis* L. *Cuckoo-flower*.—This is a perennial herbaceous plant, of the fam. *Cruciferae*, with a simple, smooth, erect stem, about a foot in height. The plant grows in Northern Europe and to some extent in wet places and bogs from New Jersey northward to Labrador. Its bitterish and slightly pungent leaves are supposed to be antiscorbutic. The seeds are said to contain *myronic acid*, and to yield on decomposition by hydrolysis an oil analogous to oil of mustard. Feist investigated *C. amara* L. and its volatile oil and found *thio-urea*. Kuntze states that two kinds of crystals were isolated, both being forms of thio-urea. (A. Pharm., 1907, 657.) In Europe they are sometimes added to salads. The flowers formerly possessed the reputation of being diuretic, and of being useful in *chorea* and *asthma*.

CARDAMOMI SEMEN. U. S. (Br.)

CARDAMOM SEED Cardam. Sem. [Cardamomum U.S. VIII Cardamom]

"The dried seeds of *Elettaria Cardamomum* White et Maton (Fam. *Zingiberaceae*), recently removed from the capsules." U. S. "Cardamom Seeds are the dried ripe seeds of *Elettaria Cardamomum*, Maton. The seeds should be kept in their pericarps and separated when required for use." Br.

Cardamomi Semina, Br.; *Cardamomum Minus*, *Cardamomum Malabaricum*; Malabar Cardamoms, Cardamoms; Cardamome du Malabar, Fr. Cod.; Petit Cardamome, Fr.; Fructus Cardamomi, P. G.; Malabar Kardamomen, Cardamomen, Kleine Kardamomen, G; Cardamomo minore. It.; Cardamomo, Cardamomo menor, Sp.; Ebil, Arab.; Kakelah seghar, Pers.; Capalaga, Malay; Gujaratii elachi, Hindost.

The fruit of cardamom is official in most of the Pharmacopoeias. The U. S. Pharmacopoeia in its definition confines cardamom to the seeds. In this it follows the British Pharmacopoeia which has always limited the drug to the seeds, but specifically states that the fruit should be kept intact and the seeds separated when required for use. This step was probably a wise one as there has always been some confusion by manufacturers as to whether the article designated as cardamom is a formula was restricted to the seeds or not. On the other hand the pericarp contains some oil and forms an excellent surface for the grinding of the seeds. Furthermore, the decorticated seeds are liable to adulteration with seed of wild cardamom and other foreign seeds which are not detected except upon careful examination.

The subject of cardamom has been involved in some confusion and uncertainty, both in its commercial and botanical relations. The name has been applied to the aromatic capsules of various Indian plants belonging to the family of *Zingiberaceae*. Three varieties have long been designated by the several titles of the *lesser*, *middle*, and *larger*—*cardamomum minus*, *medium*, and *majus*; but these terms have been used differently by different writers, so that their precise signification remains doubtful. To Pereira we are mainly indebted for the clearing up of this confusion. It is well known that the *lesser cardamom* of most writers is the variety recognized by the Pharmacopoeias and generally kept in the shops. The other varieties, though circulating to some extent in European and Indian commerce, are little known in this country.

Ceylon Cardamom.—This has been denominated variously *cardamomum majus* and *cardamomum longum*, and is sometimes termed in English commerce *wild cardamom*. It is the large cardamom of Guibourt. In the East it is sometimes called grains of Paradise; but it is not the product known with us by that name. (See below.) It is derived from a plant cultivated in Candy, in the Island of Ceylon, and also growing wild in the forests of the interior, which was designated by Sir James Edward Smith *Elettaria major*, but is now generally acknowledged to be only a variety of the official plant. (*Elettaria Cardamomum* var. *β-Major* Smith.) It is affirmed that the annual product reaches nearly 750,000 pounds. The fruit is a lanceolate-oblong, acutely triangular capsule, somewhat curved, about 3.5 cm. long and 6 to 8 mm. broad, with flat and ribbed sides, tough and coriaceous, brownish or yellow ash-colored, having frequently at one end the long, cylindrical, three-lobed calyx, and at the other the fruit-stalk. It is three-locular, and contains angular, rugged, yellowish-red seeds, of a peculiar fragrant odor and spicy taste. Its effects are analogous to those of the official cardamom.

Round or Siam Cardamom.—This is probably the *Αμωμων* of Dioscorides and the *Amomi uva* of Pliny, and is believed to be the fruit of *Amomum cardamomum*, Willd., growing in Sumatra, Java, and other East India islands. The capsules are usually smaller than a cherry, roundish or somewhat ovate, with three convex sides, more or less striated longitudinally, yellowish or 'brownish-white, and sometimes reddish, with brown, angular, cuneiform, shrivelled seeds, which have a spicy

camphorous flavor. They are sometimes, though rarely, met with connected in their native clusters, constituting the *amomum racemosum*, or *amome en grappe*, of the French. They are similar in medicinal properties to the official, but are seldom used except in the southern parts of Europe.

Java Cardamom.—The plant producing this variety is supposed to be the *amomum maximum* of Roxburgh, growing in Java and other Malay islands in the East. The capsules are oval, or oval-oblong, often somewhat ovate, from 1.5 to 3 cm. long, and from 8 to 15 mm. broad, usually flattened on one side and convex on the other, sometimes curved, three-valved, and occasionally imperfectly three-lobed, of a dirty grayish-brown color, and coarse fibrous appearance. When soaked in water, they exhibit as their distinguishing character from nine to thirteen ragged membranous wings along their whole length. The seeds have a feebly aromatic taste and odor. This variety of cardamom affords but a very small proportion of volatile oil, is altogether of inferior quality, and, when imported into London, is usually sent to the continent.

Madagascar Cardamom.—This is the *Cardamomum majus* of Geiger and some others, and is thought to be the fruit of *Amomum angustifolium*, of Sonnerat, growing in marshy grounds in Madagascar. The capsule is ovate, pointed, flattened on one side, striated, with a broad circular scar at the bottom, surrounded by an elevated, notched, corrugated margin. The seeds have an aromatic flavor similar to that of official cardamom.

Bengal or Nepal Cardamom.—The fruit of *Amomum subulatum*, Boxb., sometimes known by the name of winged Bengal cardamom. *Morung elachi*, or *Buro elachi*, is about 2.5 cm. in length, obscurely three-sided, ovoid or somewhat obconic, with nine narrow, jagged ridges or wings (best seen after soaking in water) upon its distal end, which terminates in a truncate bristly nipple. The pericarp is coarsely striated, of a deep brown, splitting into three valves, disclosing a three-lobed mass of seeds, 60 to 80 in number.

Nepal Cardamom is produced by an *Amomum* of undetermined species, and resembles the Bengal cardamom, except in having a long tubular calyx on its summit, and in being usually attached to a stalk.

Grains of Paradise. Grana Parodisi.—Under this name and that of *Guinea grains*, and *Melegueta* or *Mallaguetta pepper*, are found in commerce small seeds of a round or ovate form, often angular, and somewhat cuneiform, minutely rough, brown externally, white within, of a feebly aromatic odor when rubbed between the fingers, and of a strongly hot and peppery taste. Two kinds of them are known in the English market, one larger, plumper, and more warty, with a short conical projecting tuft of pale fibers on the umbilicus; the other smaller and smoother and without the fibrous tuft. The latter are the more common. It is probable that one of the varieties is produced by *Amomum Grana Parodisi* of Sir J. E. Smith, and the other by Roscoe's *Amomum Melegueta*. (Pereira's *Mat. Med.*, 3d ed., p. 1134.) W. F. Daniell, who has published (*P. J.*, xiv 312 and 356) an elaborate paper on the Amoma of Western Africa, states that the true Mallaguetta pepper is obtained exclusively from varieties of the same species to which belong the *Amomum Granum Parodisi* of Afzelius and the *A. Melegueta* of Roscoe; while the *A. Grana Parodisi* of Sir J. E. Smith is a different plant, and yields a different product. These grains are imported from Guinea, and other parts of the western coast of Africa. Similar grains are taken to England from Demerara, where they are obtained from a plant cultivated by the negroes, supposed to have been brought from Africa, and believed by Pereira to be the *Amomum Melegueto* of Roscoe. (*P. J.*, vi, 412.) Their effects on the system are analogous to those of pepper; but they are seldom used except in veterinary practice, and to give artificial strength to spirits, wine, beer, and vinegar. Pereira points out seven distinct Scitamineous fruits to which the name of grains of Paradise has been applied by different authors. J. C. Thresh made a proximate analysis of the seeds, and found volatile oil, resin, tannin, starch, albuminoids, and an active principle in the form of a straw-colored viscid, odorless fluid, pungent, but not so hot as capsaicin. (*P. J.*, 1884, p. 297.) Fred'k Schwartz found in the seeds a reddish-brown acrid resin, and an oil having a burning aromatic taste, upon which the virtues probably depend. (*A. J. P.*, 1886, 118; consult also Hanausek's researches on grains of Paradise in *Chem. Ztg.*, 1893, 1765.)

Bastard Cardamom, the seeds of *Amomum Xanthioides* Wall., resembles true cardamom in appearance, but is of a dirty green color, and has a very biting camphor-like taste. B. Niederstadt gives the following as the results of analysis of the true (hulled) seed and of the bastard cardamom:

	True.	Bastard.
Water	15.25	15.50
Ether soluble extract	5.10	4.04
Ash	6.55	7.50
Starch and sugar	28.84	24.00
Cellular tissue, nitrogenous mat- ters and extractive.....	44.26	48.96

A cardamom from East Africa, with a flavor resembling that of official cardamom and of the Korarima cardamom, is said to have been seen in the London market, but apparently has not been identified.

The official cardamoms are produced solely in India, chiefly in Malabar, Mysore, and adjacent regions. Malabar cardamoms are rather smaller than Mysore cardamoms.

The cardamom plant has a tuberous horizontal rhizome, sending up from eight to twenty erect, simple, smooth, green and shining, perennial stems, which rise from six to twelve feet in height, and bear alternate elliptical-lanceolate sheathing leaves. The flower-stalk proceeds from the base of the stem, and lies upon the ground, with the flowers arranged in a panicle. The fruit is a three-celled capsule, containing many seeds; during drying it is said to lose three-fourths of its weight.

This valuable plant is a native of the mountains of Indochina, where it springs up spontaneously in the forests after the removal of the undergrowth, and is very extensively cultivated by the natives. Recent reports indicate that the cultivation of cardamom is being discontinued in favor of cinchona and rubber plantations on both the Malabar Coast as well as in Ceylon. For a detailed account of culture, see *A. J. P.*, 1877, 605; also *P. J.*, 1888, and *Bull. des Sc. Pharmacol*; Paris, 1906, pp. 114 and 584. Cardamoms have also been cultivated to some extent in tropical America. The plant begins to yield fruit at the end of the fourth year, and continues to bear for several years afterwards. The capsules when ripe are picked from the fruit-stems, dried over a gentle fire or by sun-heat, and separated, by rubbing with the hands, from the footstalks and adhering calyces. J. W. Mollison describes the method of washing and curing cardamoms employed in the Bombay Presidency, India. The washing and manipulation is performed by women, and water from special wells is employed. The cardamoms are first washed in earthenware vessels containing a mixture of the well water with pounded soap nut and a species of acacia, in the proportion of two

pounds of the former to a quarter pound of the latter. About ten pounds of cardamoms are treated at one time. Two women stir them vigorously in the mixture for about one minute and then allow them to rest about an equal length of time, and again stir for another minute. A thick lather results. This completes the first washing, after which the cardamoms are baled out by hand into a basket where they are allowed to drain for a few seconds, and then subjected to a second washing similar to the first except that the mixture contains less of the soap nut preparation and an additional quantity of soap solution. They are then thrown upon a mat and sprinkled with water from the special well at intervals of a half hour, until the next morning, when they are spread upon the roof of a house and allowed to dry for four or five hours. After nipping off the short stalk, an operation performed with a large pair of shears, the cardamoms are sorted, only the most plump fruits being prepared for the foreign market. Besides bleaching by this process, cardamoms are also subjected to starching in India. The starched product has a whiter appearance than, the bleached cardamoms. The starch is prepared by pounding together rice, wheat, country soap and buttermilk. The paste is diluted with water and sprinkled over the cardamoms as they are nibbed by hand. (*B. C. D.*, 1904, see also *Ph. Era*, 1904, 137.) Most of the cardamom is sent to Bombay, from whence it is shipped to London, about 250,000 pounds being marketed annually. Thus prepared, they are ovate-oblong, from 10 to 17 mm. long, from 6 to 8 mm. thick, three-sided with rounded angles, obtusely pointed at both ends, longitudinally wrinkled, and of a yellowish-white color. The seeds constitute about 74 parts per cent. by weight. According to Pereira, three varieties are distinguished in commerce: 1, the shorts, from 6 to 12 mm. long, from 4 to 6 mm. broad, browner and more coarsely ribbed and more highly esteemed than the others; 2, the *long-longs*, from 14 to 25 mm. in length by 4 to 6 mm. in breadth, elongated, and somewhat acuminate; and 3, the *short-longs*, which are somewhat shorter and less pointed than the second variety. The odor of cardamom is fragrant, the taste warm, slightly pungent, and highly aromatic.

"Mostly agglutinated in groups of from 2 to 7, the individual seeds, oblong-ovoid in outline, 3- or irregularly 4-sided, convex on the dorsal surface, strongly longitudinally grooved on one side, from 3 to 4 mm. in length; externally reddish-gray-brown, coarsely tuberculated, and with more or less adhering portions of the membranous aril; in section showing a thin reddish-brown seed-coat, a large white perisperm and a central, greenish endosperm enclosing a small straight embryo; odor

aromatic; taste aromatic, pungent. The powder is greenish-brown; consisting chiefly of coarse angular fragments of cells of the reserve layers and seed-coat; cells of endosperm and perisperm filled with compound starch grains, the individual grains from 0.001 to 0.004 mm. in diameter; fragments of seed with dark brown stone cells, which are polygonal in surface view and about 0.02 mm. in diameter; in mounts made with hydrated chloral T.S. single prisms or crystals in rosette aggregates may separate in the cells of the endosperm and perisperm; fragments of spiral tracheae with accompanying slightly lignified bast-fibers relatively few. Cardamom Seed yields not more than 8 per cent. of ash." *U.S.*

"Fruits from one to two centimetres long, ovoid or oblong, bluntly triangular in section, shortly beaked at the apex, pale buff in color, plump and nearly smooth or with slight longitudinal striations. Seeds dark reddish-brown, about three millimetres in length and the same in breadth and thickness, irregularly angular, transversely wrinkled, and enclosed in a thin, colorless, membranous aril. The powdered Seeds exhibit abundant, minute, angular starch grains, often compacted into masses; but no spiral vessels, sclerenchymatous fibres, or strongly elongated sclerenchymatous cells (absence of pericarps). Aromatic odor; taste agreeably warm and aromatic. Ash not more than 6 per cent." *Br.*

Cardamom yields its virtues to water and alcohol, but more readily to the latter. The seeds contain 4.6 per cent. of volatile oil, 10.4 of fixed oil, 2.5 of a salt of potassium mixed with a coloring principle, 3.0 of starch, 1.8 of nitrogenous mucilage, 0.4 of yellow coloring matter, and 77.3 of ligneous fiber. (Trommsdorff.) The volatile oil is colorless, of an agreeable and very penetrating odor, and of a strong aromatic, burning, camphorous, and bitterish taste. It is dextrogyrate, and consists essentially of a terpene, $C_{10}H_{16}$, with small quantities of formic and acetic acids. From old specimens of oil Dumas and Peligot claim to have separated crystals of *terpene hydrate*, $C_{10}H_{20}O_2 + H_2O$, while Fluckiger has obtained a crystalline deposit from Ceylon oil which he considers identical with common camphor. Weber (*Ann. Ch. Ph.*, ccxxxviii, 98) found a small amount of a crystalline non-volatile compound which fuses at 60° to 61° C. (140°-141.8° F.). Schimmel & Co. published in their semi-annual reports for April and October, 1897, some results of investigation of several varieties of cardamom oil. The terpenes of Ceylon oil they state to be *terpinene* and *dipentene*; both Ceylon and

Bengal cardamom contain *cineol*, C₁₀H₁₈O; Malabar cardamom yields *terpineol* as well as cineol, while Siam cardamom yields a crystalline sediment composed of borneol and camphor in approximately equal proportions. The sp. gr. of the oil is between 0.92 and 0.94. It cannot be kept long without undergoing change, and finally, even though excluded from the air, loses its peculiar odor and taste. If ether be made to percolate through the powdered seeds, and the liquor obtained be deprived of the ether, a light greenish-brown fluid remains, consisting almost exclusively of the volatile and fixed oils. It has the odor of cardamom, and keeps better than the oil obtained by distillation. (*A. J. P.*, xxi, 116.) The oil of cardamom of commerce is often factitious, being composed of several cheap volatile oils, oils of cajuput, nutmeg, and others being used. Schimmel & Co. announced in 1901 that they no longer distilled the oil from the fruit of *Elettaria cardamomum*, but from the seeds of another species; this oil makes a clear solution with three parts by volume of 70 per cent. alcohol. (*Schim. Rep.*, 1901, 14.) See *Oil of Cardamom*, N. F. IV., Part II. The seeds should be powdered only when wanted for use, as they retain their aromatic properties best while in the capsule.

Cardamoms are sometimes adulterated; G. W. Kennedy reported nearly 4 per cent. of orange seeds and unroasted grains of coffee admixed with cardamom. Solstein (1892) found that pure powdered cardamom yields 8.36 per cent. of ash; three commercial samples of powdered cardamom that he examined contained sodium carbonate.

Uses.—Cardamom is a grateful aromatic, not strongly heating or stimulating, and useful chiefly as an adjuvant. Throughout the East Indies it is largely consumed as a condiment. It was known to the ancients, and derived its name from the Greek language. In this country it is employed chiefly as an ingredient in compound preparations.

Dose, fifteen to thirty grains (1-2 Gm.).

Off. Prep.—Fluidextractum Aromaticum (from Aromatic Powder), *U. S.*; Pulvis Aromaticus, *U. S.* (Br.); Pulvis Cretae Aromaticus, Br., *N. F.*; Tinctura Cardamomi, *U. S.*; Tinctura Cardamomi Composita, *U. S.*, *Br.*; Tinctura Aromatica, *N. F.*

Carnauba Root.—This root, the product of *Copernicia cerifera* (AT.) Mart. (*Corypha cerifera*), the Brazilian wax palm, is several feet in length, about three-eighths of an inch thick, with a thick friable cortex of a mixed grayish and reddish-brown color. (A. J. P., 1875, 349.) E. L. Cleaver found in it tannic acid, an acrid resinous body, a red coloring matter, and a minute portion of volatile oil and of an alkaloid (P. J., 1875, 965.) It is said to act like sarsaparilla. *Carnauba Wax*, with which the young leaves of the palm are coated, is a dark colored, hard, brittle wax, melting at from 83° to 88° C. (181.4°-190.4° F.) and possessing an acid number of 4 to 8, a saponification value of 80 to 95, and an iodine number of 7 to 13. (See under Cera, p. 310.) It is used in church candles to prevent guttering, for the manufacture of phonograph records, in the composition of sealing wax and for other purposes in the arts.

Carota. U. S. 1870. *Carotte*, Fr. *Mohre*, *Gelbe Rube*, G. *Daucus Carota* L.—The wild carrot (Fam. *Umbelliferae*) is widely distributed, growing along fences, and in neglected fields. It grows wild also in Europe. The well-known garden carrot is the same plant altered by cultivation. The fruits are very light, of a brownish color, an oval shape, flat on one side and convex on the other, and on their convex surface present four longitudinal ridges, which are beset with stiff, whitish hairs or bristles. They have an aromatic odor, and a warm, pungent, and bitterish taste. By distillation they yield a pale yellow volatile oil, upon which their virtues chiefly depend. Schimmel & Co. found the distilled brownish-yellow oil to possess the odor of carrots only to a slight extent and to yield 1.26 per cent. (*Schim. Rep.*, 1907, 31.) Pictet isolated from the leaves of carrots a liquid alkaloid. (*Chem. Ztg.*; 1905, No. 97.) Subsequently two volatile alkaloids, *pyrrolidine* and *daucine*, were reported to be present by Pictet and Court. Carrot seeds are slightly aromatic, moderately excitant and diuretic, and have been employed as a diuretic in chronic *renal diseases* and in *dropsy*. An ounce of them may be given in infusion, in a day. The flowers are sometimes substituted for the seeds, and the scraped root has been used as a local stimulant to sloughing or *indolent ulcers*. For additional information concerning this drug, see *U. S. D.*, 19th ed., p. 1432.

Carthamus. *Carthamus tinctorius* L. *Safflower*.—The African, false, American, or dyers' saffron is an annual composite, with a smooth, erect stem, somewhat branched at top, and a foot or two in height. The plant is a native of India, the Levant, and Egypt, and is cultivated in those countries, as well as in various parts of Europe and America. The fruit yields 25.82 per cent. of fixed oil, the separated kernels of the seeds, 50.37 per cent., according to Fendler. (*Ap. Ztg.*, 1904, 121.) The florets are brought to us chiefly from the ports of the Mediterranean. *Safflower* (*Flores Carthami*; *Flours de carthame*, *Safran batard*, Fr.; *Saflor*, Gr.; *Cartamo*, It., Sp.) in mass is of a red color, diversified by the yellow of the styles contained within the floret. It has a peculiar, slightly aromatic odor, and a scarcely perceptible bitterness. It contains a fixed oil; also two coloring substances—one red, insoluble in alkaline liquids, and called *carthamin* or *carthamic acid* by Dobereiner, who found it to possess weak acid properties; the other yellow, and soluble in water. Carthamin, $C_{14}H_{16}O_7$, exists to the amount of from 0.3 to 0.6 per cent. only in the safflower, while the safflower-yellow, to which Malin gives the formula $C_{24}H_{30}O_{15}$, is present to the amount of from 24 to 30 per cent. It is the former which renders safflower useful as a dye stuff. Kametaka and Perkins give the formula of carthamin as $C_{25}H_{24}O_{12}$. (P. J.,

1910, 299.) These flowers are sometimes fraudulently mixed with saffron, which they resemble in color, but from which they may be distinguished by their tubular form, and the yellowish style and filaments which they enclose. In large doses *carthamus* is said to be laxative, and, administered in warm infusion, diaphoretic. It is used in domestic practice, as a substitute for saffron, in *measles*, *scarlatina*, and other *exanthematous diseases*, to promote the eruption. An infusion, two drachms to a pint of boiling water, is usually employed *pro re nata*.

Caruba di Gulden.—Under this name are largely used, for the relief of *asthma*, certain gall-like bodies, formed on various species of *Pistacia*, especially *P. Terebinthus* L., as the result of the stings of a hemipterous insect. According to Ignaz Hoffman, they are used for smoking and fumigation. For this purpose they are coarsely pulverized and burned in the bowl of a pipe, or in a dish, using a small funnel attached to a rubber tube for inhaling the fumes. Preparations should be made beforehand, so that the smoke may be inhaled at the commencement of the attack. They appear to act by exciting free secretion, probably through the turpentine with which they are saturated. They are said to be useful in chronic bronchitis. (*S. Jb.*, Bd. clii.)

CARUM. U. S. (Br.)

CARAWAY [Carawayseed, Caraway Seed]

“The dried fruit of *Carum Carvi* Linne (Fam. *Umbelliferae*). Without the presence or admixture of more than 3 per cent. of other fruits, seeds or foreign matter. Preserve Caraway in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects.” *U. S.* “Caraway Fruit is the dried ripe fruit of *Carum Carvi*, Linn.” *Br.*

Carul Fructus. *Br.*; Caraway Fruit; Carvies, Cumin des Pres, Carvi,. *Fr. Cod.*; Fructus Carvi, *P. G.*; Gemeiner Kum-&el, Kummel, Garbe, *G.*

The caraway plant is biennial and umbelliferous, with a spindle-shaped, fleshy, whitish root, and an erect stem, about two feet in height, branching above, and furnished with doubly pinnate, deeply incised leaves, the segments of which are linear and pointed. The flowers are small and white, and in erect terminal umbels, with an involucre, consisting sometimes of three or four bracts, sometimes of one only, and are destitute of partial involucre.

It is a native of Europe, growing wild in meadows and pastures, and cultivated in many places. It has been introduced in many places in this country, especially in the North. The flowers appear in May and June,

and the seeds, which are not perfected until the second year, ripen in August. The root, when improved by culture, resembles the parsnip, and is used as food in Northern Europe. The fruits are the part used in medicine. They are collected by cutting down the plant, and threshing it on a cloth. Our markets are supplied partly from Europe, partly from our own gardens. The American fruits are usually rather smaller than the German. Under the name of *Ajowan*, the fruits of the *Carum Ajowan*, Bentham & Hooker (*Ammi copticum* L.) are largely used in India. (See *Ajowan*, Part II.) They contain about 4 per cent. of a volatile oil, which has the odor of the oil of thyme, and contains thymol; it may be used as an aromatic carminative. (See *B. M. J.*, June 6, 1885.)

Caraway is officially described as follows: "Mericarps usually separated, crescent-shaped, 3 to 7 mm. in length, 1.5 mm. in diameter; externally dark brown with 5 yellowish filiform ribs; in transverse section nearly equilaterally pentagonal, the commissural surface with two vittae, the dorsal surface with a vitta between each of the primary ribs; oily endosperm large, enclosing a small embryo; odor and taste agreeably aromatic. Under the microscope, transverse sections of Caraway show an epidermal layer of slightly tangentially elongated cells with thick outer walls; a layer of several rows of tangentially elongated parenchyma cells, frequently more or less collapsed; a single, large, elliptical, brown vitta or oil-tube between each of the ribs and surrounded by small epithelial or secretion cells; in each of the ribs a single fibro-vascular bundle surrounded by a layer of thick-walled sclerenchymatous fibers; inner epidermis of broadly elongated cells with very thin side walls, being very frequently broken and closely coherent with the more or less brownish collapsed cells of the seed-coat; commissural surface with 2 large vittae and at the middle portion 2 large transverse hollow spaces formed by the separation of the tissues of the seed-coat on one side and the pericarp on the other, otherwise, the cells resemble those on the dorsal surface; endosperm large, cells polygonal with thick walls and containing a fixed oil and aleurone grains, the latter not infrequently containing a small rosette aggregate or prism of calcium oxalate. The powder is yellowish-brown, mostly of irregular, angular fragments; cells of endosperm, with aleurone grains each usually containing a rosette aggregate of calcium oxalate about 0.001 mm. in diameter; fragments with light-yellow vittae, together with nearly iso-diametric or polygonal, yellowish-brown, inner epidermal cells of pericarp; fragments with trachea and sclerenchymatous fibers, the latter 0.01 mm. in width, slightly lignified and with numerous oblique

pores. Caraway yields not more than 8 per cent. of ash." U. S.

"Mericarps usually separate; each from about four to six millimetres long and about one millimetre broad; brown with paler primary ridges; slightly curved, tapering towards each end, and glabrous. In transverse section, six vittae in each mericarp. Odor and taste aromatic. Ash not more than 9 per cent." *Br.*

They have an agreeable aromatic odor, and a sweetish, warm, spicy taste. These properties depend on an essential oil, which they afford largely by distillation. (See *Oleum Cari.*) The residue is insipid. They yield their virtues readily to alcohol and more slowly to water.

"Drawn caraway seeds," a term applied to such as have been recovered from the still residue after obtaining the volatile oil, are used to adulterate caraway; the exhausted "seeds" are much darker in color than are the genuine and are less odorous. (P. J., 1896,150.) While this is the principal form of adulteration, they may contain large amounts of stems, gravel, sand, dust, weed seeds and other impurities.

Uses.—Caraway is a pleasant stomachic and carminative, occasionally used in *flatulent colic*, and as an adjuvant or corrective of other medicines. The dose in substance is from fifteen to thirty grains (1-2 Gm.). An infusion may be prepared by adding two drachms of the seeds to a pint of boiling water. The volatile oil, however, is most employed. (See *Oleum Cari.*) Three and a half ounces of the oil of caraway caused violent vomiting and abdominal pain, with loss of consciousness, ending, however, in recovery. The urine contained both acetone and albumin. (*Cb. I. M.*, xxii, 1902.) In culinary operations the seeds are added to cakes, to which they communicate an agreeable flavor, while they stimulate the digestive organs.

Dose, fifteen to thirty grains (1-2 Gm.).

Off. Prep.—Aqua Carui, *Br.*; Confectio Piperis, *Br.*; Pulvis Opii Compositus, *Br.*; Tinctura Cardamomi Composita, *U. S.*, *Br.*; Tinctura Sennas Composita, *Br.*

Carya. *Hicoria. Hickory.*—Several species of the genus *Carya* Nuttall (*Hicoria*, Eaf.) grow in the United States of which *Carya illinoensis* (Wang.) K. Koch bears the pecan nut, and grows in the Middle and Southwestern States; *C. ovata* (Mill.) K. Koch, a large and handsome tree known as shell-bark or shag-bark hickory, is the chief source

of the hickory nuts of the market. There are six other common species of carya which are indigenous to the United States and Canada, and all yield edible fruits. The leaves of most if not all of these trees are somewhat aromatic and astringent, and the bark astringent and bitter. In the bark of *H. alba* F. R. Smith found a crystalline principle, *carryin*, which he believed to be *quercetrin*.

CARYOPHYLLUS. U. S. (Br.)

CLOVE Caryoph. [Cloves]

"The dried flower-buds of *Eugenia aromatica*. (Linne) O. Kuntze, *Jambosa Caryophyllus* (Sprengel) Niedenzu (Fam. *Myrtaceae*), without the presence or admixture of more than 5 per cent. of the peduncles, stems or other foreign matter." U. S. "Cloves are the dried flower-buds of *Eugenia caryophyllata*, Thunb." Br.

Caryophyllum, Br.; Caryophylli Aromatici; Girofle, *Fr. Cod.*; Gerofle, Clous Aromatiques, Clous de Girofle, *Fr.*; Caryophylli, *P. G.*; Gewurzelken, Nagelein, *G.*; Garofani, *It.*; Clavo de especia, *Sp.*; Cravo da India, *Portug.*; Kruidnagel, *Dutch*; Kerunfel, *Arab.*

Eugenia aromatica (L.), O. Kuntze, is a small tree inhabiting the Molucca Islands and Southern Philippines. It has a pyramidal form, is always green, and is adorned throughout the year with a succession of beautiful rosy flowers. The stem is of hard wood, and covered with a smooth, grayish bark. The leaves are opposite, petiolate, about four inches in length by two in breadth, obovate-oblong, acuminate at both ends, entire, sinuated, with many parallel veins on each side of the midrib. They have a firm consistence and a shining green color, and when bruised are highly fragrant. The flowers are disposed in terminal corymbose panicles, and exhale a strong, penetrating, and grateful odor.

The natural geographical range of the clove is extremely limited, being confined to the Molucca or, as they were one time called, Clove Islands. According to Fluckiger, cloves were known in Western Europe as early as the sixth century, long before the discovery of the Moluccas by the Portuguese. After the conquest of the Molucca Islands by the Dutch, the monopolizing policy of that commercial people led them to extirpate the trees in nearly all the islands except Amboyna and Temate, which were under their immediate inspection. Notwithstanding their jealous vigilance, a French governor of the Islands of France and Bourbon, named Poivre, succeeded, in the year 1770, in obtaining plants from the

Moluccas and introducing them into the colonies under his control. Five years afterwards the clove-tree was introduced into Cayenne and the West Indies, in 1803 into Sumatra, and in 1818 into Zanzibar. At present the spice is cultivated both in the West and East Indies, in tropical Africa, and in Brazil. Approximately seven-eighths of the world's clove supply is grown in Zanzibar, the deliveries in 1911 totaled over 20,000,000 pounds. The amount imported in the United States is approximately 3,500,000 pounds annually.

The unexpanded flower buds are the part of the plant employed under the ordinary name of cloves. They are first gathered when the tree is about six years old. The fruit has similar aromatic properties, but much weaker. The buds are at first white, then become green, and then bright red, when they must be at once collected, which is done by hand picking, or by beating the trees with bamboos and catching the falling buds. In the Moluccas they are said to be sometimes immersed in boiling water and afterwards exposed to smoke and artificial heat before being spread out in the sun. In Zanzibar, Cayenne, and the West Indies they are dried simply by solar heat. The stems of the flowers also enter commerce. They possess the odor and taste of the cloves, but they are worth only about one-fifth the price of the cloves, as they are deficient in volatile oil. They are largely used as an adulterant in ground cloves, and are used in the manufacture of oil of cloves. In France they are generally known by the name of *griffes de girofle*.

Although it is stated that as early as 266 B.C., during the reign of the Han dynasty, the Chinese court officers were accustomed to hold cloves in their mouths before addressing the sovereign, that their breath might have an agreeable odor, the spice seems to have been first introduced into Europe in the fourth century, and became a great source of wealth to the enterprising merchants of mediaeval Venice, who obtained it from the Arabians. After the discovery of the southern passage to India, the trade in this spice passed into the hands of the Portuguese, but was subsequently wrested from them by the Dutch, by whom it was long monopolized. The United States derive much of their supply from the West Indies and Guiana;

but the great sources of cloves have been recently the islands of Zanzibar and Pemba, on the east coast of Africa. In 1872 the clove orchards in Zanzibar were nearly destroyed by a hurricane, but they have been replanted. (For detailed information as to method of growth,

see P. J., June, 1890.) In commerce the varieties of cloves are known by the names of the localities of their growth, and so closely resemble one another as to be distinguished only by experts. The *Penang cloves* have been especially esteemed. The *Bencoolen cloves* from Sumatra are by many druggists deemed equal to them. The Amboyna and Molucca cloves are stated to be thicker, darker, heavier, more oily, and more highly aromatic than those cultivated elsewhere. Formerly cloves were frequently adulterated, but the comparatively low price of later times has discouraged this fraud. (See Kraemer, *Proc. A. Ph. A.*, 1894, 159.)

Properties.—Cloves resemble in shape a nail with a round head with four spreading points beneath it.

"From 10 to 17.5 mm. in length, of a dark brown or brownish-black color, consisting of a stem-like, solid, inferior ovary, obscurely four-angled or somewhat compressed, terminated by four calyx teeth, and surmounted by a nearly globular head, consisting of four petals, which enclose numerous curved stamens and one style; odor strongly aromatic; taste pungent and aromatic, followed by slight numbness. When Clove is pressed strongly between the thumbnail and finger the volatile oil becomes visible. Stems either separate or attached to the flower-buds; sub-cylindrical or four-angled, attaining a length of 25 mm. and a diameter of 4 mm., either simple, branching or distinctly jointed, and less aromatic than the flower-buds. The powder varies from dark brown to reddish-brown and consists chiefly of cellular fragments showing the large oil reservoirs, spiral tracheae and a few somewhat thick-walled, slightly-lignified, spindle-shaped bast-fibers; calcium oxalate in rosette aggregates, from 0.01 to 0.015 mm. in diameter; pollen grains numerous, tetrahedral, somewhat ellipsoidal, from 0.015 to 0.02 nun. in diameter. The presence of stems in the powder is shown by stone cells of irregular, polygonal shape, 0.07 mm. in diameter, with thick porous walls and large lumina, the latter frequently filled with a yellowish-brown amorphous substance. Clove yields not less than 10 per cent. of volatile extractive soluble in ether. Clove' yields not more than 8 per cent. of ash. The amount of ash, insoluble in hydrochloric acid, does not exceed 0.5 per cent. of the weight of clove taken." U. S.

"About fifteen millimetres long, each consisting of a dark-brown, wrinkled, subcylindrical, somewhat angular calyx tube which tapers below and is surmounted by four thick, rigid, patent teeth, between which are four paler, imbricated petals enclosing numerous stamens

and a single style. Odor strong, fragrant and spicy; taste very pungent and aromatic. Cloves emit oil when indented with the finger-nail. Ash not more than 7 per cent." *Br.*

Their color is externally deep brown, internally reddish; their odor strong and fragrant; their taste hot, pungent, aromatic, and very permanent. The best cloves exude a small quantity of oil on being pressed or scraped with the nail. When light, soft, wrinkled, pale, and of feeble taste and odor, they are inferior. Those from which the essential oil has been distilled are sometimes fraudulently mixed with the genuine. For monograph on the microscopical structure of cloves, clove stems and clove fruit see Winton and Moeller, "*The Microscopy of Vegetable Foods.*" Powdered cloves sometime contain an excess of clove stems, and may be adulterated with allspice, wheat middlings and powdered peas or beans. Occasionally clove stems alone are ground and sold as cloves. It is claimed that an enormous quantity of exhausted cloves are dishonestly marketed. The amount of volatile ether extract is the best criterion of the value of cloves.

Trommsdorf obtained from 1000 parts of cloves 180 of volatile oil, 170 of a peculiar tannin, 130 of gum, 60 of resin, 280 of vegetable fiber, and 180 of water. Win. L. Peabody (1895) found the percentage of tannin in cloves to range from 10 to 13 per cent., and that it has the same chemical composition as gallo-tannic acid. Lodibert afterwards discovered a fixed oil, aromatic and of a green color, and a white resinous substance which crystallizes in fasciculi composed of very fine diverging silky needles, without taste or odor, soluble in ether and boiling alcohol, and exhibiting neither alkaline nor acid reaction. This substance, called by Bonastre *caryophyllin*, was found in the cloves of the Moluccas, of Bourbon, and of Barbados, but not in those of Cayenne, from which, however, it has since been procured. To obtain it, the ethereal extract of cloves is treated with water, and the white substance thrown down is separated by filtration, and treated repeatedly with ammonia to deprive it of impurities. The most recent determination of its formula by Mylius (*Ber. d Chem. Ges.*, 1873, p. 1053) makes it $C_{20}H_{32}O_2$. Theod. Martins obtains it cheaply by exposing cloves, previously deprived as far as possible of oil by distillation with water, to distillation at a higher temperature, redistilling the brown liquid obtained until the distillate nearly ceases to have the taste or odor of cloves, and then purifying the residue by washing with water, and treating it with boiling alcohol and animal charcoal repeatedly until the

caryophyllin, which is deposited by the alcohol on cooling, is perfectly white. (See *A. J. P.*, xxxii, 65.) Dumas has discovered another crystalline principle, which forms in the water distilled from cloves, and is gradually deposited. Like caryophyllin, it is soluble in alcohol and ether, but differs from that substance in becoming red when touched with nitric acid. Bonastre proposed for it the name of *eugenin*. (*J. P. C.*, xx, 565.) It has the formula $C_{10}H_{32}O_6$, and is isomeric with eugenol or eugenic acid, a constituent of oil of cloves. Water extracts the odor of cloves with comparatively little of their taste. All their sensible properties are imparted to alcohol; and the tincture when evaporated leaves an excessively fiery extract, which becomes insipid if deprived of the oil by distillation with water, while the oil which comes over is mild. Hence it has been inferred that the pungency of this aromatic depends on a union of the essential oil with the resin. *Caryophyllic acid*, $C_{20}H_{32}O_6$, is obtained by gradually adding caryophyllin to fuming nitric acid, kept cool by immersing the vessel in water until crystals begin to separate; these are purified by dissolving them in ammonia, precipitating with hydrochloric acid, and redissolving in alcohol and crystallizing. For an account of the oil, see *Oleum Caryophylli*. The infusion and oil of cloves are reddened by nitric acid, and rendered blue by tincture of ferric chloride, facts of some interest, as morphine gives the same reactions.

Uses.—Cloves are among the most stimulant of the aromatics, but, like others of this class, act less upon the system at large than on the part to which they are immediately applied. They are sometimes administered in substance or infusion to relieve *nausea* and *vomiting*, correct *flatulence*, and excite *languid digestion*; but their chief use is to assist or modify the action of other medicines. They enter into several official preparations.

The French Codex directs a *tincture of cloves* to be prepared by digesting for ten days, and afterwards filtering, a mixture of three ounces of powdered cloves and sixteen of 80 per cent. alcohol.

Dose, in substance, from five to ten grains (0.32 to 0.65 Gm.).

Off. Prep.—Infusum Aurantii Compositum, *Br.*; Infusum Caryophylli, *Br.*; Pulvis Cretae Aromaticus, *Br.*, *N. F.*; Tinctura Lavandulae Composita, *U. S.*; Cordiale Rubi Fructus, *N. F.*; Elixir Rubi Compositum, *N. F.*; Pulvis Aromaticus Rubifaciens, *N. F.*; Pulvis Cretae et Opii

Aromaticus (from Aromatic Chalk Powder), *N. F.*; Pulvis Myricae Compositus, *N. F.*; Tinctura Aromatica, *N. F.*

Cascara Amarga. Honduras Bark.—The bark of *Picramnia antidesma* Siv. (Fam. *Simarubaceae*), a shrub growing in Jamaica, Mexico, Panama, and Columbia. It is a bitter tonic credited with specific alterative properties. For an elaborate discussion of the microscopic and chemical characters of the bark and its alkaloid picramnine, by Thompson, see *A. J. P.*, June, 1884.

CASCARA SAGRADA. U. S.. Br.

CASCARA SAGRADA. Case. Sagr. [Rhamnus Purshiana U.S. VIII]

"The dried bark of the trunk and branches of *Rhamnus Purshiana* De Candolle (Fam. *Rhamnaceae*)." *U. S.* "Cascara Sagrada is the dried bark of *Rhamnus Purshianus*, DC., collected at least one year before being used." *Br.*

Rhamni Purshiani Cortex, *Fr. Cod.*; Sacred Bark; Chitem Wood Bark, Dogwood bark, Coffee-berry bark, Pigeon-berry bark, Bear-berry bark. Bitter bark and Yellow bark; Cascara Sagrada, *Sp.*

A number of species of *Rhamnus* have been described as growing in California, but according to the best authority there are only four species,—*R. alnifolia*, L'Her., *R. crocea*, Nutt, *R. Purshiana*, DC., and *R. californica*, Esch. Of these species, *R. alnifolia* is too rare in the Cascara district to be important; while the spinescent twigs, the very thick oval or roundish leaves, and the small roundish red fruit of *R. crocea* make it so distinct that it cannot be confounded with the Cascara, whose bark, moreover, it does not resemble. On the other hand, *R. californica* appears to be very commonly confounded with the official species by collectors, and to have yielded some of the cascara sagrada bark of commerce. *R. californica* is rare in Northern California, but abundant in the countries lying south and southeasterly, while *R. Purshiana* is abundant in Northern California, but scarce in the south, so that any bark collected in Northern California is probably genuine. *R. californica* is chiefly distinguished from the official species by its leaves being thin, and, when not smooth, having a short close pubescence, and the primary veins of the under surface not nearly so numerous, straight, or fine as those of *R. Purshiana*. Rusby thinks that its leaves are especially distinguished by the channel of the midrib of *R. californica* being

altogether absent, or shallow, or inconspicuous. Nevertheless the species so run into one another that competent botanists believe them identical.

The *Rhamnus Purshiana* is a small tree, attaining a height of twenty feet. Its leaves are rather thin, elliptic, for the most part briefly acutely pointed, finely serrated, at the base obtuse, somewhat pubescent beneath, from two to seven inches long and from one to three wide. The rather large flowers are in somewhat umbellate cymes; the sepals five; the minute cucullate petals bifid at the apex. The fruit is black, broadly obovoid, four lines long, three-lobed, and three-seeded. The seeds are convex on the back, with a lateral raphe. It is found in California, extending northward to the British territories. For details of manner of collecting the bark see an elaborate and illustrated article by Johnson and Hindman, *A. J. P.*, 1914, p. 387. The amount of Cascara that is collected annually varies between 3,000,000 and 4,000,000 pounds. Because of the rapid destruction of natural sources of the bark in the Western United States, experiments have been conducted by the Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C., to cultivate it.

The *Rhamnus californica*, or *Californian buckthorn* or *California coffee-tree*, yields a bark which is of a dark brown color externally and bright yellow internally, having an intensely bitter taste, with a persistent nauseous aftertaste, and very little odor. It is said to be much more distinctly purgative than that of *R. crocea*.

It does not seem possible to distinguish with certainty between the barks of the two species by their macroscopic appearance. The bark of *R. Purshiana* is usually more red than is that of *R. californica*, but it may be of a distinctly gray color. . The microscopic structure of the two barks is, however, different. The medullary rays in *R. Purshiana* are numerous, thin, for a long distance nearly parallel and straight (according to L. E. Sayre, they converge .at their outer ends), run nearly three-quarters of the distance through the bark, and are commonly composed of two rows of cells. In *R. californica* the medullary rays are much broader, much shorter, and are composed usually of three or more rows of cells; further, they are crooked and not parallel throughout their course. Again, the zone of resin spaces is much broader in *R. californica*, and the spaces themselves much larger and more numerous than in the official species. For further details and elaborations, see papers by H. H. Rusby, *Proc. A. Ph. A.*, 1890, and by Gathercoal, *J. A. Ph. A.*, 1915, p.

15. According to L. E. Sayre (A. J. P., March, 1897), the powder of the barks can be distinguished by paying attention to the fact that *R. Frangula* contains no stone cells, while in *R. californica* and *R. Purshiana* such cells are abundant, occurring in large, irregular groups below the cork and usually outside the region of the bast: *R. Purshiana* may also be distinguished from *R. californica* by color tests. After several days maceration in dilute alcohol the powder of *R. Purshiana* appears of an orange-yellow color, *R. californica* of a purplish color; or if 0.2 Gm. of the powdered bark be placed in a small test tube, and there be added 2 mils of potassium hydroxide test solution, *R. californica* will give a blood-red and *R. Purshiana* an orange-red color.

The bark of the *Rhamnus crocea*, the so-called California mountain holly, occurs in slightly curved pieces, externally of a dark brown color, internally of a characteristic red delicately streaked with numerous white veins. The odor is somewhat aromatic, the taste warming and not unpleasantly bitter. It is affirmed to be a tonic and mild laxative.

Properties.—Cascara sagrada occurs in commerce in the form of small broken pieces, often more or less flattened out into a somewhat compressed mass, and also as separated quills of varying length and size. The bark is " Usually in flattened or transversely curved pieces, occasionally in quills; bark from 1 to 5 mm. in thickness; outer surface dark brown or brownish-red, longitudinally ridged, often nearly covered with grayish or whitish lichens, bearing small blackish apothecia, sometimes with numerous lenticels, and occasionally with mosses; inner surface light yellow, light brown, or reddish-brown, longitudinally striate, turning red when moistened with solutions of the alkalies; fracture short, with projections of bast-fibers in the inner bark; in cross section inner bark shows diagonal or curved medullary rays, forming converging groups, the outer bark showing yellowish groups of stone cells which are especially apparent on moistening the freshly cut surface with phloroglucinol T.S. and hydrochloric acid; odor distinct; taste disagreeable, bitter, and slightly acrid. Under the microscope, a transverse section of Cascara Sagrada shows an outer yellowish-brown or reddish-brown corky layer consisting of 10 to 15 or more rows of cells; stone cells in outer bark in tangentially elongated groups of 20 to 50 cells, the walls being very thick and finely lamellated; medullary rays 1 to 4 cells wide, 15 to 25 cells deep, the contents being colored red upon the addition of solutions of the alkalies to the sections; bast-fibers in tangentially elongated groups in the inner bark, the walls being thick

and strongly lignified; crystal fibers around the bast-fibers with individual crystals from 0.008 to 0.015 mm. in length; parenchyma with spheroidal starch grains about 0.003 to 0.008 mm. in diameter, or with calcium oxalate either in rosette aggregates or prisms from 0.01 to 0.02 mm. in diameter. Add 0.1 Gm. of powdered Cascara Sagrada to 10 mls of hot water, shake the mixture occasionally until cold, filter it and add sufficient water to make 10 mls; on the addition of 10 mls of ammonia water to this liquid, it is colored an orange-yellow. Macerate 0.1 Gm. of powdered Cascara Sagrada with 10 drops of alcohol, boil the mixture with 10 mls of water, when cold filter it and shake the filtrate with 10 mls of ether; a yellow ethereal solution separates. Shake 3 mls of this ethereal solution with 3 mls of ammonia water; the separated ammoniacal solution still possesses, on diluting with 20 mls of water, a distinct, yellowish-red color. The powder is light brown to olive brown, showing characteristic elongated groups of bast-fibers associated with crystal fibers, the crystals in the latter being in the form of monoclinic prisms from 0.008 to 0.015 mm. in length; stone cells in large groups, the cells having thick and finely porous walls; fragments of parenchyma and medullary ray cells colored red upon the addition of solutions of the alkalies; starch grains either free or in parenchyma cells, the individual grains being somewhat spheroidal, from 0.003 to 0.008 mm. in diameter; calcium oxalate in monoclinic prisms or rosette aggregates from 0.01 to 0.02 mm. in diameter; occasional fragments of reddish-brown cork." *U. S.*

"In quilled, channelled, or nearly flat pieces from one to two millimetres thick, but varying in length and width. Cork nearly smooth, dark purplish-brown, marked with transversely elongated lenticels, but usually more or less covered with patches of silvery-grey lichen. Inner surface reddish-brown, with faint transverse corrugations and longitudinal striations. Fracture short, but near the inner surface somewhat fibrous. In transverse section, scattered groups of sclerenchymatous cells in both cortex and bast; the parenchymatous cells contain a yellow substance which is colored violet by *solution of sodium hydroxide*. Odor characteristic but not powerful; taste nauseous, bitter and persistent." *Br.*

For articles illustrating the pharmacognosy of Cascara bark see Kraemer, *A. J. P.*, 1912, p. 385; Miller, *J. A. Ph. A.*, 1912, p. 1207; and Farwell, *J. A. Ph. A.*, 1914, p. 649. According to the analysis of A. B. Prescott (*N. P.*, Feb., 1879), it contains a very bitter brown resin (which is colored a vivid purple-red by potassium hydroxide); a red resin; a

light yellow resin; tannic, malic, and oxalic acids; a neutral crystallizable substance; and a volatile oil. H. F. Meier and J. Le Roy Webber have pointed out in addition the presence of a ferment, glucose, and ammonia. According to these investigators, to the action of the ferment are attributed the unpleasant results attending the administration of "fresh bark"; "seasoned bark" —i.e., such as has been kept a year or two— owes its valuable properties as a laxative, free from griping, to the fact that the ferment has exhausted itself; the laxative properties, they state, reside in the resins, and the tonic effects are due to the crystalline principle. (*A. J. P.*, 1888, 91). Schwabe (*A. Pharm.*, ccxxvi, 569) found *emodin*, or trioxymethylantraquinone, which he believes is the active principle. Dohme and Engelhardt (*Proc. A. Ph. A.*, 1897, 193) have shown the analogy of cascara sagrada with *Rhamnus Frangula* by obtaining a glucoside to which they give the name of *purshianin*. This decomposes, yielding emodin. and a dextrorotatory non-fermentable sugar, while the frangulin of buckthorn yields emodin and rhamnose as the sugar. Purshianin forms brown-red needles, melting at 237° C. (458.6° F.). Dohme and Engelhardt failed to obtain in a pure form (*Proc. A. Ph. A.*, 1898, 340) the bitter principle of cascara sagrada. Le Prince (*C. R. A. S.*, 1892, 286) claimed to have obtained the active principle of cascara bark in a crystalline form, which he named *casarine*; his results are doubted by Jowett who believes that *casarine* and *purshianin* are impure forms of emodin. Jowett (*Proc. A. Ph. A.*, 1904, 288) in an exhaustive paper concludes that the active principle of cascara is contained in that portion of an alcoholic extract which is soluble in water and precipitable by lead subacetate and in that portion of the regenerated lead subacetate precipitate which is soluble in ethyl acetate. Pietsch states that a glucoside from the bark of cascara sagrada which has been named *peristaltin* has the composition C₁₄H₁₈O₈. (*Th. M.*, 1910, No. 1, p. 35.)

Uses.—Cascara sagrada belongs to the group of vegetable cathartics whose activity depends upon the presence of one or more oxides of methylantraquinone. This group includes aloes, cascara, rhubarb, and senna. In cascara the active principle appears to be emodin, which is trioxymethylantraquinone, and which appears also to be the purgative principle of aloes. The action of this principle is chiefly to excite peristalsis in the colon, although after large doses there is probably also some effect upon the upper bowel. As the action is chiefly upon the lower intestine it is not to be recommended as a laxative where it is desired to clean out the bowel, but in the treatment of *chronic*

constipation it acts very favorably. It often appears to restore tone to the relaxed bowel and in this way produce a permanent beneficial effect. The bark itself is rarely used, either the extract or fluidextract being eligible preparations.

The addition of belladonna to overcome any tendency to gripe is an advantage. Ordinarily a single dose is given at bedtime but in some cases better results are obtained by exhibiting smaller doses after meals.

Dose, ten to thirty grains (0.6-2.0 Gm.).

Off. Prep.—Extractum Cascarae Sagradae, *U. S. (Br.)*; Fluidextractum Cascarae Sagradae, *U. S. (Br.)*; Fluidextractum Cascaraa Sagradae Aromaticum, *U. S.*; Syrupus Cascarae Aromaticus, *Br.*; Elixir Cascarae Sagradae (from Aromatic Fluidextract), *N. F.*; Elixir Cascarae Sagradae Compositum (from Aromatic Fluidextract), *N. F.*, Fluidglyceratum Cascaraa Sagradae, *N. F.*; Fluidglyceratum Cascarae Sagradae Aromaticum, *N. F.*; Pilulae Aloini, Strychninae et Belladonnae Compositae) (from Extract), *N. F.*; Syrupus Ficorum Compositus (from Aromatic Fluidglycerate), *N. F.*

CASCARILLA. Br.

CASCARILLA

"Cascarilla is the dried bark of *Croton Eluteria*, *J. J. Benn.*" *Br.* "The dried bark of *Croton Eluteria* (Linne) Bennett (Fam. *Euphorbiaceae*), without the presence of more than 5 per cent. of adhering wood." *N. F.*

Cascarillae Cortex, *Br.* (1885), Cascarilla Bark, Sweet Bark, Sweetwood Bark; Cascarille officinale, *Fr. Cod.*; Cortex Eluteriae, Cortex Thuris; Chacrille, Ecorce eleutherienne Cascarille, *Fr.*; Cortex Cascarillae, *P. G.*; Cascarillrinde; Cascarilla, Kaskarillrinde, *G.*; Cascarilla, Cascariglia, *It.*, Chacarilla, Quina aromatica, *Sp.*

Croton Eluteria is a shrub or a small tree with a stem from four to eight inches in diameter. The stem is straight, and marked at intervals with white or grayish stains. The leaves are petiolate, often somewhat cordate at the base, obtusely acuminate, pale or grayish-green above, and densely covered beneath with shining silvery scales, appearing white at a distance. They are smaller and narrower in the plants of

arborescent growth. The flowers, which have a delicious odor, are monoecious, small, white, petiolate, and closely set in simple terminal or axillary spikes. The shrub is a native of the Bahamas, scarce at present in the island of New Providence, but still abundant in Andros, Long, and Eleutheria islands, from the latter of which is derived its botanical title. Daniell calls the plant *sweetwood*. The name of sea-side balsam belongs to another species, *C. balsamiferum* of Linnaeus, which grows in the Bahamas and other West India islands, and owes its name to the exudation of a balsamic juice from its young branches when wounded.

Under the name of "cascarilla," also "*Quina morada*," the bark of the *Pogonopus febrifugus* is said to be used in the Argentine Republic as a substitute for cinchona bark. There has been separated from it a blue fluorescent substance, . moradm, and an alkaloid, *moradeine*. (*P. J.*, xx, 854.)

Copalchi bark has been mistaken not only for cascarilla, but also for a variety of cinchona. Portions of it, having been taken to Europe, attracted the attention both of pharmacologists and physicians. Two kinds were noticed: one, in small slender quills, of an ash color, bearing some resemblance to a variety of pale cinchona, but having the flavor of cascarilla, and burning with a similar odor; the other in larger quills, with a thick cork-like epidermis, very bitter, and yielding an aromatic odor when burnt. The former is the product of *Croton Pseudochina*, Schlechtendal (*C. niveus* Jacquin); the latter is of unknown origin, but conjecturally referred to *C. suberosus*. J. E. Howard states that the quilled copalchi bark contains a bitter alkaloid, soluble in ether, and precipitable as a white hydroxide from its acid solution. (*P. J.*, xiv, 319.) Copalchi. bark is an aromatic tonic, employed in Mexico in intermittents, and capable of useful application in all cases requiring a mild aromatic bitter. Stark has employed it advantageously in feeble states of digestion with irritable bowels, and found it in one or two cases, to exhibit antiperiodic properties. It may be given in infusion, made with half an ounce of the bark to a pint of water, in the dose of one or two fluidounces three times a day. (*Ed. Med. and Surg. Journ.*, April, 1849, p. 410; see also *P. J.*, 1886, p. 917.)

Croton Cascarilla Bennett, known in the West Indies as *wild rosemary*, was at one time said to furnish the cascarilla of commerce. The bark is also substituted by the barks of *Croton gla-belliis* L. and *C. lucidus* L. of the Bahamas and which were formerly designated as the "mother

plants " of Cascarilla. They are not aromatic but astringent and slightly bitter. They are also distinguished by the presence of stone cells which are wanting in true Cascarilla. (See *U. S. D.*, 19th ed.)

Cascarilla is brought to this market from the West Indies, and chiefly, we have been informed, from the Bahamas. It comes in bags or casks. We have observed it in commerce in two forms, so distinct as to merit the titles of varieties. In one, the bark is in rolled pieces of every size, from three or four inches in length and half an inch in diameter to the smallest fragments, covered externally with a dull whitish or grayish-white epidermis, which in many portions is partially, sometimes wholly removed, leaving a dark brown surface, while the inner surface has a chocolate color, and the fracture is a reddish-brown. The small pieces are sometimes curled, but have a distinct abrupt edge as if broken from the branches. The second variety consists entirely of very small pieces, not more than an inch or two in length, very thin, without the white cork, not regularly quilled, but curved more or less in the direction of their length, often having a small portion of woody fiber attached to their inner surface, and appearing precisely as if shaved by a knife from the stem or branches. Whether these two varieties are derived from distinct species, or differ only because of the mode of collection, it is difficult to determine. A. W. Southall describes a bark (believed to belong to the genus *Croton*, and obtained from Colombia) in *P. J.*, 1894, 574.

"In quills usually from three to ten centimetres in length and from four to twelve millimetres in diameter, or in small curved pieces, Cork greyish-white, easily detached, and often more or less completely removed disclosing a dull brown cortex. Both cork and cortex frequently marked with numerous longitudinal and transverse cracks. Fracture short, the fractured surface exhibiting under a lens a dark reddish-brown bast traversed by numerous, thin, whitish medullary rays. In transverse section cork cells with strongly thickened outer walls, but thin inner walls, in which minute crystals of calcium oxalate are embedded; both cortex and bast free from sclerenchymatous cells. Aromatic odor, especially when burned; taste aromatic and bitter. Ash not more than 11 per cent." *Br.*

The National Formulary describes it as " in quills or curved pieces from 0.5 to 2.5 mm. in thickness, externally gray, somewhat fissured; the corky layer easily detached, more or less coated with a white lichen; the uncoated surface dull-brown, inner surface smooth; fracture short, the

fractured surface having a resinous and radially striate appearance. Odor characteristic, strong and musk-like when the bark is burned; taste warm, aromatic and very bitter. The powdered drug is pale-brown and has an odor resembling that of clove. When examined under the microscope, it exhibits simple starch grains up to 0.013 mm. in diameter and occasionally two- to three-compound; calcium oxalate in monoclinic crystals or rosette aggregates up to 0.025 mm. in diameter; fragments of parenchyma tissue, some of the cells containing starch, calcium oxalate or tannin; cells filled with reddish-brown resin or yellow oil; somewhat lignified cork cells, polygonal in outline with evenly thickened, lamellated walls and irregular lumina; non-porous bast fibers, some with lignified walls, up to 0.016 mm. in diameter; tracheas with bordered pores very few or absent. Cascarilla yields not more than 10 per cent of ash." *N. F.*

Cascarilla should yield not more than 10 per cent. of ash.

Properties.—Cascarilla has an aromatic odor, rendered much more distinct by friction, and a warm, spicy, bitter taste. It is brittle, breaking with a short fracture. When burned it emits a pleasant odor, closely resembling that of musk, but weaker and more agreeable. This property serves to distinguish it from other barks. It was analyzed by Trommsdorff, and more recently by Duval of Lisieux, in France. The constituents found by the latter were albumen, a peculiar kind of tannin, a bitter crystallizable principle called *cascarillin*, a red coloring-matter, fatty matter of a nauseous odor, wax, gum, volatile oil, resin, starch, pectic acid, potassium chloride, a salt of calcium, and lignin. The oil, according to Trommsdorff, constitutes 1.6 per cent., is of a greenish-yellow color, has a penetrating odor analogous to that of the bark, and is of the sp. gr. 0.938. G. Feudler (*A. Pharm.*, 1900, p. 671) finds the oil to contain about 2 per cent. of free acid, which consists of a liquid acid, $C_{11}H_{20}O_2$, to which the name of *cascarillic acid* was given, and a solid portion made up of a mixture of palmitic and stearic acids. The oil contains 0.3 per cent. of eugenol, a terpene differing from pinene, cymene, possibly some l-limonene, two sesquiterpenes and an alcohol, $C_{15}H_{23}OH$. To obtain cascarillin, Duval treated the powdered bark with water, added lead acetate to the solution, separated the lead by hydrogen sulphide, filtered, evaporated -with the addition of animal charcoal, filtered again, evaporated at a low temperature to a syrupy consistence, and having allowed the semi-liquid substance thus obtained to harden by cooling, purified it by twice successively treating

it, first with a little cool alcohol, to separate the coloring and fatty matters, and afterwards with boiling alcohol and animal charcoal. The last alcoholic solution was allowed to evaporate spontaneously. Thus obtained, cascarillin is white, crystalline, inodorous, bitter, very slightly soluble in water, soluble in alcohol and ether. (*J. P. C.*, 3e ser., vii, 96.) It melts at 205° C. (401° F.), is not volatile nor a glucoside. Its composition answers to the formula $C_{12}H_{18}O_4$. P. E. Alessandri regards *cascarilline* as an alkaloid, and obtains it economically by mixing powdered cascarilla with sufficient 3 per cent. aqueous solution of oxalic acid to cover it, shaking the mixture, and heating it to 60° C. (140° F.), then allowing it to cool, expressing the mixture and saturating the filtered liquor with ammonia, then evaporating at a low temperature to two-thirds of its bulk, allowing it to cool, and separating any deposit. The clear liquid is then shaken with ether; this takes up the cascarilline, which may be obtained through evaporation of the ethereal liquid. (*L'Orosi*, v, 1; *P. J.*, 1882, 993.) R. A. Cripps was unable to obtain the alkaloid by Alessandri's method, and suggests that the bitterness of the so-called cascarilline might be due to adherent resin. (*P. J.*, 1886, 1103.) Either alcohol or water will partially extract the active matters of cascarilla; but diluted alcohol is the proper menstruum. Naylor and Littlefield have reviewed the processes of Duval and Alessandri for preparing cascarilline, and find that Duval's method gives the purer product. They find its melting point to be 203.5° C. (398.3° F.), and give it the formula $C_{16}B_{24}O_5$. (*Y. B. P.*, 1896, 301.) W. A. H. Naylor subsequently found betaine in cascarilla, (*P. J.*, 1898, 279.)

Uses.—This bark is aromatic and tonic. It was known in Germany as early as the year 1690, and was much used as a substitute for Peruvian bark by those who were prejudiced against that febrifuge in the treatment of remittent and intermittent fevers. It has, however, lost its reputation, and is now employed only where a pleasant and gently stimulant (tonic is desirable, as in atonic dyspepsia, and other cases of debility of the stomach or bowels, especially in combination with the more powerful bitters. It may be given in powder or "in infusion. In consequence of its pleasant odor when burned, some smokers mix it in a small quantity with their tobacco; but it is said to occasion vertigo and intoxication.

Dose, twenty to thirty grains (1.3-2.0 Gffl.).

Off. Prep.—*Infusum Cascarillae, Br.*; *Tinctura Cascarillae, Br.*

Casearia. *Casearia esculenta* Roxb.—This Indian plant (fam. *Samydaceae*) is said to be a valuable remedy in hepatic torpor, and to contain an organic acid allied to cathartic acid. (*P. J.*, xx.)

Casimiroa. *Casimiroa edulis* La. Llav. *Zapote blanco*. *Cochilsapote*. *White Sapota*.—This is a large tree belonging to the *Rutaceae*, a native of Mexico, the leaves are employed in *diarrhea* and as an anthelmintic. The seeds are said to be narcotic. In them dose Sanchez (*Breve estudio Zapote blanco, Thesis, Mexico, 1893*) has found a resin and a crystalline alkaloidal body. The glucoside casimirose, found in this plant by Alta-mirano, as well as the alkaloidal glucoside *casimirin*, isolated by Bikorn (*A. Pharm.*, ccxii, p. 186), have been found by Esch and Kochmann (*A. I. P. T.*, 1911, xxi, p. 353) to be inert. The extracts of the crude drug, however, have pronounced narcotic properties. They conclude that this drug has the extraordinary property of abolishing the sensation of pain without affecting consciousness or motility. Somewhat in contradiction to this conclusion, however, are the results of Robin and Cojon (*Press. Med.*, 1909, p. 454) who find that the fluidextract of *casimiroa* in doses of one to two teaspoonfuls has hypnotic properties.

Cassia. *Cassia marilandica* L. *Wild Senna*. *American Senna*,. *Sene Americain*, Fr. *Amerikanische Senna*, G. (Fam. *Leguminosae*).—This is an indigenous perennial plant of vigorous growth, sending up annually numerous round, erect, nearly smooth stems, which are usually simple, and rise from three to six feet in height. The leaves are alternate, and composed of from eight to ten pairs of oblong-lanceolate, smooth, mucronate leaflets, green on their upper surface, pale beneath, and connected by short petioles with the common footstalk, which is compressed, channelled above, and furnished near its base with an ovate, stipitate gland. The *American senna* is common from New England to North Carolina. The leaves, which should be collected in August or the beginning of September, are sometimes brought into the market, compressed into oblong cakes, like those prepared by the Shakers from most herbaceous medicinal plants. The leaflets are from an inch and a half to two inches long, from one-fourth to half an inch in breadth, thin, pliable, and of a pale green color. They have a feeble odor, and a nauseous taste, somewhat analogous to that of senna. Water and alcohol extract their virtues. Hermann J. M. Schroeter (*A. J. P.*, 1888, 231) found in them *chrysophanic acid*; also an active principle corresponding in all respects with *cathartic acid*. For earlier analysis by Martin, see *A. J. P.*, i, 22. American senna is an efficient and safe cathartic, acting like senna but more feebly.

Cassia nictitans L., or *Wild Sensitive Plant*, was investigated by Gallaher (*A. J. P.*, 1888, 280), who failed to find any glucoside or alkaloid. The amount of volatile oil found was very small, and cathartic acid could not be prepared from it, although the powder produced griping. The leaves of *Cassia alba* L. are recommended by Conille-bault in *ringworm*; they are moistened and the parts affected rubbed with them. (*A. J. P.*, 1887, 266.)

Under the names of *Cheshmat*, *Chashmizok*, *Schischen*, the seeds of *C. Absus* L. are said to be used in India and Africa in the treatment of inflammations of the eye, either

in the form of a fine powder or an infusion made from the coarsely ground seeds to which several medicinal substances are added.

The root of the *Cassia bearensis* Miq. is said to be very useful in the so-called *black-water fever* of Africa. (See P. J., vols. xlvii, xlviii.)

CASSIA FRUCTUS. Br.

CASSIA PODS [Purging Cassia]

"Cassia Pods are the ripe fruits of *Cassia Fistula*, Linn." Br. "The dried fruit of *Cathartocarpus Fistula* (Linne) Persoon (Fam. *Leguminosae*)." N. F.

Cassia Fistula, N.F.IV, Purging Cassia, Pudding-stick (or pipe); Fructus Cassiae Fistulae; Casse Officinale, Fr. *Cod.*; Casse en batons, Pulpe de Casse, Casse Mondee, Casse, Fr.; Rohrenkassie, Purgircassie, Fistelkassie, G.; Cassia, It.; Cana fistula, Sp.

Cassia Fistula L. (*Cathartocarpus Fistula* Persoon). This is a large tree, with a trunk of hard, heavy wood, dividing towards the top into numerous spreading branches, and covered with a smooth ash-colored bark. The leaves are commonly composed of five or six pairs of opposite leaflets, which are petiolate ovate, pointed, undulated, smooth and of a pale green color. The flowers are large, of a golden yellow color, and arranged in long, pendent, axillary racemes. The fruit consists of long, cylindrical, woody, dark-brown, pendulous pods, which when agitated by the wind strike against each other and produce a sound that may be heard at a distance. This species of Cassia is a native of Upper Egypt and India, whence it is generally supposed to have been transplanted to other parts of the world. It is at present very extensively diffused through the tropical regions of the old and new continents, being found in Insular and Continental India, Cochin China, Egypt, Nubia, the West Indies, and the warmer parts of the continent of America. Under the name of *Golden Shower* it is known as an ornamental shade tree in all tropical countries. The fruit is the official part of the plant. It is imported from the East and West Indies, chiefly the latter, and from South America. Under the name of *Cassia Fistula* they were for a long time official.

Properties.—Cassia pods are a foot or more in length, straight, or but slightly curved, cylindrical, less than an inch in diameter, with a woody shell, externally of a dark-brown color, and marked with three

longitudinal shining bands, extending from one end to the other, two of which are in close proximity, appearing to constitute a single band, and the third is on the opposite side of the pod. These bands mark the place of junction of the valves of the legume, and are represented as sometimes excavated in the form of furrows. There are also circular depressions at unequal distances. It is described as follows: " Long, narrow, cylindrical, shortly stalked fruits about thirty-five to fifty centimetres in length, and fifteen to twenty-five millimetres in diameter. Pericarp nearly smooth, dark chocolate-brown or nearly black, thin and hard. Internally divided by thin transverse dissepiments into numerous compartments, each of which contains a smooth, oval, reddish-brown seed surrounded by a nearly black, sweet pulp." *Br.*

The N. F. describes it as in "cylindrical, from 25 to 50 cm. in length, about 20 mm. in diameter, chestnut-brown in color, on one side a longitudinal groove and on the other a smooth line or slight ridge, indicating the sutures; in-dehiscent, the cavity divided transversely into numerous compartments, each containing a reddish-brown, glossy, flattish-ovoid seed embedded in a blackish-brown sweet pulp. Odor resembling that of prunes." *N. F.*

The pods brought from the East Indies are smaller, smoother, have a blacker pulp, and are more esteemed than those from the West Indies. We have seen pods in the American market sold as cassia pods, which were an inch and a half in diameter, flattened on the sides, exceedingly rough on the outer surface, and marked by three longitudinal very elevated ridges, corresponding to the bands or furrows of the common cassia. The pulp was rather nauseous, but in other respects seemed to have the properties of the official purging cassia. They corresponded exactly with a specimen of the fruit of *Cassia brasiliana*, Lam., brought from the West Indies, and were probably derived from that plant.

The heaviest pods, and those which do not make a rattling noise when shaken, are to be preferred, as they contain a larger portion of the pulp, which is the part employed. This should be black and shining and have a sweet taste. It is apt to become sour if long exposed to the air, or mouldy if kept in a damp place. The pulp is extracted from the pods by first bruising them, then boiling them in water, and afterwards evaporating the decoction; or, when the pods are fresh, by opening them at the sutures and removing the pulp with a spatula.

CASSIAE PULPA. Br.

CASSIA PULP

"Exhaust crushed Cassia Pods by percolation with Distilled Water; strain; evaporate on a water bath to the consistence of a soft extract."
Br.

Cassia pulp has a slight odor, and a sweet mucilaginous taste. According to Henry it contains sugar, gum, coloring matter, and a tannin-like substance; while Haensel obtained from it by steam distillation a dark yellow volatile oil, also butyric acid. (*Ph. Cb.*, 41.)

Uses.—Cassia pulp is laxative, and may be advantageously given in small doses in cases of *habitual costiveness*. In quantities sufficient to purge, it occasions nausea, flatulence, and griping. In this country it is rarely prescribed, except as an ingredient in the confection of senna, which is a pleasant and useful laxative preparation.

Dose, of the pulp as a laxative, one or two drachms (3.9 or 7.7 Gm.), as a purge one or two ounces (31-62 Gm.).

Off. Prep.—*Confectio Sennse, Br.*

Castanea. *N. F.* IV. *Chestnut Leaves.*—"The dried leaves of *Castanea dentata* (Marshall) Borkhausen (Fam. *Fagaceae*), collected in September or October while still green, and without the presence of more than 5. per cent. of twigs or other foreign matter." *N. F.* It was official in the U. S. P., 1890. Of the few species included in the genus *Castanea*, two are natives of North America. Of these *C. dentata* has been considered by many botanists as identical with *C. sativa* Mill. (*C. vesca* Gaertn.), of Europe, and was described by Michaux as a variety of that species under the name of *americana*. Botanists at present, however, generally consider the two species as distinct. "Petioles stout, about 12 mm. in length; blades entire or slightly broken and usually folded or matted together; about 15 to 25 cm. in length and about 5 cm. in breadth, oblong-lanceolate, apex attenuate, acute at the base, coarsely and sharply serrate with ascending, attenuate teeth, nearly smooth, coriaceous in texture, the upper surface dark green, the lower light green; distinctly pin-nately veined, the veins of the first order diverging at an angle of about 60 degrees, each terminating in one of the teeth. Odor slight; taste astringent. The powdered drug, when examined under the microscope, shows a few non-glandular hairs from 0.1 to 0.5 nun. in length, nearly smooth, thick-walled, distinctly yellow, occasionally in groups of three to eight and spreading from the base; numerous calcium oxalate crystals in rosette aggregates or in monoclinic prisms, from 0.01 to 0.04 mm. in diameter; parenchyma cells containing irregular yellowish-brown tannin masses which are colored blue with ammonio-ferric

alum T.S. Castanea yields not more than 5 per cent. of ash." *N. F.* It is almost impossible to exhaust the leaves by percolation. Their odor is feeble and their taste slightly astringent. They yield their virtues freely to water, and probably less so to alcohol. John B. Turner found in chestnut leaves chlorophyll, tannin, gallic acid, gum, and albumen. (*A. J. P.*, 1879, p. 542.) In addition to these constituents, L. J. Steltzer found potassium, calcium, magnesium, and iron carbonates, chlorides, and phosphates, and a trace of resin and fat. (*A. J. P.*, 1880, p. 294.)

There is a popular superstition that chestnut leaves are of value in *whoopingcough*, but the possession by them of any physiological or medicinal power is extremely doubtful. They may be administered in the form of a fluidextract which is official in the *N. F. Dose*, one drachm (4 Gm.).

Castanea pumila. (L.) Mill., *Chinquapin* of the Southern United States, is a bush or small tree usually eight or ten feet in height, but in the Gulf States reaches sometimes thirty feet. The oblong, acute, mucronately serrated leaves are readily distinguished from those of the ordinary chestnut by being whitish and downy underneath. The tree produces a small, edible nut. The bark has been used as an astringent tonic. (For analysis, see *A. J. P.*, 1899.)

Castela. *Castela Nicholsoni texana* Jorrey and Gray. (Fam. *Simarubaceae*.)—This plant, which is known among the Mexicans as *Chaparro amargosa*, that is, *bitter bush*, has been highly recommended by Nixon (*J. A. M. A.*, 1916, Ixvi, p. 946) in the treatment of amebic dysentery. He found that a detannated fluidextract in the proportion of one part in a million was sufficient to cause the *Entamoeba histolytica* to become immobile and to assume a spherical shape, with sharp differentiations of ectoplasm and endoplasm. In ordinary diarrhea or in helminthiasis he found the drug of no value.

Putegnat (*N. R.*, 1883, xii, p. 102) has separated a bitter principle, *amargosin*, which, however, is of doubtful importance. Nixon preferred a decoction of the drug, but the fluidextract is upon the market and may be given in doses of one to three fluidrachms (4.0-12.0 mils).

Catalpa. *Catalpa bignonioides* Walt. *Catalpa-tree*, or *Catawba-tree*. *Indian Bean*.—This is a beautiful, indigenous, flowering tree, of the fam. Bignoniaceae, the seeds of which have been employed in *asthma*. Eugene O. Eau obtained from them. tannin and a bitter crystalline principle. (*A. J. P.*, xlii, 204.) F. K. Brown obtained from the seeds resin, fixed oil, tannin, sugar, and two crystalline bodies, their exact nature not being determined. (*A. J. P.*, 1887, 230.) I. Schneck states that large doses cause nausea, vomiting, and slow, weak, intermittent pulse. He gave two fluidrachms (7.5 mils) of the tincture (1 oz. troy to 1 pint) every one to three hours.

CATECHU. Br.

CATECHU [Catechu Paliidum]

"Catechu is an extract of the leaves and young shoots of *Uncaria Gambier*, Roxb." *Br.*

Catechu is described in the *Br. Pharm.*, 1914, as follows: " In cubes, sometimes more or less agglutinated, each side measuring about twenty-five millimetres. Dark reddish-brown externally, pale cinnamon-brown internally, porous and friable. When examined under the microscope they are found to consist chiefly of minute acicular crystals. No odor; taste at first bitter and very astringent, but subsequently sweetish. Almost entirely soluble in boiling *water*. Not less than 80 per cent. is soluble in *alcohol* (90 per cent.); the alcoholic solution made strongly alkaline with *solution of sodium hydroxide* and shaken with *petroleum spirit* imparts to the latter a brilliant green fluorescence (distinction from Black Catechu); the residue insoluble in *alcohol* (90 per cent.) exhibits no starch grains when examined under the microscope. Ash not more than 5 per cent.; ash of the powder not more than 8 per cent." *Br.*

(See *Gambir*.)

CATECHU NIGRUM. Br.

BLACK CATECHU

"Black Catechu is an extract prepared from the wood of *Acacia Catechu*, Willd." *Br.*

Cutch, Cachou, Fr.: Phgu, Katechu, *G*; Caticu, Catto, *It.*; Catecu, *Sp.*; Cutt, *Hindustanee*.

The U. S. P. (8th Rev.) dismissed catechu and introduced gambir because of the greater uniformity in quality of the latter. See *Gambir*.

The U. S. P. 1890 defined catechu as "an extract prepared from the wood of *Acacia Catechu* (Linnr fil.) Willdenow (Fam. Leguminosae)."

Acacia Catechu is a small tree, seldom more than twelve feet in height, with a trunk one foot in diameter, dividing towards the top into many close branches, and covered with a thick, rough, brown bark. This species of *Acacia* is a native of the East Indies, growing abundantly in various provinces of Hindostan, and in the Burmese Empire. It is also

common in eastern Africa where it is valued for its wood; but no extract appears to be made from it. Pereira says that its is common in Jamaica.

This drug had been long known before its source was discovered. It was at first called *Terra japonica*, under the erroneous impression that it was an earthy substance derived from Japan. When ascertained by analysis to be of vegetable origin, it was generally considered by writers on the *Materia Medica* to be an extract of the *betel nut*. Its true origin was made known by Kerr, assistant surgeon of the civil hospital in Bengal. According to Kerr, the manufacturer, having cut off the exterior white part of the wood, reduces the interior brown or reddish-colored portion into chips, which he then boils in water in unglazed earthen vessels until all the soluble matter is dissolved. The decoction thus obtained is evaporated first by artificial heat, and afterward in the sun, until it has assumed a thick consistence, when it is spread out to dry upon a mat or cloth, being, while yet soft, divided by means of a string into square or quadrangular pieces. The account subsequently given by Royle, of the preparation of the extract in Northern India, is essentially the same. The process, as he observed it, was completed by the pouring of the extract into quadrangular earthen moulds. It is said that the unripe fruit and leaves are also sometimes submitted to decoction. Three colors of catechu are prepared; the light red or red, which is considered best and is especially employed in Burma and India to chew with the betel nut; the dark red and black, which are made especially for European and American markets, and which are apt to suffer adulteration *en route* in China.

The name *catechu* in the native language signifies the *juice of a tree*, and appears to have been applied to astringent extracts obtained from various plants. Commerce is chiefly supplied with catechu from Bahar, Northern India, and Nepal through Calcutta, from Canara through Bombay, and from the Burmese dominions. It is frequently called *cutch* by the English traders, a name derived from the Hindostanee word *cutt*.

It enters commerce in large masses, sometimes of one cwt., consisting of layers of flat cakes, frequently wrapped in the leaves of the *Dipterocarpus tuberculatus* Roxb. In this form, however, we do not see it in drug stores, but almost always in angular, irregular fragments, in which portions of two layers sometimes cohere with leaves between them, indicating their origin. It is characterized by its compactness, shining fracture, and blackish-brown or dark port-wine color, so that

when finally broken it bears considerable resemblance to kino. This is an excellent variety of catechu.

Catechu is inodorous, with an astringent and bitter taste, followed by a sense of sweetness. It is brittle, and breaks with a fracture which is rough in some specimens, in others uniform, resinous, and shining. That which is preferred in our market is of a dark color, easily broken into small angular fragments, with a smooth, glossy surface, bearing some resemblance to kino. Catechu is often mixed with sand, sticks, and other impurities.

Black catechu is described in the Br. Pharm., 1914, as follows: "In irregular masses of a dark brown color; brittle, having a porous, glossy, somewhat conchoidal fracture. Partially soluble in cold *water*, almost entirely soluble in boiling *water*. Not less than 60 per cent. is soluble in *alcohol* (90 per cent.). No odor; taste sweetish, astringent. Its dilute aqueous solution gives a dark green color with *T. Sol. of ferric chloride*, changing to purple when made slightly alkaline with solution of sodium hydroxide. Ash not more than 5 per cent.; ash of the powder not more than 8 per cent. In India, in the Eastern, and in the North American Divisions of the Empire, Black Catechu may be employed in making the official preparations for which Catechu is directed to be used." *Br.*

The proportion of tannic acid, which may be considered the efficient principle, varies from about 45 to 55 per cent. in catechu or cutch, and from 36 to 40 per cent. in gambir. The portion designated by Davy as extractive is said to contain, if it does not chiefly consist, of a principle discovered by Buchner, and now called *catechin*, *catechuin*, or *catechuic acid*, to which Etti gives the formula $C_{18}H_{18}O_8$, and catechu red, $C_{36}H_{34}O_{15}$, which is evidently the first anhydride of catechin. The *catechu tannic acid* is of the variety which precipitates iron of a greenish-black color, and differs from most of the other varieties in not yielding grape sugar when digested with diluted sulphuric acid. It is not, therefore, a glucoside. It precipitates gelatin, but not tartar emetic (Kane), and is not, like the tannic acid exposure of galls, converted into gallic acid by the access of the air. Catechu is almost wholly soluble in a large quantity of water, to which it imparts a brown color. The extractive or catechuic acid is much less soluble than the astringent principle, which may be almost entirely separated from it by the frequent application of small quantities of cold water. Boiling water dissolves it much more readily than cold, and deposits it of a reddish-

brown color upon cooling. Both principles are readily dissolved by alcohol or proof spirit, and also by ether.

De Meyer affirms that the best method of detecting adulteration of catechu is to treat the suspected drug with ether. Catechu of good quality, after repeated treatment with ether, loses 53 per cent. of its weight, and the dried residue weighs only 47 per cent. of the catechu employed. If this be exceeded, the drug must be proportionately impure. (*J. P. C.*, June, 1870, 479.) . A. Jossart (*J. P. A.*, 1881, 41) examined a catechu which was adulterated with from 60 to 65 per cent. of ferrous carbonate. For methods of assaying catechu and gambir, see Trimble's *The Tannins*, 43; also *Ph. Rev.*, 1897, 27. (See also *Gambir*, p. 507, and *U. S. D.*, 19th ed., p. 1436.)

Catechu is used for the same purposes and in the same proportions as Gaymbir, see page 507.

Dose, five to fifteen grains (0.3-1.0 Gm.).

Off. Prep.—*Pulvis Catechu Compositus*, *Br.*; *Tinctura Catechu*, *Br.*; *Trochiscus Catechu*, *Br.*

Catha. *Catha edulis*.—Under various Arabic names, such as *Kat*, *Khat*, *Chaat*, *Kus es Salahin*, *Tchaad*, *Tschut*, *Tohat*, *Tohai*, *Gat*, the leaves of *Catha edulis* Forsk. (fam. *Celastraceae*) (*Abyssinian* or *African tea*) are very largely used as a stimulant in Northern Africa, the plant being extensively cultivated. According to Collin, from 1400 to 1500 camel loads are yearly sold in Aden. The plant is a shrub, reaching the height of 9 to 12' feet, with thin coriaceous leaves whose margins are bluntly serrate. The rounded grayish-green twigs are, for commercial purposes, dried with the leaves and tied together in bundles containing about forty twigs; the bundles are commonly from twelve to fourteen inches in length and three to four inches in diameter, but sometimes much smaller. The leaves are chewed both in the green and fresh condition, and are in some places made into a tea. The taste is sweetish and astringent, somewhat suggesting licorice. They are asserted to act as stimulants, overcoming the sense of fatigue in the same way as cocaine, or caffeine. Fluckiger and Gerrock found in it an alkaloid, ratine, $C_{10}H_{18}ON_2$, which has been studied by Chevalier (*B. G. T.*, 1911), who finds that it is a stimulant to the central nervous system. Stockman (*P. J.*, Nov. 30, 1912) found three alkaloids, *cathine*, *cathinine*, and *cathidine*, and also a fourth alkaloid in too small quantities for study. He found (*J. P. Ex. T.*, 1913, iv) that these alkaloids were stimulating to both the brain and spinal cord, and in large doses produced paralysis through a direct action upon the muscle.

Catnep. *N. F.*, *IV. Cataria*. *Catmint*. *Catnip*. *Cataire*, Fr. *Katsenmunze*, G. *Cattara*, It. *Gatera*, Sp.—It is described in the *N. F.* as " the dried leaves and flowering tops of

Nepeta Cataria Linne (Fam. *Labiatae*). Tops, when whole, from 10 to 20 cm. in length, much branched, commonly crushed and broken; stems quadrangular, downy; leaves opposite, those of the stem petiolate, from 2 to 7 cm. in length, rounded heart-shaped at the base, oblong, pointed at the apex, pale gray-green, soft-hairy above, downy beneath, margin deeply crenate, floral leaves small, bract-like; flowers small, in dense, interrupted spikes; calyx hairy, tubular, curved obliquely and sub-equally five-toothed; corolla whitish, dotted with purple, throat dilated, limb bilabiate, the upper lip erect, two cleft, lower spreading, three cleft, the middle lobe largest, crenulate; stamens two pairs ascending under the upper lip, lower pair shorter. Odor faintly aromatic and mint-like; taste bitter, pungent and aromatic. Catnep yields not more than 16 per cent. of ash." *N. F.* Catnep is a perennial labiate plant which is common near dwellings in the United States, but is supposed to have been introduced from Europe. It is called catnip on account of the fondness which cats show for it either in the fresh or the dried condition. The active constituents are volatile oil, and tannin of the kind which produces a greenish color with the salts of iron. Therapeutically it is very feeble. *Dose*, one drachm (4 Gm.).

Caulophyllum, *N. F. IV. Pappoose Root. Squaw Root. Blue Cohosh.*—"The dried rhizome and roots of *Caulophyllum thalictroides* (Linne) Michaux (Fam. *Berberidaceae*)."*N. F.* This is an indigenous, perennial, herbaceous plant, with matted, knotty rhizomes, from which rises a single smooth stem, about two feet high. "Rhizome of horizontal growth, from 7 to 25 cm. in length, and from 5 to 15 mm. in thickness, much branched, slightly compressed from above, bearing large, cup-shaped stem scars on the upper surface, underneath a tangled or matted mass of long, curved, thin, tough roots which frequently conceal the rhizome; both rhizome and roots of a grayish or yellowish-gray color; fracture tough and woody. Odorless but sternutatory; taste bitter-sweet and acrid. The powdered drug is light brown and, when examined under the microscope, it exhibits numerous starch grains, spherical in outline, mostly simple, up to 0.016 mm. in diameter; fragments of cork with cells about 0.05 mm. in diameter and having yellowish-brown walls; tracheae with bordered pores, the cells being up to 0.05 mm. in width; wood fibers with heavily lignified walls; fragments of parenchyma tissue with many of the cells containing starch grains. *Caulophyllum* yields not more than 6 per cent. of ash." *N. F.*

Mayer found *caulophyllum* to contain a saponin and a colorless alkaloid. (*A. J. P.*, 1863, 99.) The *caulophyllin* of the eclectics is made by pouring a concentrated alcoholic tincture into water and collecting the precipitate, washing with ether, and drying. For an analysis of this substance by J. F. H. Gilbard, see *P. J.*, 1911, 101. J. U. Lloyd purified the substance which Ebert described as analogous to saponin, and for distinction terms it *leontin*. (See *Drugs and Medicines of North America*, vol. ii, 152.) He also obtained *caulophylline*, the alkaloid first announced by Mayer in 1863. Lloyd describes it as colorless, odorless, possessed of little taste, and dissolving freely in water, alcohol, ether, and chloroform. It crystallizes with difficulty. The hydrochloride has been obtained, however, in crystals. It has not been tested physiologically. The fruit has been analyzed by Edith Stockton and C. G. Eldridge. (See *Chem. News*, 1908, 190.)

Caulophyllum has been used by eclectic and homoeopathic practitioners. It is said to be sedative, antispasmodic, and oxytocic, and to have the power when uterine inertia occurs during labor to cause the contractions to become very severe, without altering their general character as does ergot. It is also alleged to be capable of arresting threatened abortion, to be very efficacious in hysteria, amenorrhea, dysmenorrhea, menorrhagia, uterine subinvolution, etc.; also to be capable of originating uterine contractions and of producing abortion. For a detailed description of the various contradictory powers ascribed to it, the reader is referred to Lloyd's *Drugs and Medicines of North America*, vol. ii, p. 155. It is given in decoction, infusion, or tincture, the first two being made in the proportion of an ounce to a pint of water, the last of four ounces to a pint of spirit. Dose, of decoction or infusion, one or two fluid-ounces (30 or 60 mils); of the fluidextract five to ten minims (0.3-0.6 mil). *Leontin* has been used in doses of six-tenths of a grain (0.04 Gm.) in a one per cent. solution.

Cayaponia. *Cayaponia globosa*. *Silva Manso*. —This is a cucurbitaceous plant of Brazil, from which Gubler has extracted the alkaloid *cayaponine*, said to purge without griping. Dose, one grain (0.065 Gm.). (*Rep. de Pharm.*, 1879, 193.)

Ceanothus. *Ceanothus americanus* L. *New Jersey Tea*. *Red-root*. *Ceanothe*, Fr. *Seckel-blumen-wurzel*, G.—A small indigenous shrub, of the fam. *Rhamnaceae*, growing from western Ontario and Maine southward. The *root* is astringent, and imparts a red color to water. H. K. Bowman found in it 9.21 per cent. of tannin. (*A. J. P.*, 1869, 195.) F. C. Gerlach has again examined the root. (*A. J. P.*, 1891, 332.) He finds 6.48 per cent. of tannin and 0.52 per cent. of an alkaloid to which he gives the name *ceanothine*. J. H. M. Clinch has found in the leaves a resin and a volatile oil. (*A. J. P.*, xiv, 1884.) J. A. Buckner (*A. J. P.*, 1891, 428) found 9.45 per cent. of tannin in the leaves. *Ceanothus* is said to be useful in *syphilis*. Schoepf states that it is purgative. The leaves were used during the Revolutionary War as a substitute for tea. The Mexican *C. cceruleus* Lagasca (*G. azureus* Desf.) is used as a febrifuge.

Cecropia Obtusa Tree. (Fam. *Urticaceae*.)— An extract of these leaves is used as a diuretic, having an action similar to that of digitalis though less toxic than it. *Dose* of the liquid extract, thirty minims (1.8 mils).

Cedron.—The seeds of the *Simaba Cedron* Planch., a tree growing in Colombia and Central America, belonging to the *Simarubaceae*. The fruit is a large solitary drupe, containing a single seed. *Cedron* seed is from 3 to 4.5 cm. long, and 1.5 to 2.5 cm. broad, elongated ovate, convex on one side, flat or slightly concave on the other, and presenting an oval scar" near one extremity of the flat surface. It is often yellowish, hard and compact, but readily cut with a knife; is inodorous, but of a pure and intensely bitter taste, not unlike that of quassia. It yields its virtues to water and alcohol. Lowry (*J. P. C.*, xix, p. 365) separated from what he believed to be the seeds of *Simaba Cedron*, a crystalline substance which he named *cedrin*. Tanret, however, in attempting to confirm his work, was unable to obtain a crystalline substance from this plant, but he did from one closely allied to it, namely, the *S. waldivia*, and believed that Lowry was mistaken in the identity of his crude material. (See *P. J.*, 1908, lxxxii,

p. 103.) Cedrin is now an article of commerce in the colorless crystals. It is bitter, slowly soluble in water, more readily so in alcohol or ether.

Cedron has been used in Central America as a remedy for snake bite and Purple has recommended it as an antiperiodic. The *dose* of the crude drug is from five to fifteen grains (0.3-0.9 Gm.). The bitter principle cedrin has been given hypodermically in *doses* of one-fifteenth of a grain (0.004 Gm.).

Celastrus.—Various species of the *Celastraceae* have medicinal properties. In the East Indies the oil obtained from the seeds of *Celastruspaniculatus* Willd. is used as a powerful stimulant and diaphoretic in *rheumatism*, *gout*, and various *fevers*. The oil is said to be deep reddish-yellow, and to become thick and honey-like on keeping. It is sometimes known as *oleum nigrum*. In Abyssinia, according to Dragendorff, the leaves of *C. serratus* Hochst. (*C. obscurus* A. Rich.) are used as an antiperiodic under the name of *Add-add*. Dragendorff found in them tannic acid, a volatile oil, and a bitter principle, *celastrine*. (*A. J. P.*, xxvi.) In North America the bark of *Celastrus scandens* L. (climbing staff tree, false bittersweet, fever twig) has been used in chronic affections of the liver and in secondary syphilis, and is said to be emetic, diaphoretic, and alterative. C. H. Bernhard found in the bark acid and neutral resin, starch, glucose, gum, a caoutchouc-like body, coloring matter, and volatile oil. (*A. J. P.*, 1882, 1.) Wayne stated that he had isolated from *C. scandens* white minute crystals, to which he gave the name of *celastrine*. According to Ugolino Mosso (*Rivista Clinica*, 1891), *celastrine* arrests the frog's heart in systole; does not affect markedly the blood pressure in mammals, and influences the respiration only through its action on the vagus. The stimulant action is especially manifest on the brain and is not followed by a secondary depression. There is marked, persistent elevation of the temperature.

Celery Fruit. *Apii Fructus*. N. F. IV. *Celery Seed*. *March*, *Celeri*, Fr. *Sellerie*, *Eppich*, G.— "The ripe fruit of *Apium graveolens* Linne (Fam. *Umbelliferae*), without the presence of more than 10 per cent. of foreign fruit or other foreign matter." N. F. The ordinary celery of our gardens is too well known to need description. The N. F. recognizes the fruits and describes them as follows : " The fruits consist of two mericarps which may be united or separate. Mericarps ovoid, slightly curved, from 1 to 2 mm. in length, rather more than half as broad and about half as thick, of a rather deep brown color; the inner surface flat, the outer convex, smooth except for five very Blender light-colored ribs, two of which are marginal. Oil-tubes in the pericarp from 6 to 15. Odor characteristic, agreeable; taste aromatic, warm and somewhat pungent. Transverse sections, when examined under the microscope, exhibit nearly equilateral pentagonal mericarps, with somewhat convex surfaces; the carpophore consisting of two groups of strongly lignified sclerenchyma cells; each mericarp has from six to fifteen vitae in the pericarp, the latter closely surrounding a somewhat pentagonal seed; the pericarp has an epidermal layer of cells elongated tangentially and with a thick cuticle; a few of the cells are developed into abort, smooth, papillae; a fibro-vascular bundle in each of the prominent ribs, composed of a few tracheae and strongly lignified sclerenchyma fibers; the inner tissue of the pericarp consists of largely tangentially elongated parenchyma with brownish walls; the seed consists chiefly of endosperm; the seed coat is composed of several layers of yellowish more or

less collapsed cells, the endosperm of thick-walled polygonal cells containing fixed oil and aleurone grains, the latter each containing- a small rosette aggregate of calcium oxalate. The powdered drug is oily and has a brown color and, when examined under the microscope, exhibits fragments of the pericarp showing yellowish vittae, brown secretion cells and few of the epidermal papillae; tracheae and sclerenchyma fibers; cells of the endosperm with aleurone grains containing rosette aggregates of calcium oxalate from 0.002 to 0.006 mm. in diameter. Celery Fruit yields not more than 8 per cent. of ash." *N. F.*

Oil of Celery Seed was investigated by Swenholt, who found that it consisted of two oils, one heavy, sp. gr. 0.877, at 20° C. (68° F.), the other light, sp. gr. 0.84. Celery seed contains apiol but in less quantity than parsley (see *Petroselinum*). Celery has by some been believed to act as a nerve sedative and is used in hysteroidal statea, but with doubtful advantage. The *dose* is twenty to sixty grains (1.2-3.9 Gm.).

Apium nodiflorum (L.) B. et I-I. (*Sium nodiflorum* L.) Water parsnip. —This is a perennial, umbelliferous, aquatic, European plant, growing also in the southern section of the United States. It is commonly considered poisonous; but the fresh juice has been used by Withering and others, in the dose of three to four ounces every morning, for scrofulous *lymphadenitis* and obstinate *skin diseases*.

Centaurea. *Cnicusbenedictus* L. (*Centaureabenedicta* L.) *Blessed Thistle. Chardon benit*, Fr. *Herba Cardui Benedicti*, P. G. *Benedicten Distel*, G.—This is an annual herbaceous composite common in Europe and occasionally seen on roadsides and waste places in the United States. The leaves were formerly official. They should be gathered when the plant is in flower, quickly dried, and kept in a dry place. The herb has a feeble, unpleasant odor and an intensely bitter taste, more disagreeable in the fresh than in the dried plant.

Water and alcohol extract its virtues. The infusion with cold water is a grateful bitter; the decoction is nauseous, and offensive to the stomach. The active constituents are volatile oil and *cnicin*. This is crystallizable, inodorous, very bitter, neutral, scarcely soluble in cold water, more soluble in boiling water, and soluble in all proportions in alcohol. Its formula is C₄₂H₅₆O₁₅, and it is analogous to salicin in composition. It has been used as a bitter tonic, and is, in larger quantities, emetic. Tonic *dose*, from half a drachm to one drachm (2.0-3.9 Gm.) preferably given as an infusion.

Silybum Marianum Gaertn. (*Mariana Mariana*, (L.) Hill, *Carduus Marianus* L.) was of old used for the same purpose as *C. benedictus*. Rademacher attributed great value to the seeds in hemorrhages, particularly when connected with diseased liver or spleen. Lobach found the decoction (two ounces to the pint of water), in doses of four fluidrachms (15 mils) every hour, useful in amenorrhea and menorrhagia. (*Am. J. M. S.*, April, 1859.)

Centaury. *N. F. IV. Centaurium. Common European Centaury. Herba Centaurii*, P. G. *Erythraea Centaurium* (L.) Pers. *Centaurium Centaurium* (L.) Wight. (Fam.

Gentianaceae.) —This is a small, annual herbaceous plant which grows wild in most parts of Europe. The dried flowering plant is found in commerce. It is described in the N. F. as " the dried flowering plant of *Erythraea Centaurium* (Linne) Persoon (Fam. *Gentianaceae*). Glabrous, from 1.5 to 5 dm. in height, much branched from the base, but little branched, if at all, from above; stems slender, sharply angled or narrowly winged, sparsely leafy; leaves opposite, entire, mostly three-nerved, sessile, those at the base obovate and obtuse, from 2 to 5 cm. in length, their base narrowed and petiole-like, those of above gradually changing to oval, then ovate or even lance-linear, acute; flowers in a terminal and at length compound cyme, rose-colored; calyx from 5 to 7 mm. in length, deeply five-parted, the tube short, sharply angled, lobes linear-attenuate with a sharp midrib; corolla tube nearly twice the length of the calyx, slender, the limb from 10 to 15 mm. in breadth, its lobes broadly oblong or oval; stamens five, exserted, bright-yellow, their anthers twisted when old; pistil two carpelled. Odor faint but characteristic; taste persistently bitter. Centaury yields not more than 5 per cent. of ash." N. F. The fresh, bitter, -odorless herb yields an odorous, pungent distillate in which Mehu (J. P. C., 1862, xliii, 38) has found valeric acid, also a peculiar, colorless, crystalline, non-nitrogenous substance, *erythrocentaurin*, $C_{27}H_{24}O_8$. Erythrocentaurin occurs in needle-shaped crystals, fusing at $136^{\circ} C.$ ($276.8^{\circ} F.$), and crystallizing easily on cooling again. They are strongly reddened by exposure to solar light, and reacquire their colorless character upon being again dissolved and crystallized, or by mere heating to $130^{\circ} C.$ ($266^{\circ} P.$). They are almost insoluble in cold water, more readily soluble in boiling water, alcohol, ether, and chloroform. Carbon disulphide, benzene, volatile and fatty oils dissolve them easily. J. F. Huneker believes that erythrocentaurin exists also in American centaury. (See *Sabbatia*.) Leuderich assigns to erythrocentaurin the formula $C_9H_{14}O_5$ and states that in its decomposition a dextrorotatory carbohydrate is produced, while R. Reis states that the formula of the crystals is $C_{10}H_{10}O_3$. (*Ap. Ztg.*, 1911, 148.) Herissey and Bourdier isolated a glucoside from centaury, *erytaurin* (*J. P. C.*, 1908, No. 6), but later R. Reis could not detect a glucoside in it. (*Ap. Ztg.*, 1911, 148.) The common centaury of Europe has tonic properties very closely resembling those of gentian. The dose of centaury is from twenty to forty grains (1.2-2.3 Gm.).

A species of *Erythraea*, *E. chilensis* Pers., is employed to a considerable extent in Chili as a mild tonic. (For details, see *J. P. C.*, 3e ser., xxv, 434.) *E. acaulis*, which grows in great abundance in the territory of French Algiers bordering on the Sahara, yields a root which, under the name of *rejagnou*, is much employed by the natives for dyeing yellow. (*J. P. C.*, 1867, v, 87.)

Cephalanthus. *Cephalanthus occidentalis* L. *Button Bush. Button Wood. Crane Willow. Swamp Dogwood.* (Fam. *Rubiaceae*.)—A common indigenous shrub which grows in moist places, as along streams or on the borders of swamps. Its bark is bitter, is said to be laxative as well as tonic, and has been given in periodical fevers, in decoction or infusion. (See *M. R.*, 1911, 216.) E. M. Hattan found in it a crystallizable fluorescent acid, a bitter uncrystallizable principle, a principle resembling saponin, tannin, two resins, fatty matter, gum, glucose, and starch. (*A. J. P.*, xlvi, 314.) According to Claassen (*Ph. Rund.*, Bd. vii, 1889), the fluorescent acid of Hattan is composed of two substances, *cephalin* and *cephaletin*. Carl Mohrberg has separated

from the bark a substance which he knows as *cephalanthin*, and also a toxic saponin-like principle which, like its allied poisons, has the power of dissolving the blood corpuscles. Cephalanthin he finds to be a distinct poison to both cold and warm blooded animals, causing destruction of blood corpuscles with conversion of oxyhemoglobin into methemoglobin, violent vomiting, convulsions, and paralysis. (See Robert's *Arbeiten*, viii, 1892.)

Ceratopetalum.—The New South Wales species of this genus, viz., *C. gummiferum* Sm. and *C. apetalum* Don., of the *Saxifragaceae* yields considerable quantities of a kino-like gum. The barks contain coumarin. (See *P. J.*, xxi, 742.)

Cercis. *Cercis canadensis* L. *Judas Tree. Redbud.*—The bark of this beautiful leguminous tree, indigenous and well-known throughout the Eastern and Central United States on account of its brilliant red-purple flowers, which appear before the leaves, has been highly recommended by Wm. R. Smith as a mild but very active astringent in the treatment of *chronic diarrhea* and *dysentery*. *Dose*, of the fluidextract, from half to one flui-drachm (1.8-3.75 mils).

Cetraria. *U. S.* 1890. *Iceland Moss. Iceland Lichen.*—Under this name the U. S. P. formerly recognized the dried plant of *Cetraria islandica* Acharius, *Liche, islandicus* L. This plant, although known as a moss, is not a moss, but a lichen which grows in most northern latitudes and on elevated mountains further south, including the Northern United States.

The dried plant is of diversified color, grayish-white, brown, and red, in different parts, with less of the green tint than in the recent state. It was officially characterized as follows: " From 5 to 10 Cm. long, foliaceous, irregularly branched into fringed and channelled lobes, brownish above, whitish beneath, and marked with small, depressed spots; brittle and inodorous; when softened in water, cartilaginous, and having a slight odor; its taste is mucilaginous and bitter." U. S., 1890. Macerated in water, it absorbs rather more than its own weight of the fluid, and, if the water be warm, renders it bitter. Boiling water extracts all its soluble principles. The decoction thickens upon cooling, and acquires a gelatinous consistence without viscosity. After some time the dissolved matter separates, and when dried forms semi-transparent masses, insoluble in cold water, alcohol, or ether, but soluble in boiling water, and in solution forming a blue compound with iodine. *Lichenin*, or *lichenstarch*, $C_{12}H_{20}O_{10}$, resembles starch in its general characters, but differs from it in some respects. Lichenin has been found to consist of two distinct proximate principles, for one of which the name lichenin may be retained, while for the other no particular designation has been chosen, but which we may call lichenoid. According to Th. Berg (*These de Dorpat*, 1872), *cetraria* yields 35.15 per cent. of the mixed principles, of which 20 per cent. is of lichenin, and 15.15 of the so-called lichenoid. To separate them, a decoction of the moss, concentrated to a small bulk, and still hot, is treated by alcohol. The lichenoid is deposited in flocculi, which gradually unite in a viscid mass. This, being washed by alcohol until it ceases to be bitter, and then dried, yields a light friable matter partly soluble in cold water, with which it forms a yellow, limpid solution. To deprive it of mineral and coloring substances, it is dissolved in a little water, and precipitated

afresh by alcohol. Lichenin is insoluble in cold water, but swells up and easily dissolves in hot water. It is insoluble in alcohol and in ether. It is only tinged by iodine. Lichenoid is, on the contrary, colored blue by that reagent. It is, in part, dissolved in cold water, and the undissolved part is equally colored blue by iodine. It is, like lichenin, insoluble in alcohol and ether. Both substances have strong analogies with starch, yet are distinct. For a further account, see *J. P. C.*, 1873.

The name *cetrarin* has been conferred on the bitter principle. Herberger's process for extracting it may be found in the 18th ed., U. S. D. By it one pound of moss yielded to Herberger 133 grains of cetrarin, Schnedermann and Knop have ascertained that cetrarin consists of three distinct substances: (1) *cetraric acid*, $C_{18}H_{16}O_8$, which is the true bitter principle, crystallizable, and intensely bitter; (2) a substance resembling the fatty acids, called *lichen-stearic acid*, $C_{14}H_{34}O_3$, the crystals of which melt at $120^{\circ} C.$ ($248^{\circ} F.$); and, (3) a green coloring substance, which they name *thallochlor*. These principles are obtained perfectly pure with great difficulty. (*Ann. Ch. Ph.*, lv, 144.) Hilger and Buchner (*Ber. d. Chem. Ges.*, 1890, p. 461) give to lichen-stearic acid the formula $C_{43}H_{76}O_{13}$, and to cetraric acid the composition $C_{30}H_{30}O_{12}$, and both are shown to be dibasic acids.

The gum and starch contained in the moss render it sufficiently nutritive to serve as a food for the Lapps and Icelanders, who employ it powdered and made into bread, or boiled with milk, after having partially freed it from the bitter principle by repeated maceration in water. As suggested by Berzelius, the bitterness may be entirely extracted by macerating the powdered moss, for twenty-four hours, in twenty-four times its weight of a solution formed with 1 part of an alkaline carbonate and 375 parts of water, then decanting the liquid, and repeating the process with an equal quantity of the solution. The powder, being now dried, is perfectly sweet, and has been used to some extent in pharmacy as a substitute for acacia, although lacking in adhesiveness. (See also *Gelatina Lichenis Islandici Saccharata Sicca* (Germ. Unoff. Formulary), *Proc. A. Ph. A.*, 1892, 455.) This plan which has been proposed of first extracting the bitterness by maceration in water or a very weak solution of an alkaline carbonate, and afterwards preparing the decoction, has been criticised, as the peculiar virtues which distinguish the medicine from the ordinary demulcents are thus entirely lost. A pint (473 mls) of the decoction may be taken during the day.

Iceland Moss has been much used in chronic *catarrhs*, especially of the pulmonary mucous membrane and even in *phthisis*. It acts chiefly as a mucilaginous drink, but as Kobert has found that *cetrarin*, is a stimulant to the gastro-intestinal mucous membrane and to peristalsis, cetraria probably is feebly tonic. A 20 per cent. tincture has been recommended in *doses* of twenty to thirty minims (1.2-2 mls) by Deymg and Brice-Moret as an anti-emetic (*P. J.*, Oct. 30, 1897), which is confirmed by Gigon. (*R. T.*, 1905, p. 610.)

Cetrarin, or *Cetraric acid*, $C_{30}H_{30}O_{12}$; a white, crystalline, bitter principle, soluble in solutions of alkalies and their carbonates, in hot water and slowly in cold water. It is administered in the treatment of anwnia, chlorosis and digestive disturbances. Dose, one and a half to three grains (0.096-0.2 Gm.).

Decoction Cetrariae. U. S. 1890. *Decoction of Cetraria. Decoction of Iceland Moss.*

"Cetraria, *fifty grammes* [or 1 ounce av., 334 grains]; Water, *a sufficient quantity*, to make one *thousand cubic centimeters* [or 33 fluidounces, 61/3 fluidrachms]. Cover the Cetraria, in a suitable vessel, with *four hundred cubic centimeters* [or 13 fluidounces, 252 minims] of cold Water, express after half an hour, and throw the liquid away. Then boil the Cetraria with *one thousand cubic centimeters* [or 33 fluidounces, 61/2 fluidrachms] of Water for half an hour, strain, and add enough cold Water, through the strainer, to make the product, when cold, measure *one thousand cubic centimeters* [or 33 fluidounces, 61/2 fluidrachms]." U. S., 1890.

Saccharum Cetrariae.—Cetraria 1, sugar 1, water 100. Wash the cetraria with water to remove bitterness, then boil with 100 mils of water, strain and express lightly, and in the strained liquid dissolve the sugar and evaporate upon a water bath. When sufficiently firm remove from the bath and dry in an oven to a scale or a powder.

The *Cetraria juniperina* (probably *Cetraria vulpina*) of Europe is said to be sometimes used as a poison for wolves and foxes, while the *wolfs moss* (*Ulfmossa*) of the north of Europe contains vulpinic acid, C₁₉H₁₅O₅, which has been found by Kobert to be an active protoplasmic poison, in frogs it produces tetanus, convulsions, and paralysis of central origin; in mammals it causes dyspnea, vomiting, trembling, and a slowing of the pulse, with rise of the blood pressure due to stimulation of the respective nerve centers. After death the blood is not coagulable, and the secreting kidney cells are found covered with a, crystalline or amorphous mass of a vulpinate. The acid is found also in species of *Calycium*, *Culveraria*, *Parmelia*, and *Cyphelium*. (Schmidt, *Ph. Chemie*, St. 1319.) No difference of action exists between vulpinic acid derived from wolf's moss and that synthetically produced. From *Cetraria pinastrin* Zopf has separated *pinastrinic acid*, which seems to be very closely allied to vulpinic acid. (*Sitzungsb. der Dorpat. Naturforsch.-Gesellschaft*, 1892.)

Chamaelirium. *Chamaelirium luteum* (L.) A. Gray. (*C. carolinianum* Willd.) *Starwort. False Unicorn Root. Devil's Bit. Blazing Star.*—This plant is indigenous to the United States. The rhizome is the part employed in medicine. It is commonly known by the erroneous name *Helonias*, under which title it is recognized by the N. F. (for description, see *Helonias*). F. V. Greene obtained from it in 1878 a bitter principle, *chamaelirin*. He states that it is a cardiac poison. *Helonin* is a term used by the eclectics to define the alcoholic extract found in commerce. *Chamaelirium* is said to be diuretic, tonic, and antihelminthic. It is usually given in aqueous infusion, one in sixteen, in the *dose* of a wineglassful.

Champaca.—This is the *Michelia Champaca* L. (fam. *Magnoliaceae*), a Javan tree which is famous for the sweet odor of its blossoms. From it Merck has obtained a camphor (C₁₇H₃₀O) to which the name *champacol* has been applied. For a study of the volatile *oil of champaca* flowers, see *Schim. Rep.*, Oct., 1907, p. 32.

Cheiranthus. *Cheiranthus Cheiri* L. *Wall flower*.—The flowers yield an oil which when highly diluted has the natural pleasant odor, but when concentrated the odor is disagreeable. (*Schim. Rep*; 1911, 95; also *A. Pharm.*, 1912, 211.) From the leaves of this cruciferous European plant Moritz Reeb (*A. E. P. P.*, 1899, vol. xliii) has obtained a glucoside, belonging to the digitalis group, of such power that 0.0005 Gm. will produce systolic cardiac arrest in the frog; also a crystalline alkaloid, *cheirinine*, $C_{18}H_{35}O_{17}N_3$, which acts upon nerve centers and also upon muscles.

Chelidonium. *U. S.* 1890. *Chelidonium majus* L. (Fam, *Papaveraceae*.) *Celandine*. *Tetterwort*.

A perennial herbaceous plant growing wild in both Europe and America, recognized readily by its pinnate leaves, small peduncled yellow flowers and yellow opaque juice. The plant was formerly official and was described as follows: "Root several-headed, branching, reddish-brown; stem. about 50 Cm. long, light green, hairy; leaves about 15 Cm. long, thin, petiolate, the upper ones smaller and sessile, light green, on the lower side glaucous, lyrate-pinnatifid, the pinnae ovate-oblong, obtuse, coarsely crenate or incised and the terminal one often three-lobed; flowers in small, long-peduncled umbels with two sepals and four yellow petals; capsule linear, two-valved and many-seeded. The fresh plant contains a saffron-colored milk-juice, and has an unpleasant odor and acrid taste." *U. S.*, 1890.

Probst, of Heidelberg, found in it a peculiar acid denominated *chelidonic acid*; two alkaline principles, one of which forms neutral salts with the acids, and is called *chelerythrine* (see *Sanguinaria*), in consequence of the intense redness of its salts; the other unites with, but does not neutralize the acids, and is named *chelidonine*, $C_{20}H_{19}C_5N$; and lastly a neutral crystallizable, bitter principle, which from its yellow color he calls *chelidoxanthin*. Orlow believes, however, that the latter is an alkaloid, and gives a process for its preparation in *Ph. Z. R.*, 1893, No. 21. Chelerythrine appears to be an acrid narcotic poison. (*Ann. Ch. Ph.*, xxix, 113.) For an elaborate investigation of chelidonine, see a paper by Schlotterbeck and Knapp in *Proc. A. Ph. A.*; 1905, 217. For color tests for chelidonine, see *Proc. A. Ph. A.*, 1895, 922. *Chelidonine phosphate*, *chelidonine sulphate*, *chelidonine tannate*, and *chelidonine muriate* have been used medicinally. (See *Proc. A. Ph. A.*, 1897, 721.)

Although both Peronin and Meyer (*A. E. P. P.*, 1892, xxix, p. 397) asserted that chelidonine has distinct narcotic properties, the experiments of Hanzlik (*J. P. Ex. T.*, 1915, vii, p. 99) throw grave doubt on their conclusions. The latter investigator found that its only physiological action was a paralyzing effect on the unstriated muscle and suggested its use in *asthma*, and *spasmodic colic*. Ribbing and Rumpf have used chelidonin clinically in *gastralgiæ* in doses of one and one-half to three grains (0.1-0.2 Gm.), but Peronin used from one-twentieth to one-third of a grain (0.003-0.02 Gm.). In 1902 J. O. Schlotterbeck showed that the *chelidoaxanthine* of Probst is really *berberine*. Schlotterbeck has also established the identity of the most abundant of the alkaloids of *sanguinaria* with chelerythrine.

Celandine is an irritant purgative to which toxic properties have been ascribed with

doubtful correctness; in the fatal case of poisoning reported in the *Zeitsch. f. Medisinallieamte*, 1898, it was not the cause of death. The irritant juice has long been used locally upon corns, warts, eczema, and other diseases of the skin, and even in cancer. The *dose* of the dried root or herb is from thirty grains to a drachm (2.0-3.9 Gm.), that of the fresh root one or two drachms (3.9-7.7 Gm.), and the same quantity may be given in infusion. The dose of the aqueous *extract* is from five to ten grains (0.32-0.65 Gm.), of the expressed juice from ten to twenty minims (0.6-1.3 mils), to be gradually increased.

Chelone. *Chelone glabra* L. *Snake-head. Turtle-head. Balmony. Shellflower. Chelone*, Fr., G.—The leaves of this very common indigenous, perennial, herbaceous plant, of the fam. *Scrophulariaceae*, have a bitter taste, and are said to be tonic and aperient, with a supposed peculiar action on the liver. The decoction (two ounces of the fresh herb to the pint) may be given in the *dose* of one or two fluidounces (30-60 mils). *Chelonin*, an eclectic medicine prepared from *chelone*, is a brown, bitter powder administered as a tonic laxative in one and two grain doses (0.06-0.12 Gm.).

Chenopodium. *Chenopodium. American Wormseed.*—The fruit of *C. Ambrosioides* var. *anthelminticum* (L.) Gray (Fam. *Chenopodiaceae*). This species of *Chenopodium*, known commonly by the names of *wormseed* and *Mexican Tea*, grows in almost all parts of the Eastern United States. The whole herb has a strong, peculiar, offensive, yet somewhat aromatic odor, which it retains when dry. All parts of the plant are occasionally employed, but the fruit alone was official in the U. S. P., 1890. This should be collected in October.

Wormseed, as found in commerce, is a small fruit, about 2 mm. in diameter, having a membranaceous pericarp, irregularly spherical, very light, of a dull greenish-yellow or brownish color, a bitterish, somewhat aromatic, pungent taste, and possessed in a high degree of the peculiar odor of the plant. These fruits, when deprived, by rubbing them in the hand, of the membranaceous covering which invests the proper seed, exhibit the shining, blackish surface of the obtusely-edged seed. They abound in a volatile oil, upon which their sensible properties and medicinal virtues depend and which is obtained by distillation. (See *Oleum Chenopodii*) The same oil impregnates to a greater or less extent the whole plant.

Of the activity of the wormseed as an anthel-mintic there can be no question, but it has been entirely displaced by the official oil. The *dose* of the crude drug is from twenty to forty grains (1.3-2.6 Gm.).

Chimaphila. *N. F. IV (U. S. P. VIII). Pipsissewa. Prince's Pine. Wintergreen. Bitter Wintergreen. King's Cure. Ground Holly. Love-in-winter. Rheumatism Weed. Herbe de Pyrole ombellee*, Fr. *Doldenbluthiges Harnkraut, Wintergrun*, G.—There are two American species, the official variety being described by the N. F. as " the dried leaves of *Chimaphila umbellata* (Linne) Barton (Fam. *Ericaceae*), without the presence of more than 5 per cent. of stems or other foreign matter." N. F. It is a small evergreen plant, with a perennial, creeping, yellowish rhizome, which gives rise to several simple, erect or semiprocumbent stems, from four to eight inches in height,

and ligneous at their base. The leaves are "oblanceolate, from 2.5 to 7 cm. in length and from 8 to 20 mm. in breadth, the upper portion coarsely and sharply serrate, acute or somewhat obtuse, the lower wedge-shaped and nearly entire; coriaceous, smooth and uniformly dark green on the upper surface, paler beneath, the veins prominent. Odor slight; taste astringent and bitter. The powdered drug is brownish-green and, when examined under the microscope, exhibits characteristic epidermal tissue composed of cells with unevenly thickened, porous, and wavy vertical walls; the fragments from the lower epidermis show numerous broadly elliptical stomata up to 0.04 mm. in length, the epidermal tissue in transverse view shows outer walls from 0.008 to 0.015 mm. in thickness; fragments of palisade and mesophyll tissue containing chloroplastids; tracheae with spiral or annular markings; a few characteristic, elongated trachea-like cells, about 0.014 mm. in width, thick-walled, slightly lignified and with minute, double-spiral bands or delicate reticulations; fragments of the epidermis from the stems and root-stocks, the cells containing a purplish coloring substance which is intensified when the powder is mounted in hydrated chloral T.S.; parenchyma cells containing a reddish-brown amorphous substance; calcium oxalate in rosette aggregates mostly about 0.035 mm. in diameter, occasionally up to 0.065 mm. in diameter; starch grains few, rounded, simple, up to 0.016 mm. in diameter and sometimes with a central cleft or fissure, or two- to four-compound; trichomes absent. *Chimaphila* yields not more than 7 per cent. of ash." N. F.

The leaves are short petiolate, occurring in irregular whorls, of which there are usually two on the same stem. The flowers are disposed in a small terminal corymb, and stand upon nodding peduncles. It is found in the Northern latitudes of Europe and Asia, also in dry woods from Nova Scotia to Georgia and westward to the Pacific. The flowers appear in June and July.

C. maculata, (L.) Pursh., or spotted wintergreen, though not official, probably possesses similar virtues. The character of the leaves of the two plants will serve to distinguish them. Those of *C. maculata*, are lanceolate, rounded at the base, where they are broader than near the summit, and of a deep olive green, veined with greenish-white; the leaves of *C. umbellata* are broadest near the summit, gradually narrowing to the base, and of a uniform shining green color.

Pipsissewa, when fresh and bruised, exhales a peculiar odor. Boiling water extracts the active properties of the plant, which are also imparted to alcohol. Fairbank found in the leaves a peculiar substance which he calls *chimaphilin*.

Chimaphilin was obtained by extracting the tincture with chloroform, or by distilling the sterna with water. It occurs in golden-yellow auricular crystals, odorless and tasteless, practically insoluble in water, but dissolving in alcohol, ether, chloroform, and the fixed oils. It is possessed of neither acid nor alkaline properties. Peacock (*A. J. P.*, 1892, p. 295) found that *chimaphilin* has the chemical composition $C_{24}H_{21}O_4$.

Ridenour (*A. J. P.*, 1895, '236) confirms the formula, $C_{24}H_{21}O_4$, given by Peacock. He finds the melting point of the purified *chimaphilin* to be 114° C. (237.2° F.). He also

prepared another crystalline principle melting above 250° C. (482° F.), to which he gives the formula C₁₀H₁₉O, which agrees with Beshore's product. *Arbutin*, C₁₂H₁₆O₇, is also found in *chimaphila*.

This plant is stated to have been used internally by the North American Indians in *scrofula* and *rheumatism*, and was a popular remedy among the settlers of this country. It has no medicinal properties, however, beyond a feeble diuretic action and perhaps some antiseptic influence on the urine. It is occasionally prescribed for *cystitis*. The best preparation is the fluidextract, which may readily be made into a syrup. *Dose*, thirty to ninety grains (2-6 Gm.).

China Morada.—Under this name there appear to be used in Bolivia several barks. One of these has been ascertained by Arati and Canzoneri (*L'Orosi*, Feb., 1889) to be the product of a rubiaceous tree, *Pogonopustubulosus* (Rich.) K. Sch., and to contain an alkaloid, *moradeine*, besides a fluorescent substance, *moradin*, allied to scolopetin. (See *P. J.*, xix.)

Chionanthus. *N. F. IV. Chionanthus virginica* L. *Fringe Tree Bark. Old Man's Beard.* It is described in the *N. F.* as "the dried bark of the root of *Chionanthus virginica* Linne (Fam. *Oleaceae*), without the presence of more than 8 per cent. of other parts of the plant or other foreign matter. Usually in transversely curved pieces, occasionally in single quills from 1 to 10 cm. in length; bark from 2 to 10 mm. in thickness; heavy, some pieces of the whole drug sinking when thrown into water; outer surface usually reddish-brown, occasionally grayish-brown, with few transverse wrinkles, whitish cork patches and root-scars; inner surface yellowish-brown, more or less striate and undulate; fracture short, hard, and coarsely granular, due to projecting groups of stone cells; the broken surface of a light yellowish-white color. Odor characteristic; taste bitter. The powdered drug is light brown and, when examined under the microscope, exhibits somewhat rounded, simple or two- to four-compound starch grains, the individual grains mostly 0.003 to 0.025 mm. in diameter; numerous stone cells, in groups and isolated, the walls thick, strongly lignified and with simple and branching pores; brown resin masses; fragments consisting of light brown, thin-walled cork cells; parenchyma tissue with many of the cells filled with starch grains. *Chionanthus* yields not more than 5 per cent. of ash." *N. F.*

In the bark of this indigenous plant saponin was found by E. S. Justice (*A. J. P.*, xlvii, 195), but not by W. von Schuiz, who, however (*Ph Z. R.*, 1893, 579), detected a glucoside. The fluid-extract has been recommended in doses of from one-half to one fluidrachm (1.8-3.75 mils) two or three times a day, as an aperient and a diuretic.

Chione. *Chione glabra* DO. *Palo Blanco.*— The bark of this West Indian rubiaceous plant is said to be largely used as an aphrodisiac and tonic. According to B. H. Paul and A. J. Cownley, it yields 1.5 per cent. of a pale yellow volatile oil composed largely of phenols. (*P. J.*, vol. lx.)

CHIRATA. Br.

CHIRETTA

"Chiretta is the plant, *Swertia Chirata*, Buch.-Ham., collected when in flower, and dried." Br. "The dried plant of *Swertia Chirayita* (Roxburgh) Hamilton (Fam. *Gentianaceae*)." *N. F.*

East Indian Balmony; Chiretta; Chirette, *Fr.*; Chiretta. Ostindischer Enzian, *G.*

Chirata was for many years official in the IT. S. Pharmacopoeia and is still retained by the British authority and in the N. F. According to Lloyd, this drug has long been held in esteem by the Hindoos. It first attracted attention in England in 1829 and was introduced into the Edinburgh Pharmacopoeia in 1839.

Swertia Chirayita (Roxb.), Hamilton (*Ophelia Chirata*, Griesbach).—The *chirayta*, or *chirata*, is an annual plant, about three feet high, with a branching oblique root, and an erect, smooth, slightly winged branching stem, and furnished with opposite, lanceolate, very acute, entire, smooth, three or five-nerved leaves. The flowers are numerous, peduncled, yellow, with a four-cleft calyx having linear acute divisions, the limb of the corolla spreading and four-parted, four stamens, a single style, and a two-lobed stigma. The capsules are unilocular. The plant is a native of Nepaul and other parts of Northern India. The whole of it is gathered when the flowers are well advanced. In the Indian bazaars the name *chirata* is applied to various dried gentianaceous plants; the most important of these is the *Ophelia angustifolia* (Buch.-Ham.). It yields the *Paharee* or *Hill chirata*, which is distinguished by its inferior bitterness, and its rectangular, winged stems, whose section presents a thick woody ring and a centre nearly or entirely hollow, with only traces of pith, A false *chirata*, which also found its way into the London markets, and resembles the official variety in having a well developed pith, but which is completely lacking in bitterness, is affirmed to be the product of *Ophelia alata*. (P. J., xvii, 903.) Under the name of Indian *chirata*, the dried plant of the *Andrographis paniculata* Nees has appeared in the London market. It resembles much more closely recently dried broom tops than the true *chirata*. It is a little more than two feet long. The branching stems are from $\frac{1}{8}$ to $\frac{1}{4}$ inch in thickness near the base, woody, quadrangular, furrowed, smooth, slightly knotted at the point from which the branches spring, the longitudinal furrows are

continued through the roots, which have numerous fine radicles, the leaves are opposite decussate, branches erect or forming an acute angle with the stem, terminal shoots extremely slender.

The dried plant is imported into Europe in bundles, consisting mainly of the stems, with portions of the root attached. The stems contain a yellowish pith. The drug is officially described as " Stem about one metre long, smooth, brown, or purplish-brown, slightly winged and much branched above, rounded below and containing a large, continuous, easily separable pith. Root oblique. Branches slender, elongated, decussate. Leaves opposite, ovate, glabrous, entire, usually with three to seven lateral veins. Flowers small, numerous, paniced. Fruits superior, bicarpellary, unilocular. No odor; taste extremely bitter." *Br.*

It is described in the N. F. as " smooth, root simple, about 7 mm. in thickness near the crown, stem about 1 M. in length, externally yellowish-or purplish-brown; cylindrical near the base, quadrangular and slightly winged above, with numerous opposite, ascending branches; wood yellowish, thin, enclosing usually a large yellowish easily separable pith; leaves opposite, sessile, ovate-lanceolate, entire, five nerved, about 6 cm. in length; flowers numerous, paniced, small, with a four-lobed calyx and corolla, capsule ovoid^ acute, one-celled, many-seeded. Odor slight; taste intensely bitter. Chirata yields not more than 6 per cent. of ash." *N. F.*

The virtues of chirata are imparted to water and alcohol, and are retained in the extract. According to Lassaigne and Boissel, the stems contain resin, a yellow bitter substance, brown coloring matter, gum, and various salts. Fliickiger and Hohn, who subsequently examined the stems and roots of chirata, extracted from them sugar, wax, chlorophyll, soft resin, tannin, an acid which they name *ophelic*, possessing the formula $C_{13}H_{20}O_{10}$, and a peculiar bitter substance, denominated *chiratin*, $C_{26}H_{48}O_{15}$. The acid is syrupy, deliquescent, yellowish-brown, at first slightly sour, afterwards intensely bitter. It is soluble in water, with some turbidness, probably owing to resin mixed with it, and completely soluble in alcohol, or a mixture of this with ether. It decomposes certain salts, and forms amorphous compounds with acids. Chira-fcin is a yellow, hygroscopic powder, but feebly crystallizable, very bitter, sparingly soluble in cold water, more so in hot water, and readily dissolved by alcohol and ether. It is neutral to test paper, and yields a copious precipitate with tannic acid. By the action of acids,

chira-tin is separated into ophelie acid, and a yellowish-brown, amorphous substance, bitter, scarcely soluble in water, readily soluble in alcohol, and not reducing copper solutions, as the ophelic acid does. Hohn gives it the formula $C_{13}H_{24}O_3$, and names it *chiratogenin*.

Uses.—Chirata has long been used in India. It has been introduced into Europe, and appears to be highly esteemed, but has not been employed to any considerable extent in this country. Its properties are those of the pure bitters, and probably do not differ from those of the other members of the family of *Gentianaceae*. (See *Gentiana*.) Like these, in overdoses it nauseates and oppresses the stomach. Some have supposed that, in addition to its tonic properties, it exerts a peculiar influence over the liver, promoting the secretion of bile and correcting it when deranged, and restoring healthy evacuations in cases of habitual costiveness. It has been used in *dyspepsia*, and in the *debility* of convalescence, and generally in cases in which corroborant measures are indicated. In India it has been employed in *intermittents* and *remittents*, combined with the seeds of *Guilandina Bonducella* L. It may be given in powder, infusion, tincture, or fluid-extract.

Dose, ten to twenty grains (0.65-1.3 Gin.).

Off. Prep.—Infusum Chiratae, *Br.*; Tinctura Chiratas, *Br.*; Fluidextractum Chiratae, *N. F.*

CHONDRUS. U. S.

CHONDRUS [Irish Moss]

"The dried plant of *Chondrus crispus* (Linne) Stackhouse or of *Gigartina mamillosa* (Goodenough et Wood-ward) J. Agardh (Fam. *Gigartinaceae*) " U. S.

Carrageen, Caragahen, Fucus Crispua, Pigwiacis:, Killeen, Pearl Moss; Carragheen; Carragaheen; Carrageen ou Mousse perlee, *Fr. Cod.*; Mousse Marine perlee, *Fr.*; Carrageen, *P. G.*; Irlandisches Moos, Perimoos, Knorpeltang, *G.*; Fuco carageo, Musco d'Irlanda, Fuco crispo. *It.*; Caragaen, Musgo marino perlado, *Sp.*

Chondrus crispus grows upon rocks and stones on the coast of Europe, and is especially abundant on the southern and western coasts of Ireland, where it is collected. It is also a native of the United States, and

is gathered largely on the coast of Massachusetts, below Boston, where it is partly torn from the rocks and partly collected upon the beach, on which it is thrown up during storms. It is prepared for market 'by spreading it out high on the beach, to dry and bleach in the sun. (Aug. P. Melzar, Proc. A. Ph. A., 1860.) For elaborate accounts of the plant, of its distribution on the sea coast of Massachusetts, and of the mode of gathering and curing, see *U. S. Agricultural Report*, 1866; also *A. J. P.*, 1868, 417; 1895, 596; 1899, 483. Henry Kraemer witnessed the methods pursued on the Massachusetts coast in the collection of Irish moss at Scituate, which appears to be a particularly favorable situation. The season for collection begins late in May and continues to September, June and July being the best months. The moss at present is only found on rocks that are from 15 to 20 feet below the tide, hence women no longer engage in its collection. The men go out in their sail boats or dories at half tide, and come in at half flood. With their long rakes they scrape the moss off the rocks, collecting thus about 50 pounds to the boat, the total for the season at Scituate being about 10,000 pounds. The moss is spread out on the high beach for a week or so, the action of the sun and dew bleaching it. It is then enclosed in hogsheads, in which it is again saturated with sea water by rolling them in the marshes; after which it is again spread out and subjected to the bleaching process, this alternate treatment being repeated four or five times, until the product is of a yellowish or white color. The final drying is done in barns, where the moss is stored until it is packed in 100 lb. barrels at the end of the season. In the course of his journey he had opportunity to observe the *Chondrus* growing and gathered in different localities along the coast, and found it to consist chiefly, if not entirely, of *Chondrus crispus*. While it is stated in Dr. Farlow's "The Marine Algae of New England" that the closely resembling *Gigartina mamillosa* is common from Boston northward, Kraemer is inclined to believe that *Chondrus crispus* (L.), Lyngbye, is practically the only source of the American drug. (See *Proc. Penn. Pharm. Assoc.*, 1899, 113-116.) Tunmann (*Apoth. Zeit.*, 1909, pp. 91 and 151) has given an elaborate account of the morphology and composition of *Chondrus*.

Gigartina mamillosa Ag. resembles the true Irish moss, and, growing with it upon the rocks, is often gathered with it. It can, however, be at once distinguished by the numerous papillae which cover the surface and margins of the fronds and bear the fruit (cystocarps). In chemical and medicinal properties it is probably identical with *C. crispus*.

Irish moss when collected is washed and dried. It is probably sometimes bleached by the use of potassium permanganate and sodium thiosulphate by the same process as that used for bleaching sponge. Herr Schack was led to suspect this, through discovering the presence of sulphurous acid in a German specimen. (*Ph. Ztg.*, 1886, p. 87.) The presence of arsenic has been determined in some commercial lots, being caused, no doubt, by the impurities in the sulphur used for bleaching Chondrus. Some "faked" samples have yielded as much as 35 per cent. of ash which contained a large quantity of calcium sulphate. The gelatinizing value of specimens of this kind is about 60 per cent. below normal. In the fresh state it is of a purplish color, but, as found in the shops, is yellowish or yellowish-white, with occasionally purplish portions. It is officially described as:

"Entire plants more or less matted together, consisting of a slender stalk from which arises a series of dichotomously branching, more or less flattened segments, emarginate or deeply cleft at the tips; from 5 to 15 cm. in length, and 1 to 10 mm. in width; yellowish-white, translucent, frequently coated with a calcareous deposit which effervesces with hydrochloric acid; sometimes with fruit bodies or sporangia embedded near the apex of the segments (in *C. crispus*) or with sporangia borne on short tuberculated projections or stalks, more or less scattered over the upper portion of the segments (in *G. mamillosa*); somewhat cartilaginous; odor slight, seaweed like; taste mucilaginous, saline. Boil one part of Chondrus for about ten minutes with 30 parts of water, replacing the water lost by evaporation; the strained liquid forms a thick jelly upon cooling. When softened in cold water Chondrus becomes gelatinous and transparent, the thallus remaining nearly smooth and uniform and not swollen except slightly at the tips; a solution made by boiling 0.3 Gm. of the drug in 100 mls of water and filtering gives no precipitate on the addition of tannic acid T.S. (*gelatin*), and when cold does not give a blue color on the addition of iodine T.S. (*starch*)."*U. S.*

It swells in cold water, but does not dissolve. Boiling water dissolves a large proportion of it, and the solution, if sufficiently concentrated, gelatinizes on cooling. Herberger found 79.1 per cent. of a so-called pectin (mucilage), and 9.5 of mucus, with fatty matter, free acids, chlorides, etc., but neither iodine nor bromine. Dupasquier discovered in it both of these elements, which had generally escaped attention in consequence of their reaction, as soon as liberated, upon the sodium sulphide resulting from the decomposition of the sodium sulphate of the

moss when charred. (*J. P. C.*, 3e ser., iii, 113.) The analysis made by Church in 1877 gave: mucilage, 55.4; water, 18.8; mineral matter, 14.2; albuminoids, 9.4; and cellulose, 2.2 per cent. The pectin Pereira thought peculiar, and proposed to call it *carrageenin*.

It is distinguished from gum by affording, when dissolved in water, no precipitate with alcohol; from starch, by not becoming blue with tincture of iodine; from pectin, by yielding no precipitate with lead acetate and from mucic acid by the action of nitric acid. Ch. Blondeau gives the name of *goemine* to a substance obtained by boiling carrageen (*goemon*, Fr.) for several hours in distilled water, and precipitating the mucilaginous liquid by alcohol. Fluckiger, who analyzed this mucilage with care, found in it *no* sulphur, and only 0.88 per cent. of nitrogen. The drug itself yielded not more than 1.012 per cent. of nitrogen. (*Pharmacographia*, 2d ed., 748.) Haedicke, Bauer, and Tollens obtained, on extraction with water containing 0.6 per cent. of sulphuric acid, and further purification by alcohol, a small quantity of a crystalline compound which resembles galactose in its composition, in its action on polarized light, and in its behavior with nitric acid. On oxidation with nitric acid, the dry moss yields from 21.6 to 22.2 per cent. of mucic acid. Carrageenin is said to have been used as a substitute for acacia, under the name of *imitation gum arabic*; the latter occurs in three forms, white, light yellow, and yellow. They all have similar properties, swelling' up like tragacanth when mixed with cold water, but not forming' a clear solution unless the mixture be boiled, in this latter respect differing from tragacanth or albumen; iodine does not give a blue color, and alcohol does not precipitate the solution, even when 50 per cent. of it is added. It has mild adhesive properties. (E. C. Federer, *Ph. Era*, 1887, 146.) The mucilage of Irish moss has come into considerable use as an emulsifying agent. (*Proc. A. Ph. A.*, 1887; *A. J. P.*, 1888, 170.)

Uses.—Chondrus is nutritive and demulcent, and, being easy of digestion and not unpleasant to the taste, forms a useful article of diet in cases in which the farinaceous preparations, such as tapioca, sago, barley, etc., are usually employed. It has been particularly recommended in *chronic pectoral affections, scrofulous complaints, dysentery, diarrhea, and disorders of the kidneys and bladder*. It may be used in the form of decoction, made by boiling a pint and a half of water with half an ounce of the moss down to a pint. Sugar and lemon juice may usually be added to improve the flavor. Milk may be

substituted for water when a more nutritious preparation is required. It is recommended to macerate the moss for about ten minutes in cold water before submitting it to decoction. Any unpleasant flavor that it may have acquired from the contact with foreign substances is thus removed.

Dose, four drachms (15.5 Gm.).

Off. Prep.—*Gelatinum Chondri, N. F.*; *Mucilago Chondri, N. F.*

Cichorium. *Cichorium Intybus* L. *Chicory. Succory. Blue Sailors.*—A perennial herbaceous composite plant, indigenous in Europe, but naturalized in the Northern United States and Canada, where it grows in fields, and in roads along the fences. The whole plant has a bitter taste, without acrimony or any very peculiar flavor. The taste is strongest in the root and weakest in the flowers. The leaves, when young and tender, are eaten as salad. Chicory is a feeble, non-irritating tonic.

The root is much used as a substitute for or adulterant of coffee. In preparing it, Dausse recommends that the dried root should be cut into rather large and equal pieces, which are to be roasted until they lose 140 out of 500 parts. The pieces are then easily ground in a mill, and afford a yellowish-brown powder. (*Ph. Cb.*, 1850, 688.) For methods of detection in ground coffee, see P. J., 1867, 141; also Alien (*Corn. Org. Anal.*, 2'd ed., vol. iii, part 2, 540), and J. R. Leebody (*Chem. News*, 1874, 243); see also paper by LaWall and Forman (*A. J. P.*, 1913, 535). A glucoside has been obtained from the blossoms of *Cichorium Intybus* by Nietzki (*A. Pharm.*, (3) 8, 327), to which the formula $C_{34}H_{34}O_{19}$ is assigned. On boiling with dilute acids it yields glucose and a compound, $C_{20}H_{14}O_9$. This decomposition product seems to exist in the blossoms ready formed along with the glucoside. The garden *endive* is also a species of *cichorium*, *C. Endivia* L.

Cicuta. *Cicuta virosa* L. *Water Hemlock. Cowbane. Cigue vireuse, Fr. Wasserschierling, G.*—A perennial, umbelliferous European plant, growing on the borders of pools and streams. It is very poisonous to most animals, though said to be eaten with impunity by goats and sheep. A number of the species of *cicuta* are intensely poisonous; indeed, the statement is made that *C. maculata* L. is the most poisonous plant native in the United States. The *C. vagans* (*Oregon water hemlock*), *C. occidentalis* Dougl. and *C. bulbifera* L., all of which are found in various parts of North America, are actively poisonous, as is also the European species *C. virosa*. From the last named. Van Ankum (*J. P. C.*, 1868) obtained a resinous body which was intensely poisonous, resembling picrotoxin in its physiological action, and to which he gave the name of *cicutoxin*. Bohm (*A. E. P. P.*, v, 281) has since obtained this principle pure, as a thick, tenacious, amorphous substance, of acid reaction, of slight odor but disagreeable taste. The dry root yielded about 3.5 per cent., the fresh 0.2 per cent. of *cicutoxin*. The presence of a volatile alkaloid resembling coniine, and termed *cicutine*, has been observed by Wittstein and Buignet. According to Jacobson

(*J. Am. C. S.*, 1915, xxxvii, p. 916), cicutoxin is a complex derivative of pyrone and is fatal to lower animals in doses of 50 mgm. per kilo.

Cicuta maculata L., *American water hemlock, Musquashroot. Beaver poison, Spotted cowbane.* This grows in meadows and on the borders of streams throughout the United States, and is closely analogous, in botanical character and in effects, to the European species. In several instances children have been fatally poisoned by eating its root. This consists of several oblong, fleshy tubers, sometimes as long as the finger, spreading out from the base of the stem, and having an odor and taste not unlike those of parsnip. For microscopic examination of plant, see *A. J. P.*, July, 1891, and Merck's Report, 1909, p. 35. *Cicuta* has been highly lauded as a specific in nervous and sick headache (*Proc. A. Ph. A.*, 1858, 253), but is rarely if ever used. J. E. Young found in the seeds an alkaloid supposed to be identical with coniine. (*A. J. P.*, xxvii, 294, confirmed by E. Glenk, *A. J. P.*, 1891, 328.)

Egdhal (*A. I. M.*, 1911, vii, p. 348) has collected the history of 46 cases of poisoning by *cicuta*, of which twenty-one were fatal. Nausea, vomiting, and convulsions occurred in practically all the cases. In most of them there was also bloody froth at the mouth and in many dilated pupils and unconsciousness. In his own case there was cyanosis apparently from interference with the respiration by the convulsions.

In *cicuta* poisoning there is generally violent vomiting, followed by vertigo, cold, clammy skin, slow, feeble pulse, general convulsions and later paralysis, unconsciousness and dilated pupils. Tannic acid has been suggested as an antidote, but its efficiency has not been proved. The treatment should be evacuation of the stomach, stimulants to combat the collapse, and the cautious use of morphine to control the vomiting and convulsions.

CIMICIFUGA. U. S.

CIMICIFUGA Cimicif. [Black Cohosh, Black Snakeroot, Macrotys]

"The dried rhizome and roots of *Cimicifuga racemosa* (Linne) Nuttall (Fam. *Ranunculaceae*), without the presence or admixture of more than 2 per cent. of stems or foreign matter." *U. S.*

Cimicifugae Rhizoma, Br., 1898, *Acetaeae Racemosae Radix; Cohosh; Macrotys; Rattleroot; Squaw Root; Rattle Snake Root; Bugbane; Rattle Weed; Richweed; Bugwort, Rattletop; Racine d'Actee a Grappes, Fr.; Schwarae Schlangenwurzel, G.*

Cimicifuga was dismissed from the *Br. Pharm.*, 1914.

Cimicifuga racemosa is a tall stately plant, having a perennial root, and

a simple herbaceous stem, which rises from» four to eight feet in height. The leaves are large, and ternately decomposed, having oblong-ovate leaflets, incised and toothed at their edges. The flowers are small, white, and disposed in a long, terminal, wand-like raceme, with occasionally one or two shorter racemes near its base. The calyx is white, four-leaved, and deciduous; the petals are minute, and shorter than the stamens; the pistil consists of an oval ovary and sessile stigma. The fruit is an ovoid capsule containing numerous flat seeds. The plant grows in shady or rocky woods from Southern New England to Wisconsin and southward, flowering in June and July. The name *Cimicifuga* is derived from the Latin *Cimex*, bug; and *fugare*, to drive away.

Properties.—It is officially described as follows : “Rhizome horizontal, more or less branching, from 2 to 12 cm. in length, and from 1 to 2.5 cm. in thickness; externally dark brown, slightly annulate from circular scars of bud scale-leaves, the upper surface with numerous stout, erect or somewhat curved branches terminated by deep, cup-shaped sears, each of which usually shows a distinct radiate structure; inferior and lateral portions with numerous root-scars and a few short roots; fracture horny; internally whitish and mealy or dark brown and waxy, bark thin, wood distinctly radiate and of about the same thickness as the pith; odor slight; taste bitter and acrid. Roots somewhat cylindrical or obtusely quadrangular, from 1 to 3 mm. in thickness, externally dark brown, longitudinally wrinkled; fracture short; internally bark dark brown, wood yellowish, 4 to 6-rayed. Under the microscope, sections of the rhizome of *Cimicifuga* show a yellowish-brown suberized epidermis, a cortex made up of about 30 layers of starch-bearing parenchyma cells; the fibro-vascular bundles collateral, the xylem consisting of tracheae with bordered pores, and resembling tracheids in that the ends are rather acute; wood-fibers numerous, thin-walled, strongly lignified and with simple, oblique pores, the bundles separated by starch-bearing parenchyma strands from 5 to 30 cells wide; pith cells numerous, resembling those of the cortex. Under the microscope, sections of the root of *Cimicifuga* show a hairy epidermis, which becomes suberized in older roots; the cortex shows about 12 rows of starch-bearing parenchyma cells; endodermis distinct; fibro-vascular bundles 4 to 6, showing in older roots as separate collateral bundles. The powder is light to dark brown; starch grains numerous, single or compound, the individual grains spherical or more or less polygonal, each with a somewhat central cleft, from 0.003 to 0.015 mm. in diameter; fragments showing trachea with bordered pores and lignified wood-fibers; irregular, yellowish-brown

fragments of suberized epidermis made up of more or less tabular cells, sometimes elongated and considerably thickened. *Cimicifuga* yields not more than 10 per cent. of ash." *U. S.*

For a detailed description of the microscopic character of the root, see *A. J. P.*, 1884, 460; also 1895, 121; Holm., M. K., 1911, p. 6.

The roots "exhibit in transverse section from three to five wedge-shaped wood-bundles, separated by as many broad medullary rays. Both rhizome and roots are blackened by test-solution of ferric chloride (presence of tannic acid)." *Br.*, 1898.

The odor, though not strong, is peculiar and rather disagreeable, and is gradually lost with age. The drug of commerce is likely to be unintentionally admixed with other species of *Cimicifuga* and *Actaea*. *Cimicifuga* yields its virtues to boiling water.

Tilghman found gum, starch, sugar, resin, wax, fatty matter, tannic and gallic acids, a black coloring matter, a green coloring matter, lignin, and salts of potassium, calcium, magnesium, and iron. (*A. J. P.*, vi.) It no doubt also contains, when fresh, a volatile principle, with which its virtues may be in some degree associated. Davis separated by distillation a small proportion of volatile oil having decidedly the peculiar odor of the root. He also found albumen, extractive, and silica. The sugar noticed by him was of the uncrystallizable variety, and the resin of two kinds, one soluble in alcohol but not in ether, the other soluble in both these menstrua. (*A. J. P.*, xxxiii.) A crystallizable principle has been obtained by T. Elwood Conard from a strong tincture of the root by treating with solution of lead sub-acetate to precipitate resin, tannin, and coloring matters, then filtering, and precipitating the lead by hydrogen sulphide in excess, and allowing the tincture to evaporate spontaneously; and, finally, having treated the residuary powder with petroleum benzine, afterwards washing it with water, dissolving it to saturation in strong alcohol, and treating the solution with alumina. The mixture was allowed to evaporate to a dry mass, which was nearly exhausted with alcohol. The solution, being allowed to evaporate, left behind a crystalline mass, somewhat resembling alum. This substance has little taste, on account of its extreme insolubility in the saliva, but in alcoholic solutions has very strongly the acrid taste characteristic of the fresh root. The crystals are very soluble in cold, and more so in hot alcohol, soluble also in chloroform, and slightly so in ether. They are

fusible and inflammable. They are neutral, possessing neither acid nor alkaline properties. Their effects on the system were not determined. (A. J. P., 1871.) L. F. Beach (A. J. P., 1876) obtained from commercial resin of *cimicifuga* (the so-called cimicifugin or macrotin) a crystalline principle by Conard's process. M. S. Faick (A. J. P., 1884) found in the juice of the fresh plant a crystalline principle resembling the principle announced by Conard. On the other hand, neither F. H. Trimble (A. J. P., 1878) nor Warder and Coblenz were able to obtain a crystalline principle, while C. S. Gal-lagher obtained crystals of cane sugar from the fluidextract. (A. J. P., 1887.) In view of these facts, it would appear that the active principle is a resinous amorphous body. (See *Drugs and Medicines of North America*, vol. i.) Pinnemore reports on the chemical examination of the rhizome of *cimicifuga*. A systematic examination has resulted in the isolation and identification of *isoferulic acid*, also a minute quantity of an acid whose melting point was unaffected by admixture with salicylic acid. Palmitic, oleic, and other unsaturated acids, and phytosterol, are also present, and distinct reactions for alkaloids have been found, but the amount present is very small. (P. J., 1910, 31 (85), pp. 142-144,178.)

Uses.—In 1831 *cimicifuga* was introduced to the notice of the profession by Young. In overdoses it is said to cause general relaxation, vertigo, tremors, decided reduction of the pulse; occasionally it causes vomiting, but its emetic action is never violent, and is probably simply the result of a mild gastric irritation. It certainly, in large doses, produces giddiness, with intense headache and prostration. It has been found by R. Hutchinson to cause in frogs complete anesthesia by a direct action upon the sensory side of the spinal cord. The same observer noted that toxic doses produce in mammals slowing of the pulse and fall of the arterial pressure, results which appear to be due in part to a direct depressant action upon the heart muscle or its ganglia, in part to a paralysis of the vasomotor center. Clinical experience has shown this drug to be a useful remedy in the treatment of *chorea*. It has also been employed, though with less certainty of benefit, in *chronic rheumatism*, *urticaria*, *neuralgia*, and *dysmenorrhea*. It is also asserted to act as a specific in *tinnitus aurium*.

In *chorea* it is necessary to give large doses. The proper method of administration is to start with about fifteen minims of the fluidextract three times a day, increasing one minim daily until the occurrence of frontal headache or improvement in the condition. The practitioners

calling themselves eclectics use, under the name of *cimicifugin*, or *macrotin*, an impure resin obtained by precipitating a saturated tincture of the root with water; dose, a grain or two (0.065-0.13 Gm.). (See *N. J. Med. Rep.*, viii, 247.)

Dose, of powdered cimicifuga, five to thirty grains (0.3-2.0 Gm.).

Off. Prep.—Extractum Cimicifugae, *U. S.*; Fluidextractum Cimicifugae, *U. S.*; Elixir Sodii Salicylatis Compositum (from Fluidextract), *N. F.*; Syrupus Cimicifugae Compositus (from Fluidextract), *N. F.*; Tinctura Cimicifugae, *N.F.*

CINCHONA. U. S.

CINCHONA Cinch. [Peruvian Bark, Yellow Peruvian Bark]

"The dried bark of *Cinchona Ledgeriana* Moens, *Cinchona Calisaya* Weddell, and of hybrids of these with other species of *Cinchona* (Fam. *Rubiaceae*), yielding not less than 5 per cent. of the alkaloids of *Cinchona*." *U. S.*

Cinchonae Flavae Cortex; Yellow *Cinchona* Bark, *Cinchona Flava*, *U. S.* 1880, Yellow *Cinchona*, *Calisaya* Bark; *Cortex Chinae Calisayae*, *Cortex Chinae Regiae*; *China Regia*; *Konigschina*, *Calisayarinde*, *G.*; *Quinquinajaune royal*, *Quinquina Calisaya*, *Fr. Cod.*; *China gialla*. *It.*; *Quina calisaya*, *Quina amarilla*, *Sp.*

CINCHONA RUBRA. U. S. (Br.)

RED CINCHONA Cinch. Rub.

"The dried bark of *Cinchona succirubra* Pavon (Fam. *Rubiaceae*), or of its hybrids, yielding not less than 5 per cent. of the alkaloids of Red *Cinchona*." *U. S.* "Red *Cinchona* Bark is the dried bark of the stem and branches of cultivated plants of *Cinchona succirubra*, Pav." *Br.*

Cinchonae Rubrae Cortex, *Br.*; Red *Cinchona* Bark; *Cortex Chinae Ruber*, *China Rubra*; Red *Peruvian* Bark; *Bed Bark*; *Quinquina rouge*, *Fr.*; *Cortex Chinee*, *P. G.*; *Chinarinde*, *Rothe Chinarinde*, *G.*; *China rossa*, *It.*; *Quina roja*, *Sp.*

Botanical History.

"Though the Peruvian bark was introduced into Europe so early as 1640, it was not until the year 1737 that the plant producing it was known to naturalists. In that year La Con-damine, on a journey from Quito to Lima, through the province of Loxa, had an opportunity of examining the tree, of which, upon his return, he published a very complete description, with plate, under the name *Quinquina*, stating that three species were recognized. (*Mem. Ac.*, Paris, 1738, p. 226.) Four years later, Linne proposed a new name, *Cinchona*, in honor of the Countess of Chinchon, who first made the bark known in Europe. Linne recognized but one species, which he called *C. officinalis*, and this continued for a long time to be recognized by the Pharmacopoeias as the only source of the Peruvian bark of commerce. But a vast number of plants belonging to the Linnaean genus *Cinchona* were in the course of time discovered; and the list became at length so unwieldy and heterogeneous that botanists were compelled to distribute the species into several groups, each constituting a distinct genus, and all associated in the natural family of Rubiaceae.

For our knowledge of these plants as they existed naturally, we are chiefly indebted, to the following botanists, besides La Condamine, of whom we have before spoken: Joseph de Jussieu, who, in the year 1739, explored the country about Loxa, and gathered specimens which still exist in the cabinets of Europe; Mutis, who in 1772 discovered *Cinchona* trees in Colombia, and afterwards, aided by his pupil, Zea, made further investigations and discoveries in the same region; Ruiz and Pavon, who in 1777 began a course of botanical inquiries in the central portions of Lower Peru, and discovered several new species; Humboldt and Bonpland, who visited several of the Peruvian bark districts, and published the results of their observations after 1792; Poppig, who travelled in Peru so late as 1832, and published an account of his journey about the year 1835; Wed-dell, whose researches in Bolivia are so well known and have been productive of valuable information in relation to the *Calisaya* bark and allied species; while Karsten, Caldas, Martius, Ledger, Markham, and other intrepid explorers have in later times largely added to our information. At the present time (1917) thirty or forty more or less clearly defined species of *Cinchona* are recognized. Of all of these probably but four with their cultivated hybrids yield the *Cinchona* Bark of commerce. The principal sources of information bearing on this phase of the subject are the

several reports of the plantations in Java, India, and Jamaica. Howard's *Quinology of the East Indian Plantations*, Markhanrs *Peruvian Bark*, Kuntze's *Arten, Hybriden und Cultur der Chininbaume*, Hooper in the *Pharmacographia Indica*, several contributions by Trimen to the *Tropical Agriculturist*, and Rusby in the *Pharmaceutical Record*, October, 1887. The literature of the cinchona hybrids is hopelessly confused by the same name being frequently used by different authorities for the different hybrids and the one hybrid having various names. Thus, *C. robusta* of Trimen is known in Ceylon as *C. lanosa*, and in the Neilgherry Hills as *C. magnifolia*, also as *C. pubescens*.

C. Calisaya Weddell, is tall, usually surpassing those about it, the trunk often more than two feet in diameter. Leaves petiolate, the blade ovate-oblong to slightly obovate, 7 to 17.5 cm. long by 2.5 to 7 cm. broad, obtuse, the base acute or slightly attenuated, very thin, smooth, and, especially below, with a satiny luster, above dark green, below emerald-green or deep purple-green, scrobiculate, the glands scarcely visible above. Stipules oblong, about equalling the petioles, very smooth, very obtuse. Panicles ovate to subcorymbose. Calyx pubescent, with a cup-shaped limb and short triangular teeth. Corolla rose-colored (in cultivation often white or nearly so), the tube cylindrical and about 8 mm. long, the laciniae more deeply colored, the edges white-hairy. Stamens included. Capsule ovate, scarcely as long as the flowers. Seeds elliptical lanceolate, the margin irregularly fimbriate-toothed. Bolivia and Southern Peru, 4000 to 6000 feet. Source of the Calisaya or Yellow Bark. The species presents many forms, and two varieties are recognized.

C. Ledgeriana Moens., formerly recognized as a variety of *C. Calisaya*, differs from the type chiefly in its thicker, narrower, oblong leaves, with attenuate base, often bluish-green below. It yields a thick and remarkably rich bark, and is probably the most valued of all the cinchonas. This species was named in honor of Ledger, who first brought seed of this species from Bolivia.

C. succirubra Pavon, Mas. (Howard in *P. J.*, Oct., 1856, p. 209, with a figure). Extreme size even greater than that of the last. Branches silvery. Petiole pubescent, leaf ovate to oval, acute with a very short point, the base more or less narrowing, often 6 by 9 inches, dark green and smooth above, below paler and pubescent to a variable degree, especially on the veins, not scrobiculate, the margin slightly revolute.

Stipules entire, oblong, obtuse, sub-amplexicaul. Flowers much as in the last, but rather smaller. Fruit lanceolate. Western slopes of Mt. Chimborazo. The source of the Red Bark.

C. officinalis Hooker fil.—Petioles smooth, cylindrical, and, like the veins, reddish; blade 10 to 12.5 cm. long, varying from broadly oval to lanceolate, acute at both ends, the margins usually recurved, smooth and deep green above, paler, but bright green below, scrobiculate, the principal veins pubescent. Stipules equalling the petioles, ovate, acute, entire, pubescent. Flowers and fruit much as in *C. Calisaya*. Widely distributed in the equatorial Andes, at an elevation of from 5000 to 7500 feet. The source of the barks known as Pale, Crown, Loxa, Cuenca, and Huanuco. This is the original species, upon which the genus *Quinquina* or *Cinchona* was founded. All things considered, it is, perhaps, to be regarded as the principal species of the genus and its variability is extreme.

The specific variations produced by hybridization in the above characters may not be here considered, though it may be stated that they are entirely characteristic. The parentage of a hybrid is ordinarily fully and strongly indicated in its appearance. As a rule, also, the alkaloidal yield takes a mean between that of the parents, but sometimes this is conspicuously not the case. Goris and Reimers (*Trav. Lab. Nat. med. Ecol. supe. Pharm.*, in *Bot. Centrdbbl.*, 1906, p. 462) pointed out the use of *Cinchona robusta* Trimen as a collective name for all hybrids of *C. succirubra* and *C. officinalis*. Rosenthaler gives an account of the structural characteristics and alkaloidal content of *C. robusta* and other cinchona hybrids produced by grafting. (*B. P. G.*, 1908, p. 126.)

Geographical Distribution.

The genuine Cinchona trees are natives exclusively of South America. In that continent, however, they are widely diffused, extending from the 19th degree of south latitude, considerably south of La Paz, in Bolivia, to the mountains of Santa Marta, or, according to Weddell, to the vicinity of Caracas, on the northern coast, in about the 10th degree of north latitude. They follow, in this distance, the circuitous course of the great mountain ranges, and for the most part occupy the eastern slope of the second range of the Cordilleras. Except northward from Guayaquil, both the western slope and the plateau are entirely too dry

or too cold for these plants, which require a moderate and equable temperature and an abundant and fairly constant supply of water. Irrigation cannot supply the place of a humid climate, for the atmosphere as well as the soil must be well charged with moisture. A certain amount of dry weather is, however, required for the ripening of the capsules. Free drainage is an important condition. Cross and others, who have personally inspected the region in the Andes where the best barks are obtained, have found the *Cinchona* trees only on the well drained slopes, and never on wet ground. With regard to temperature, Cross found that in the region of the *C. officinalis* the variation was from 1.1° to 21.1° C. (34°-70° F.), a fall below 40° or a rise above 65° being rare, and the mean range being from 45° to 60°.

The limits of altitude and climatic conditions are closely drawn. In the most southern districts, the trees descend to about 2500 feet, "while in the warmest regions they scarcely ascend to the 10,000-foot level. The individual species are for the most part rigidly restricted as to altitude and latitude, and, indeed, it has not always been found easy to detect the climatic conditions which would cause one species or variety to thrive while another very near it would languish. This is especially true of the more valuable forms.

It is to be noted that at present the stocks of wild barks have been enormously reduced, as detailed under Commercial History. Indeed, in certain sections, as the Calisaya district, the tree was practically exterminated in the wild state, so far as relates to a bark supply. From the far interior, however, occasional bales of wild Calisaya have been received. The low price of cultivated bark since 1885 has resulted in checking the destruction of the wild trees, which have begun again to multiply, so that they may possibly become once more common or even abundant. The Crown Bark region of Ecuador is still fairly productive, and in Colombia and Venezuela there are vast supplies of more or less inferior barks which await some favorable change in the market—never very likely to take place—that will render their collection profitable. Even at present a limited and irregular supply of one of these barks is furnished. With the exceptions here noticed, our present supplies of bark are entirely the product of cultivation, to which, therefore, we must give our chief attention.

Cultivation and Production.

The alarming prospect of the failure of the supply of Cinchona bark (see Commercial History) induced Europeans, about the middle of the nineteenth century, to turn their attention to the possibility of introducing the trees to cultivation. So early as 1737, La Condamine had collected a large number of young plants, with a view of conveying them to Europe; but, after having descended the Amazon in safety for more than a thousand leagues, they were washed overboard, near the mouth of that river, from the boat containing them, and were all lost. After this failure, though the idea of transplanting the Cinchonas was occasionally suggested, nothing was done until 1846, when Weddell, now celebrated for his successful exploration of the region of the Calisaya bark, sent some seeds to France, which were planted with success in the Jardin des Plantes, and thus supplied some of the conservatories of Europe with specimens of the plant. But the first successful effort with a view to great practical results was made in 1853 by the Dutch government, by which Hasskarl, formerly superintendent of the Botanical Garden in Java, was sent to South America on this important mission. Five hundred Calisaya seedlings were forwarded by him directly across the Pacific to Batavia, which they reached before the close of 1854. From these, and from seeds obtained from other sources, which were planted in the mountains of Java, in sites selected for their supposed conformity in climate with the native locality of the Cinchona, have sprung the most important plantations now in existence.

Stimulated by the suggestions of Royle, and by the partial success of the Dutch, the English government engaged, in 1859, the services of Clements R. Markham, who proceeded to Bolivia, in South America, and, after almost incredible hardships, arising partly from the nature of the country and partly from the jealousy of the native authorities, succeeded in collecting and transmitting to England upwards of 400 Calisaya plants. Most of these, however, were so much injured on their way from England to India, by the excessive heat of the Red Sea, that very few, on their arrival in Hindostan, had sufficient life remaining to grow when planted. Happily, the deficiency was supplied by seeds of *C. Calisaya* sent from Java, to Calcutta, at the request of the English Governor-General. While Markham was in Bolivia, other agents were collecting other species in Peru and Ecuador, whence seeds of the pale and red bark Cinchonas reached India, and, being planted in the selected sites, proved to be very productive.

Careful attention to the conditions of growth enumerated under Geographical Distribution was found essential in the selection of sites for the plantations. Those selected were near the Sanitary Station of Ootacamund in the Neilgherry Hills of Southern India, at heights varying from 5000 to 7450 feet. These positions unite the peculiar characters of the native regions of the Cinchonas in the Andes, not only as regards elevation and latitude, but also as to atmospheric moisture. Other sites were selected for experimental plantations, and since the first introduction of the Cinchona trees, their culture has been extended to various points from Hakgalla, in the island of Ceylon, to the Himalaya Mountains,—as in the Wynaad, the Coorg, the hills of Travancore, and especially at Peermede in the Presidency of Madras; in Sikkim and Darjeeling in the Presidency of Bengal; at Lingmulla in the Presidency of Bombay; and in the valley of Kangra in the Punjab,—from the southern to the northern extremity of British India. Outside of India and Ceylon, culture by the British has been undertaken in the West Indies, particularly Jamaica, in Guiana, and in the Fiji Islands. The first plants taken by Weddell from Peru to Paris all perished, but the French afterward established plantations in the Isle of Bourbon, at Guadeloupe, and in Algiers, none of which are known now to exist. The Portuguese have established plantations upon the west coast of Africa, and these now yield considerable quantities of bark. Very extensive plantations have been formed, chiefly by the Germans, in Bolivia. A rather large plantation in Colombia is now old enough to be productive. In Mexico and Central America various attempts to introduce the industry have been made. The question of introducing it into the United States has frequently been raised, but it may be stated that there is no spot in North America where the conditions warrant the slightest hope of success in this direction.

The history of Cinchona cultivation affords a striking illustration of the importance of government aid in the establishment of a new industry of this kind. The early and repeated disappointments and failures, owing to the natural obstacles in the way of securing stocks, and to an almost total ignorance of the conditions determining the successful propagation and growth of the plant, and the composition of its bark, were such as to have discouraged the most hopeful of private enterprises. Repeated and expensive expeditions were necessary before the first transplantings were accomplished, and these stocks were preserved and propagated only through the instrumentality of well appointed public gardens and

plantations. In Java, after these early difficulties had been surmounted and success apparently attained, it was found that owing to cross fertilization much of the progeny was entirely worthless, and the work of propagation had to be begun anew. The same difficulty was encountered elsewhere, and the slow and expensive method of propagation by cuttings was largely resorted to. In Ceylon the public were slow to become interested, and the officials were obliged not only to give away the young plants, but to solicit experiments with them as a personal favor. In Jamaica a hurricane visited the young and flourishing plantations and almost completely destroyed them. But at length, in spite of all, not only were thriving and permanent government plantations established, but private capital and enterprise upon a vast scale were enlisted. The question of commercial success is dominated not simply by climatological surroundings, but also by the price of labor. It is stated that both in India and Java the natives who work in the cinchona forests are paid from one dollar to one dollar and seventy cents per month, without food, according to the age and sex. The ability to extract the bark upon the spot is capable of largely counterbalancing a lack of market facilities; but it so happens that this advantage also inures to the benefit of the Eastern countries. Originally undertaken in India for the purpose of affording a cheap antiperiodic (the crude alkaloids known as "*febrifuge*" or "quinetum") home extraction has become a most important industry, and has assumed various forms. In Java the powdered bark is thrown into a 5 per cent. solution of caustic soda at 50° C. (122° F.) treating this with Java petroleum, separating, treating the petrolic solution with water acidulated with sulphuric acid and evaporating; the result is said to be a quinine containing less than 1 per cent. of cinchonine. (*J. P. C.*; 1901.) It is imported largely into the United States— 50,000 kilogrammes a year—but on account of its yellow color is chiefly employed in the making of proprietary medicines rather than tablets. Through the influence of the above conditions the locations of the important industry of Cinchona cultivation have been gradually wrought out, and at present about four-fifths of the cinchona barks of the world, outside of India, are furnished by Java. The first shipment from Java was of 900 pounds, in 1869. In 1902 it was 14,700,000 pounds and in 1911 over 20,000,000 pounds. India produces annually over 2,000,000 pounds; Ceylon about 400,000 pounds; Portuguese West Africa about 180,000 pounds, and South America 775,000 pounds. Tunmann estimates that the yearly output of cinchona bark is about 10,000,000 kilogrammes, and the production of quinine as about 500,000 kilogrammes. (*Apoth.*

Zeit., 1910, p. 565.)

It is to be remembered that a great part of the Indian product is not exported.

Methods of Cultivation.

The history of Cinchona cultivation teems with evidence as to the difficulty of obtaining pure seeds, owing to the tendency of the plants towards cross-pollination. In every locality where the industry has been established has the disgust of the gardener been excited by the discovery that the plants which he had reared, with great care, and upon which he had based great expectations, were contaminated by the admixture of foreign pollen. This was especially true in case of the earlier attempts, before this tendency had become known. Experience at length established the fact that absolute isolation of the seed-trees was essential. One of the curious developments of these experiments was the fact, already referred to, that the value of the progeny was not always assured by the value of its parentage. Some of the hybrids, even when least expected, would develop a surprisingly rich yield; and this tendency has been utilized to develop the most valuable stocks in existence. So certain is it that some of the plants from the best seed will prove worthless, that the careful selection of the seedlings while young is deemed necessary, and in South America, at least, all planting contracts are based upon this expectation, the contractor not being paid for his work until the plants have become old enough to show with certainty the proportion of good plants contained. Both in the selection of the young seedlings and the acceptance of the plantation, the test of identity is found in the leaf. Propagation by cuttings, extensively practised in some localities, has been found too slow and expensive to become general. A thorough preparation of the soil is as beneficial in the case of Cinchona as in that of other crops. Thorough tillage after transplantation is also essential, a free growth of weeds meaning destruction to a large number of the young trees. The cultivation of a secondary crop between the rows of trees is, however, practicable. A large percentage of profit depends upon the selection of a suitable age for collecting the bark. There comes a time when the use of the ground for starting a new crop is more valuable than the gain by permitting the present crop to remain, and after some years an actual deterioration of the bark sets in. This age is not the same for all the trees in the plantation. Several years' difference may occur in the maturing of trees

germinated at the same time. In the case of Calisaya it occurs at from six to nine years from seed, and its indication is the it chicken-leg" scaliness of the bark, as described under Classification. The "officinalis" matures somewhat less early. In the Bolivian plantations the most experienced hand is selected as the marker, and the cutters follow him, peeling the trees which he has indicated. How far these careful methods of selection are followed elsewhere, the writer is not informed.

Collection of Bark.

Four principal methods of collecting the bark are in vogue, these being variously modified in different sections. The first is *uprooting*, the most primitive, by which the trees are simply uprooted at the proper age, and the ground replanted. The barks of root, stem, and branches are preserved and marketed separately. The second method is *coppicing*, by which, after peeling a quill from the lower portion of the trunk, the latter is cut a few inches from the ground and the remainder of the stem bark and the branch bark are removed. The "coppice" is formed by a second growth of two shoots from each of the stumps. A second coppice is commonly grown, and this is harvested by uprooting. By the third method, *scraping*, the outer bark is scraped off, leaving the liber untouched. This has been found especially applicable to young trees, in which the second growth of bark is rapidly formed and contains 20 to 30 per cent. more alkaloid than that which has been taken off. It seems to be a general opinion among the planters that scraping checks the growth of the tree after it is five years old, so that from three to five years is the age at which it is best practised. The fourth method is known as *mossing*. It having been noticed that the Cinchona alkaloids, especially in any other form than that of sulphate, were apt, on exposure to the direct light of the sun, to become reddened by the generation of coloring matter, at the expense of the alkaloid, it was a very natural inference that a similar change might take place in the living plant, as a consequence of which the proportion of alkaloids they were capable of producing might be greatly diminished. It was also observed that the bark upon that side of the tree where the sun struck it was less rich than that upon the shady side. To obviate this presumed effect, Maelvor was induced to make the experiment of covering the stems of the growing trees with a layer of moss, so as to completely protect the bark against the influence of sunlight. The result was favorable beyond all expectation, and the yield of alkaloids in the bark thus protected is said to be doubled, tripled, or increased even in larger

proportion. A tree can thus be made continuously productive; for if a slip is removed longitudinally from the trunk, from top to bottom, by covering the decorticated portion with moss, the bark is renewed at least as rich as previously in the alkaloids, while from time to time other strips may be taken, until the whole of the old bark is removed, and the new ready for removal by a repetition of the same process; and the tree is thus preserved indefinitely, probably for the whole normal length of its life. Hooper says that renewed bark is always of greater value than the mossed, and mossed than the natural, so long as the trees are under twenty years old, for it has been found that after that time the bark ceases to thicken, and the alkaloids remain stationary or even decrease. Perhaps twenty years is even too old. The practical difficulty with the process is that it requires skilled workmen, not always attainable, and hence the "coppicing system" still largely prevails in India.

The methods of packing the bark have also undergone important modifications since the early days of cultivation. The extensive adulteration practised when the wild bark brought very high prices led to a demand for it in large pieces which could be readily and quickly examined; hence the appearance of the large *tabla* and *quill* forms, the latter afterwards becoming the standard for the cultivated bark. The bark of the trunk, and sometimes of the branches when very large, is cut into two-foot lengths, and each length removed in a single piece, which in drying rolls up to form a quill. Such peeling can of course be successfully practised only at the appropriate season of the year. The bark or the roots, branches, and dead or dry trunks must be removed by chipping, scraping, or shaving, commonly the latter. The quills, after thoroughly drying, are carefully packed in bales, or preferably in boxes, to avoid breakage, and are marketed in packages of from 100 to 250 pounds. Large quantities of cultivated bark are still marketed in this way, but, increasing competition having lowered prices so that economy in freight has become a very important item, most of the bark is now broken up, and its bulk even reduced by high pressure, and in fact only a trifling amount of wild South American bark comes into commerce. Cultivation has very greatly increased, not only the quantity, but also the quality of bark. For some years, in India the attempt was made largely to increase the general average in total alkaloids rather than in quinine, so as to increase the production of the impure alkaloids which are so largely used as febrifuges in the British East Indies. Of recent years, however, even in India, efforts have been directed to the obtaining of quinine rather than of inferior alkaloids. The barks of

Ceylon have always been of poor quality, while those of Java to-day are probably the best that have ever been put upon the market. The effect of the efforts of arboriculturists is well shown by the facts that in 1889 the average percentage of quinine in Java bark was 4; in 1893 it had risen to 4.6; while in the five years, from 1900 to 1904 inclusive, the average quinine percentage of all the Java barks sold in the Amsterdam market was 5.37. The result does great credit to Java, for during the early history of her bark. enterprise her plantations were stocked with discouraging quantities of poor or even worthless barks, which have been eliminated by the most steady enterprise and patient industry. David Howard presented a comprehensive survey of cinchona barks and their cultivation. (*J. Soc. Ch. Indus*; 1906, p. 97.) Winkler describes the methods employed in the cultivation of Cinchona in Java, also the manner of collecting the bark and preparing it for market. (*Der Tropenpflanzer*, 1906, p. 222.) Bohringer gives a review of the progress in the cultivation of Cinchona in Ceylon. (*Tropenpflanzer*, 1909, p. 269.) Sehneider discusses the possibility of cultivating Cinchona in California. (*W. D.*, 1906, p. 136.)

Commercial History.

The above general history of Cinchona leaves little necessary to be said of its commercial history, except to deduce from the facts already presented certain practical conclusions showing the present conditions of supply and demand, these bearing especially upon our concluding remarks concerning pharmacognosy and classification.

For more than a century after Peruvian bark came into use, it was procured almost exclusively from the neighborhood of Loxa. In a memoir published in 1738, La Condamine speaks of the bark of Riobamba, Cuenca, Ayavaca, and Jaen de Bracomoros. Of these places, the first two, together with Loxa, lie within the ancient kingdom of Quito, at the southern extremity; the others are in the same vicinity, within the borders of Peru.

Towards the end of the eighteenth century, however, the trees were discovered to exist in Colombia, in central Peru, near Lima (whence the name *Lima bark*, at one time applied to the drug) and in Bolivia.

The consequence of these discoveries was a vast increase in the supply of bark, which was now shipped from the ports of Guayaquil, Payta,

Luna, Africa, Buenos Ayres, Cartagena, and Santa Marta. At the same time the average quality was probably deteriorated; for, though many of the new varieties were possessed of excellent properties, yet equal care in superintending the collection and assorting of the bark could scarcely be exercised in a field so much more extended. The varieties poured into the market soon became so numerous as to burden the memory if not to defy the discrimination of the druggist, and the best pharmacologists found themselves at a loss to discover any permanent peculiarities which might serve as the basis of a proper and useful classification. More or less perplexity attending the recognition of the barks continued until after the firm establishment of the bark culture and the cheapening of the price, to the exclusion of the worthless varieties, as already described.

One of the most important developments of the modern bark trade is the fixing of the price in accordance with the quality as determined by assay. The most accurate method of selecting a characteristic sample for assay is a subject which has received much study, without the discovery of any method which does not depend for its value upon the discrimination and care exercised in its employment. The plan which is regarded as the safest, is to take a given weight, say eight ounces, from the inner portion of each package constituting the lot, mix and powder the whole of it, and furnish to applicants the required amount of the resulting powder. If any portion of any bale or bales is damaged, care is taken to add a proportionately large fragment of such portion. The bark is then recorded as containing so many units, a "unit" being each per cent. of quinine contained in a pound of bark. In rich bark the units are of course worth more than in poor, owing to the increased yield of alkaloid for the same cost of manufacture.

In the United States, at least, some difficulty has been experienced by druggists in securing the better grades of bark at regular rates, owing to the activity of the manufacturers in draining the market of the most desirable stock. The finer appearing packages of unbroken bark, having been marketed at greater cost, are necessarily held at higher prices. Possessing no special value for manufacturing purposes, these fall to the share of the druggist, but at higher prices than broken bark of the same richness. This fact has led to the recognition of two distinct classes, known as *manufacturers' bark* and *druggists' bark*. Druggists' bark, though in quills or unbroken pieces, and of a much finer appearance than manufacturers' bark, is on the average, inferior in quinine

percentage. The druggists' bark finds its entrance into commerce through various channels but the bulk of the cinchona trade, including practically all that is known as manufacturers' bark, centres in Amsterdam and London; of these marts that at Amsterdam is much the more important. In 1916 there were imported into the United States 3,947,320 pounds of cinchona barks, and 1,791,738 pounds of quinine sulphate and other salts of the cinchona alkaloids. The bark which is sold in Amsterdam comes almost exclusively from Java; that in London from India, Ceylon, and South America. Manufacturers' bark is sold, without respect to its physical characters or place of origin, entirely by its chemical analysis, the buyer in London being furnished with samples of the different lots of the bark sufficient time before the sale to enable him to make his own analysis, while in Amsterdam the percentage of quinine sulphate in any lot is given in the catalogue and often tagged upon the bale.

Formation of the Alkaloids.—In a very careful series of experiments made at the Java governmental cinchona plantations, Lotsy (*Bull. Inst. Botanique Buitenzorg*, 3, 1900) found that the seeds of *C. succirubra* and *C. Ledgeriana* contain no alkaloids, but that these alkaloids appear in the cotyledons shortly after they become green. They exist chiefly in the bark in combination with a tannic acid. Lotsy found that the percentage of alkaloids is ten times greater in young than in old leaves; also that the petioles are richer in alkaloids than is the blade, and that the branch bark contains more than the trunk bark, and that the root bark is practically free from alkaloids. During the active life of the parenchymatous cells of the leaves, wood, and cortex, the alkaloids can always be found in the active protoplasmic contents, but when these cells pass into the inactive condition, are deposited in the cell-walls. The alkaloids found in the leaves are, however, never crystalline, hence it would appear that these organs produce by direct synthesis, probably as the result of the action of cinchonic acid with ammonia, a fundamental alkaloidal base, which probably in the cambium layer of the tree, and during its deposition in the growing bark, is elaborated into the true cinchona alkaloids.

Classification.

Extreme difficulty attended the earlier attempts to classify the Cinchona barks of commerce,—difficulties not probably encountered elsewhere in the *Materia Medica*. The varieties have, however, been reduced to a

very few, and the whole subject decreased greatly in importance by the chemical method of the sale now in vogue. Most of the discarded barks will be found described in previous editions of this work. We find it necessary to enumerate and describe here only the Pale bark, from *C. officinalis*, the Red bark, from *C. succirubra*, the Yellow bark, from *C. Calisaya* and its var. *Ledgeriana*, and the Hard Yellow or Maracaibo bark, and to refer briefly to the hybrid forms. First, a few words concerning the forms in which Cinchona bark occurs. We have (1) the large flat pieces or chips of irregular shape and size, —this referring at present almost wholly to the Maracaibo variety; (2) the small chips or broken bark, referring in large part to the root bark, and to other bark broken for close packing; (3) the shaved bark, referring to some root bark and to stem bark taken from dry stems, but chiefly to branch bark; (4) the quill bark, referring to natural bark taken from the stem and root in quill form, this including the uncultivated pale bark and all the varieties of cultivated bark; and (5) the renewed and mossed bark, which may be of any cultivated variety. The classification of all varieties and forms into druggists' and manufacturers' barks enables us to dispense in great part with a description of some of these forms. The manufacturer cares nothing for form, appearance, or structure, and but little for the variety of his supplies. He is interested wholly in its composition, and this he determines by assay. For this reason most of the broken bark goes to him. The druggist requires the quill or large chip bark; so that the great bulk of the branch bark is also thrown, at low prices, upon the hands of the manufacturer.

As regards the root barks, no classified description is available. In their structure they correspond very closely to the stem barks of the same variety. They can be readily distinguished from the latter by being thinner, having lighter external and darker inner color, greater softness, and twisted or contorted structure. They occur in short, irregular quills or chips, or sometimes as shavings, and contain very much more dust than any other form. Except partly as regards structure, the description of stem barks will not apply to branch barks of the same variety, for the characteristic markings do not appear in the young condition. The branch bark appears in shavings, to the inner surfaces of many of which more or less wood adheres. If the branches were shaved while yet fresh, these shavings will be more or less rolled up and curled; but if dry before being removed, this rolling and curling will not occur. Shaved bark taken from living trees is thin, soft, and brittle, consisting of the outer bark only. The large quills are of uniform

length from the same plantation, but not necessarily so from different plantations or different sections. They are commonly from two to three feet in length, but some have been marketed having a length of five feet. Usually they represent the entire circumference of the stem, but occasionally only half of it. In drying they roll up very tightly from one or both edges, and rarely one will be wholly or partly involved in another. The periderm, with all its markings, remains intact, and no other form so well displays the natural appearance as this. Mossed bark differs from natural stem bark in its great thickness and weight, less breadth of the quills, freedom from lichens, very dark color, and rough, corrugated or warty surface. The outer bark or cellular portion bears a greater ratio to the inner or fibrous portion than in natural bark. Renewed bark is lighter, both in color and weight, thinner, soft and brittle, and marked by a very peculiar external smoothness, sometimes very marked indeed. In its general appearance it is strikingly like a root bark, except for the relative straightness of its fibres. Like the mossed bark, it is in narrow, only partly rolled quills or bands, and is entirely free from lichens.

As they differ so greatly among themselves in coloration, lichen-growth, degree and form of exfoliation, structure and consequent fracture, there are but few characters which can be combined in a general description of the Cinchona barks which we consider. The external color varies from light ashy gray to nearly black, the inner varies less in its shades of yellow-brown and red-brown. All are more or less bitter, and most are astringent, but only Loxa bark has a distinctive odor. The fracture is never very long-splintery and never tough. As to structure, the bast fibers are loosely arranged, the radial rows being neither continuous nor very long. The fibers themselves are always unbranched, which distinguishes the true from the false barks, are rather short and obtuse, brittle, and usually easily detached from the bark. Laticiferous ducts and stone-cells may or may not be present. The former become less conspicuous as the bark grows older, so that their relative absence becomes indicative of a stage in which the due proportion of alkaloid should have been acquired.

It may be noted here that by far the greater portion of the alkaloid, particularly quinine, is stored in the outer bark, though that in the inner bark is in a purer state. The latter is not stored in the fibers, but in the cellular tissue between them.

As regards the former classification of barks by color, it referred only in small part to the external color, chiefly to the powder. These colors were never regarded as absolutely characteristic, as the three barks, yellow, red and pale, exhibited gradations by which they mingled at their extremes. Under present conditions, the lines of demarcation have become even more indistinct, and, as a matter of fact, in the market the terms " yellow " and " red " are used with great looseness. It is true that we receive much pure-blooded Yellow Bark, *Ledgeriana* from the East, and *Calisaya* both from there and from South America; but it is also undeniable that much of the bark sold under the several names is of mixed hybrid, and the typical characters are often greatly obscured. The presence in our market of these mixed forms has made the terms even less valuable than they once were, and dealers cannot be found to agree as to the character of many samples. Nevertheless, the occurrence of the typical forms, and appearance in a hybrid of the blended characters, render it desirable to preserve this classification, and to group the new forms around the types.

YELLOW OR CALISAYA BARK. CINCHONA FLAVA.

The official description is as follows: "In quills or curved pieces of variable length, bark from 3 to 5 mm. in thickness, or in small broken fragments or in transversely curved pieces from 3 to 7 mm. in thickness, externally gray, rarely brownish-gray, with numerous intersecting-transverse and longitudinal fissures having nearly vertical sides, and usually with patches of foliaceous lichens with their small, brownish-black apothecia; when the outer bark is absent, the color externally is cinnamon-brown; inner surface light cinnamon-brown, finely striate; fracture of the outer bark short and granular, of the inner bark finely splintery; odor faintly aromatic; taste very bitter and somewhat astringent. The powder is reddish-brown; bast-fibers spindle-shaped, yellowish, from 0.3 to 1.35 mm. in length, with thick, strongly lignified, lamellated walls having slit-like, oblique pores; starch grains single or 2- to 5-compound, the individual grains spherical or plano-convex and from 0.003 to 0.015 mm. in diameter; sphenoidal micro-crystals of calcium oxalate numerous. Heat 1 Gm. of powdered Cinchona in a dry test tube; a tarry distillate forms, having a purplish color and a somewhat granular appearance." *U. S.*

Its lichens are thin and closely adherent, not rendering it shaggy. External markings very characteristic, consisting of a very light

longitudinal ridging or none at all, but of numerous transverse and longitudinal fissures or cracks, the presence and arrangement of which constitute the chief characteristic of Calisaya. Upon the young stems and branches they do not appear. The first to appear are the usually large primary fissures, which encircle the stem at the nodes, or points where pairs of leaves once stood. Subsequently, numerous smaller secondary transverse fissures appear upon the internodes, and these quickly become connected and crossed by longitudinal cracks, thus dividing the periderm up into more or less quadrangular checks, which may remain attached or fall away. This gives to mature Calisaya bark an appearance of scaliness like that upon the tarsus of a fowl, and this is known to the South American collectors by a term which signifies the "chicken-leg appearance." It has also been spoken of as a "carving-like" marking. Like the roughness upon a musk-melon, its great development is regarded as an indication of high quality, and especially is this true of a close proximity of the primary fissures. This roughness is also regarded as a sure indication of maturity. There are excellent distinctions between these and the somewhat similar fissures upon the bark of *C. officinalis*. In the latter they are coarser and more gaping. Even more important is the absence from Pale Bark of most of the longitudinal cracks, so that it does not become "chicken-legged," or at most only very slightly so. The external color of Yellow Bark is lighter than that of the Pale Bark. Longitudinal ridges are few if any, short, irregular, and inconspicuous. In fine South American bark some very small bright-red spots can be detected upon the periderm. East Indian Calisaya can commonly be recognized by its somewhat dingy or brownish shade of gray, the gray of the South American bark being bright and somewhat bluish-steel-colored.

In structure, the zone of large, rather numerous laticiferous ducts just outside the bast is conspicuous in young, and therefore inferior, samples. The rather small bast fibers are loosely scattered, almost uniformly single or a radial arrangement being apparent. The fracture is rough-splintery, though not coarse. Stone cells few or none. Odorless, more bitter, and less astringent than the Pale Bark. Ledger bark is the same as Calisaya in all its essential characters, but does not reach so great a size. In hybrids of Calisaya with succirubra the characters and quality of the latter appear to predominate.

This bark is scarcely collected in a wild state, but cultivated in all plantations. It is the largest quinine yielder, its amount being 70 to 80

per cent. of the total alkaloids contained in the bark. The var. *Ledgeriana* yields a very valuable hybrid bark with *C. succirubra*. *C. Calisaya* also hybridizes with the latter species. Hartwich describes the microscopical characteristics of Cinchona and related barks in *S. W. P.*, 1909, p. 249. Grutterink discusses the micro-chemistry of Cinchona alkaloids, with illustrations in *Zeit. anal. Chem.*, 1912, p. 215. Rosenthaler reviews the pyro-analytical results that have been obtained with Cinchona bark and describes the crystals found in the tar. (*B. P. G.*, 1911, p. 203.)

RED BARK. CINCHONA RUBRA.

This bark is recognised by the U. S. and Br. Pharmacopoeias (for definition, see page 333). It is described in the U. S. P. IX as "in quills or curved pieces of variable length, bark from 2 to 4 mm. in thickness, or in small broken fragments or in transversely curved pieces from 3 to 7 mm. in thickness; externally gray, grayish-brown, or reddish-brown, more or less rough from corky protuberances, occasionally with transverse fissures which are rarely numerous or much intersected, and having their sides sloping, and with occasional patches of foliaceous lichens; inner surface reddish or orange-brown, distinctly striate; fracture short and granular in the outer bark, shortly and rather coarsely splintery in the inner bark; odor slight; taste very bitter and astringent. The powder is light brown; bast-fibers and sphenoidal micro-crystals of calcium oxalate, resembling those in cinchona; starch grains resembling those of cinchona relatively few, from 0.003 to 0.01 mm. in diameter. Heat 1 Gm. of powdered Red Cinchona in a dry test tube; a tarry distillate forms having a bright red color." *U. S.*

In the British Pharmacopoeia it is described as "In quilled or curved pieces, length varying from 5 to 30 cm. or more; usually from about 2.5 to 6 mm. thick; cork brownish or reddish-brown, with longitudinal ridges which are most apparent in the branch bark, and sometimes with reddish warts; inner surface brick-red or deep reddish-brown, irregularly and coarsely striated; fracture shortly fibrous in the smaller, and finely fibrous in the larger, pieces. In transverse section in the cortex, cells filled with minute crystals of calcium oxalate, and also large secretion tubes; in the bast numerous, large, strongly-thickened fibers usually 0.050 to 0.070 mm. wide and about 1 mm. long, isolated or in small groups. The powdered Bark is brownish or reddish-brown, exhibits abundant parenchymatous tissue with brownish cell-walls, and often

with brownish contents, small starch grains, and large isolated bast fibers about 0.060 mm. in diameter, with distinctly striated walls. No marked odor; taste bitter and somewhat astringent."

The quills are similar to those of *Calisaya*, though running somewhat broader and thicker. Externally of a dingy brown gray, less lichen-bearing than either of the others. Inner surface of a more reddish cinnamon-brown than in *Calisaya*. Powder reddish-brown.

The important characteristic of red bark is the prominent longitudinal ridges, many of them short and confluent, with intervening furrows or elongated meshes. The ridges are suberous, bear numerous small warty protuberances, and may be traversed by faint fissures. Transverse fissures may or may not be present in red bark. If so, they are few, short, and irregularly disposed, and not connected by longitudinal cracks to give the checkered appearance of *Calisaya*. Hybrids with "officinalis" display numerous transverse fissures, and the external color is lighter and more dingy. Fracture short-splintery, not coarse. Odor none. Taste bitter and astringent.

It is scarcely collected in a wild state, but cultivated in all plantations except those of South America. Demand and production rapidly decreasing. A large alkaloid yielder, but of this only about 20 per cent. is quinine. Largely hybridized with *C. officinalis*. Also hybridized with *C. Calisaya* and its var. *Ledgeriana*.

PALE BARK.

Varieties and Synonyms.—Crown Bark, Loxa or Loja Bark, Cuenca Bark, Huanuco Bark. Derived from *C. officinalis*. Collected in a wild state above Loxa and other parts of Ecuador, and cultivated in all plantations except the South American, especially in India. Demand and production decreasing. Quinine constitutes 60 to 70 per cent. of the total alkaloids. Largely hybridized with *C. succirubra*.

Description.—Quills single or double, irregularly broken or entire, attaining a length of nearly 2 dm., a width of nearly 2.5 cm., and having a very wide range in thickness, the natural mostly 2 to 4 mm. thick. Shaggy, with more abundant lichens than in any other species, the abundance of these having been considered, not entirely without reason, as an indication of the relative quality. Color of periderm darker

than in the other species, but varying much from a brown gray to nearly black. Inner surface of a paler brown than in the other species, finely striate. Color of powder pale brown. The external markings consist of transverse fissures and longitudinal ridges, some of them wart-bearing. It is only in the thinner samples, in which the warts and fissures scarcely appear, that the ridges are continuous and conspicuous. In the prominence and breadth of its fissures and the inconspicuousness of its ridges, this bark is most distinct from the Red Bark. These characters are yet sufficiently distinct from the somewhat similar ones of *Calisaya*, as noted in describing that bark.

Fracture short, the inner fibrous zone sharp and narrow. Taste not so bitter as in the others. Odor of the genuine *Loxa* variety peculiar and characteristic. Its structure shows the rather short and not numerous bast fibers in short interrupted single or double radial rows, and much disposed to occur in bundles of three to six or more. Stone cells rarely seen, and lactiferous ducts conspicuous only when young.

HARD YELLOW, OR MARACAIBO BARK. PUERTO CABELLO BARK.

Derivation not at all certain. Collected only in a wild state in the mountains of Southern Colombia, and yielding almost the whole of the inferior wild bark now collected for market. Importation and sale in the United States quite irregular and unimportant. One of the best of the lower-grade barks, but not to be compared with any of those already described. Said to yield about 2 per cent. of crystallizable sulphates, three-fourths of which is quinine sulphate, but a characteristic specimen assayed for this investigation by Virgil Coblenz yielded 2.65 per cent. of total alkaloids, only a trace of which was quinine. Contains a large amount of resin. The common or commercial names by which have been designated the several barks of the northern countries related to this one are of very irregular application. At the time when the trade in them was large and important, the term "Maracaibo Bark" was restricted to the less resinous variety, derived from *C. cordifolia*. It was also formerly sold simply as "Yellow Bark," and it's not impossible that it was sometimes accepted, under this synonym, for *Calisaya*. The investigations of Morgenthau into the value of certain derivatives of cuprein may give these barks a real value. For a description of *Cuprea Bark*, see 19th ed., *U. S. D.*, p. 349.

Description.—Rusby described it as occurring in irregular broken pieces,

mostly from 5 to 15 cm. long, 2.5 to 7 cm. broad, and 3 to 10 mm. thick. Formerly it included many much smaller fragments as well as much dust, but these portions are now mostly sifted and winnowed out before marketing. The pieces are more or less flat, the thinner and narrower ones somewhat incurved, the broader and thicker recurved. The bark is compact, heavy, and fibrous. Most of the pieces display upon the outer surface more or less of the periderm, forming silvery-white or yellowish-white patches, very thin and rather soft. Occasionally the periderm is instead dark, hard, very rough, and much fissured. From many pieces the entire periderm is absent, disclosing the outer face of the bast, very similar to the inner face. This is compactly and rather finely fibrous, of a deep yellow, with a slight rust-brown tinge. Throughout, the bast is of this structure and color. Between it and the periderm there may be seen with varying distinctness, in most pieces, a characteristic resinous band of irregular width, dark reddish-brown and waxy-lustrous on the cut surface. The radial rows of bast fibres are irregular. The fracture is long-fibrous. The odor is distinct, and the taste quite bitter.

Chemical History.

I have deleted 14 pages of agonizingly precise discussion of the alkaloids of Cinchona...trust me—you don't need to know...

Uses.—This valuable remedy was unknown to the civilized world until about the middle of the seventeenth century, though the natives of Peru are generally supposed to have been long previously acquainted with its febrifuge powers. Humboldt, however, is of a different opinion. In his memoir on the Cinchona forests, he states that it is unknown as a remedy to the Indians inhabiting the country where it grows, and, as these people adhere pertinaciously to the habits of their ancestors, he concludes that it never was employed by them. They have generally the most violent prejudices against it, considering it poisonous, and in the treatment of fever prefer the milder indigenous remedies. Ruiz and Pavon, however, ascribe the discovery to the Indians; and Tschudi states, in his "*Travels in Peru*" (Am. cd., ii, 280), that the inhabitants of the Peruvian forests drink an infusion of the green bark as a remedy in intermittent fever. On the other hand, the statements of Humboldt have been confirmed by the travellers Markham and Spence, the former remarking that the native Indian doctors did not use the bark, and the latter that the Cascarilleros of Ecuador believed that their red bark is used solely for dyeing. It is uncertain whether, as Jussieu stated in

1739, the Jesuit fathers received their knowledge from the Indians, or, as Humboldt believes, discovered the virtues of the drug for themselves, having been led to make trial of it by its extreme bitterness. The Countess Chinchon, wife of the Viceroy of Peru, having in her own person experienced the beneficial effects of the bark is said, on her return to Spain in the year 1640, to have first introduced the remedy into Europe. Hence the name of *pulvis Comitissae*, by which it was first known. After its introduction it was distributed and sold by the Jesuits, who are said to have obtained for it the price of its weight in silver. From this circumstance it was called *Jesuits' powder*, a title which it long retained. In 1653, Chifflet, physician to the Archduke Leopold, directed the attention of all Europe to the bark by his work entitled *Pulvis Febrifugns Orbis Americani*. This gave rise to a very active controversy, the high price of the drug aiding very greatly those who opposed its introduction. According to Stunn, twenty doses in 1658 cost sixty florins. It seems first to have been advertised in England for sale in 1658 by a James Thomson, and by 1660 it was much employed. It still, however, encountered much prejudice and ignorance, and was not made official in the London Pharmacopoeia until 1677. Sir Robert Talbot (or Talbor) used it as a secret remedy with so much address and success that in 1679 he cured Charles II of a tertian, and subsequently sold his secret to Louis XIV of France, who published it in 1681.

When taken into the stomach, the bark usually excites in a short time a sense of warmth in the epigastrium, which often diffuses itself over the abdomen and even the breast, and is sometimes attended with considerable gastric and intestinal irritation. Nausea and vomiting are sometimes produced, especially if the stomach was previously in an inflamed or irritated state; and its action is not unfrequently accompanied by purging. If the dose of the cinchona bark has been large enough, the symptoms of cinchonism may result. At one time cinchona bark and its preparations were used as antiperiodics, but at present for such purpose one of its alkaloids is always selected. The best preparation for use as a tonic is the compound tincture.

Dose, ten grains to one drachm (0.65-3.9 Gm.).

Off. Prep.—*Cinchona*.—Fluidextractum Cinchonas, *U. S.*; Tinctura Cinchonae, *U. S.*; Extractum Cinchonae, *N. F.*

Red cinchona.—Extractum Cinchonae Liquidum, *Br.*; Infusum

Cinchonas Acidum, *Br.*; Tinctura Cinchonae, *Br.*; Tinctura Cinchonae Composita, *U. S.* (*Br.*, from Tincture); Fluidextractum Cinchonae Aquosum, *N. F.*; Gargarisma Guaiaci Compositum (from Compound Tincture of Cinchona), *N. F.*

CinerariaMaritima L.—This composite plant, known popularly as *DustyMiller*, is a native of the West Indies, and has been introduced as a house plant into this country. There is upon the market a proprietary preparation which professes to be the expressed juice of this plant, and is recommended in diseases of the eye, especially as an absorbent of cataracts. We do not know, however, of any sufficient scientific justification for a belief in this improbable property.

CINNAMOMUM SAIGONICUM. U. S.

SAIGON CINNAMON Cinnam. Saigon.

"The dried bark of an undetermined species of *Cinnamomum* (Fam. *Lauraceae*)." *U. S.*

Annam cinnamon, China cinnamon. God's cinnamon; Cannelle de Saigon, *Fr.* ; Saigonzimmt, *G.*

CINNAMOMUM ZEYLANICUM. U. S. (Br.)

CEYLON CINNAMON Cinnam. Zeylan.

"The dried bark of cultivated trees of *Cinnamomum zeylanicum* Breyne (Fam. *Lauraceae*), without the presence or admixture of more than 3 per cent. of the outer bark or other foreign matter." *U. S.* "Cinnamon Bark is the dried inner bark of shoots from the truncated stocks of *Cinnamomum zeylanicum*, Breyn. Obtained from cultivated trees. Imported from Ceylon, and distinguished in commerce as Ceylon cinnamon." *Br.*

Cinnamomi Cortex, *Br.*; Cinnamomum, *U. S.* 1880; Cinnamon Bark; Cortex Cinnamomi Zeylanici; Cinnamomum Acutum, s. Verum; Cannelle de Ceylan, *Fr. Cod.*; Cannelle, *Fr.*; Brauner Kaneel, Zeylonzimmt, Zimmt, *G.*; Cannella, *It.*; Canela, *Sp.*; Kurundu, *Cingalese*; Karua puttay, *Tamil*.

Both *cinnamomum* and *cassia* were terms employed by the ancients, but whether exactly as now understood it is impossible to determine. The term *cassia*, or *cassia lignea*, has been generally used in modern times to designate the commoner barks of *Cinnamomum Cassia* (Nees)

Blume. The barks sold as cinnamon and cassia in different parts of the world are derived from various species of *Cinnamomum*.

Cinnamomum zeylanicum is a tree about 20 or 30 feet high, covered with a thick, scabrous bark. The branches are numerous, strong, horizontal, and declining, and the young shoots are beautifully speckled with dark green and light orange colors. The leaves are petiolate, opposite for the most part, coriaceous, entire, ovate or ovate-oblong, obtusely pointed, and three-nerved, with the lateral nerves vanishing as they approach the point. There are also two less obvious nerves, one on each side arising from the base, proceeding towards the border of the leaf, and then quickly vanishing. In one variety the leaves are very broad and somewhat cordate. When mature, they are of a shining green upon their upper surface, and lighter-colored beneath. The flowers are small, white, and arranged in axillary and terminal panicles. The fruit is an oval berry, which adheres like the acorn to the receptacle, is larger than the black currant, and when ripe has a bluish-brown surface, diversified with numerous white spots. The tree emits no odor perceptible at any distance. The bark of the root has the odor of cinnamon with the pungency of camphor, and yields this principle upon distillation. The leaves have a spicy odor when rubbed, and a hot taste. A volatile oil has been distilled from them. The petiole has the flavor of cinnamon. It is a singular fact that the odor of the flowers is to most persons disagreeable, being compared by some to the scent exhaled from newly-sawed bones. The fruit has a terebinthinate odor when opened, and a taste in some degree like that of juniper berries. A fatty substance, called *cinnamon-suet*, is obtained from it when ripe, by bruising it and then boiling it in water, and removing the oleaginous matter which rises to the surface, and concretes upon cooling. It is the prepared bark that constitutes the genuine cinnamon.

This species is a native of Ceylon, where it has long been cultivated. It is said also to be a native of the Malabar Coast, and has at various periods been introduced into Java, the Isle of France, Bourbon, the Cape Verds, Brazil, Cayenne, several of the West India islands, and Egypt, and in some of these places is at this time highly productive, especially in Cayenne, where the plant was flourishing so early as 1755. It is exceedingly influenced, as regards the aromatic character of its bark, by the circumstances of soil, climate, and mode of culture. Thus, we are told by Marshall that in Ceylon, beyond the limits of Negombo and Matura, in the western and southern parts of the island, the bark is never of

good quality, being greatly deficient in the aromatic flavor of the cinnamon, and that even within these limits it is of unequal value, from the various influences of exposure, soil, shade, and other circumstances. Cinnamon closely resembling Ceylon cinnamon is said to have been sent to Europe from Brazil.

Cassia Cinnamon which was formerly official is the product of *Cinnamomum Cassia* (Nees) Blume, a tree resembling *C. Zeylanicum* but distinguished by the hairiness of the young twigs, petioles and under surfaces of the leaves. The tree is indigenous to and cultivated in southern China, Annam and Cochin-China. It is also cultivated in Sumatra, Ceylon, Japan, Mexico and South America. The bark is known in commerce as *China* or *Canton Cassia* and the commonest or cheapest grade as "*Cassia lignea*."

Besides the two species above described, others have been thought to contribute to the cinnamon and cassia of commerce. In 1839 (*Madras Journ. Lit. and Sci.*, No. 22), Wight stated that in his belief cinnamon was derived from 12 to 18 specifically distinct trees. *C. inners*, Reinw., is distinguished from *C. zeylanicum* by the nervation of its leaves, which are also paler and thinner than those of the official plant, of which, however, it is probably only a variety.

It yields the so-called *wild cinnamon* of Japan. *C. obtusifolium* Nees, growing in Ceylon, Java, and on the mainland of India, is said to have been the chief source of the drug known formerly by the name of *Folia Malabathri* and consisting of the leaves of different species of *Cinnamomum* mixed together. *C. Culilawan* Blume of the Moluccas yields the aromatic bark called culilawan, noticed in Part II of this work; and similar barks are obtained from *C. Sintoc* of Java. *Massoy bark*, from which an aromatic volatile oil is obtained called *oil of massoy*, is the product of *Sassafras Goesianum* Leijom. In the mountains of Eastern Bengal, at a height of 1000 to 4000 feet, flourish *C. obtusifolium* Nees, *C. pauciflorum* Nees, and *C. Tamala* Nees et Ebern, and these, with other unknown species, afford quantities of bark which are shipped from Calcutta, Java, Timor, etc., to Europe under the name of *wild cassia*. The bark of the *C. pedatinervium* Meissn, a tree indigenous to Fiji, yields nearly one per cent. of a white aromatic volatile oil, with a pungent spicy taste. For constitution, etc., see *Proc. Chem. Soc.*, xix. These barks are mostly highly aromatic, resembling cinnamon more or less closely in flavor, and are distinguished by yielding to cold

water an abundant mucilage. Holmes described the bark of *C. pedativum* Meis., and concludes that it might be of value as a source of safrol and linalool in *P. J.*, 1904, p. 892.

Cassia Buds.—This spice consists of the calyx of *Cinnamomum Cassia* (Nees) Blume, surrounding the young ovary, and, as stated by Martius, on the authority of the elder Nees, about one-quarter of the normal size. It is produced in China; and Reeves states that great quantities of it are brought to Canton from the province which affords cassia. Cassia buds have some resemblance to cloves, and are compared to small nails with round heads. The enclosed ovary is sometimes removed, and they are then cup-shaped at top. They have a brown color, with the flavor of cinnamon, and yield an essential oil upon distillation. They may be used for the same purposes as the bark.

Culture, Collection, Commerce, etc.—In Ceylon, cinnamon bark was originally collected exclusively from the tree in a wild state; but the Dutch introduced the practice of cultivating it, which has been continued since the British came into possession of the island. The principal cinnamon gardens are in the vicinity of Colombo, but the plant is grown from the sea-level up to a considerable elevation, giving the finest product, however, on the sandy soil of the coast line. The seeds are planted in a prepared soil at certain distances, and, as four or five are placed in a spot, the plants usually grow in clusters like the hazel-bush. In favorable situations they attain the height of five or six feet in six or seven years; and a healthy bush will then afford two or three shoots fit for peeling, and every second year afterwards from four to seven shoots in a good soil. The cinnamon harvest commences in May and continues

until late in October. The first object is to select shoots proper for decortication, and those are seldom cut which are less than half an inch or more than two or three inches in diameter. Before decortication these shoots are trimmed up, and the small pieces, when dried, constitute cinnamon chips. The bark is divided by longitudinal incisions, of which two are made in the smaller shoots, several in the larger, and is then removed in strips by means of a suitable instrument. The pieces are next collected in bundles, and allowed to remain in this state for a short time, so as to undergo a degree of fermentation, which facilitates the separation of the epidermis. This, with the green matter beneath it, is removed by placing the strip of bark upon a convex piece of wood and

scraping its external surface with a curved knife. The bark now dries and contracts, assuming the appearance of a quill. The peeler introduces the smaller tubes into the larger, and connects them also endwise, thus forming a congeries of quills which is about forty inches long. When sufficiently dry, these cylinders are collected into bundles weighing about, thirty pounds and bound together by pieces of split bamboo. The commerce in Ceylon cinnamon was formerly monopolized by the East India Company; but the cultivation is now unrestricted, and the bark may be freely exported upon the payment of a fixed duty. It is assorted in the island into three qualities, distinguished by the designations of *first*, *second*, and *third*. The inferior kinds, which are of insufficient value to pay the duty, are used for preparing oil of cinnamon.

The importations of *cassia buds* into the United States in 1916 amounted to 197,056 pounds, and of *cassia* and *cassia leaves* to 7,487,156 pounds, valued at \$493,161. Immense quantities of cinnamon barks are exported from China, the finest of which is little inferior to that of Ceylon, though the mass of it is much coarser. It passes in commerce under the name of *cassia*, was formerly official, and is said by Reeves to be brought to Canton from the province of Kwangse, where the tree producing it grows very abundantly. It is, indeed, asserted that true cinnamon of very fine grade occurs in China, although it never enters foreign commerce, because of the high price which it commands at home. (*P. J.*, xxi, 1890.) These fine cinnamons are said to be produced in the mountainous district of Annam, or Cochin-China. Cinnamon of good quality is said to be collected in Java, and considerable quantities of inferior quality have been thrown into commerce, as *cassia lignea*, from the Malabar Coast. Manila and the Isle of France are also mentioned as sources whence this drug is supplied. Little, however, reaches the United States from these places. The island of Martinique, Cayenne, and several of the West India islands yield to commerce considerable quantities of cinnamon of various qualities. That of Cayenne is of two kinds, one of which closely resembles, though it does not quite equal, the aroma of Ceylon, the other resembles the Chinese. The former is supposed to be derived from plants propagated from a Ceylonese stock, the latter from plants which have sprung from a tree introduced from Sumatra. By far the greater proportion of cinnamon brought to this country is imported from China. It is entered as *cassia* and *Saigon cassia* at the custom house.

From what source the ancients derived their cinnamon and cassia is not

certainly known. Neither the plants nor their localities, as described by Dioscorides, Pliny, and Theophrastus, correspond precisely with our present knowledge; but in this respect much allowance must be made for the inaccurate geography of the ancients. It is probable that the Arabian navigators at a very early period conveyed this spice within the limits of the Phenician and Uredan and subsequently of Roman commerce.

Properties.—*Saigon cinnamon* takes its name from Saigon, the capital of French Cochin China. It is a thick cassia bark, which has come into European commerce, and was recognized for the first time by the U. S. P., 1890. It is officially described as "in quills attaining a length of 30 cm., and from 3 to 30 mm. in diameter; the bark from 0.5 to 3 mm. in thickness; outer surface light brown to dark purplish-brown with grayish patches of foliaceous lichens and numerous bud-scars; finely wrinkled, especially the bark of younger twig's, otherwise more or less rough from corky patches surrounding the lenticels; inner surface reddish-brown to dark brown, granular, and slightly striate; fracture short; inner bark porous, owing to the presence of large oil cells and mucilage cells, and separated by a continuous layer of stone cells from the outer bark; odor aromatic; taste sweetish, aromatic and pungent. Under the microscope, sections of the older bark of Saigon Cinnamon show a thin layer of more or less lignified cork cells; a narrow layer of starch-bearing parenchyma with scattered stone cells; a nearly continuous zone, several layers wide, of stone cells, among which are small groups of bast-fibers with thickened and slightly lignified walls; a wide inner bark with medullary rays 1 to 3 cells in width, isolated bast-fibers, mucilage cells, oil cells and parenchyma, the cells of the latter either filled with starch grains or containing very small rap hides of calcium oxalate; the lumina of parenchyma cells, stone cells and bast-fibers frequently filled with an amorphous reddish-brown substance, which is for the most part insoluble in the ordinary reagents. In the bark of young twigs there is an epidermal layer with a thick yellowish cuticle, fewer stone cells in the zone associated with bast-fibers, and the inner bark is narrower and with fewer secretion cells than in the older bark. The powder is yellowish- or reddish-brown; starch grains numerous, single or compound, the individual grains being somewhat ellipsoidal or polygonal and from 0.003 to 0.02 mm. in diameter; fragments, with colorless stone cells, rather prominent. the cells being very irregular in shape and the lumina containing either air or a reddish-brown amorphous substance; bast-fibers from 0.3 to 1.5 mm. in

length and usually in groups of from 2 to 20 with very thick and scarcely lignified walls; numerous cellular, reddish-brown fragments in which the oil cells are not readily distinguishable. Saigon Cinnamon yields not less than 2 per cent. of volatile extractive, soluble in ether. Saigon Cinnamon yields not more than 6 per cent. of ash. The amount of ash insoluble in diluted hydrochloric acid does not exceed 2 per cent. of the weight of Saigon Cinnamon taken." *U.S.*

"In closely rolled quills, each about nine millimetres in diameter, and containing numerous smaller quills or channelled pieces. Dull, pale yellowish-brown, darker on the inner surface; thin, brittle and splintery; entirely free from cork; marked with small scars or holes and with faint, shining, wavy longitudinal lines. The powdered Bark exhibits abundant parenchymatous tissue with brown cell-walls, isolated bast-fibers not more than 30 microns in diameter, small simple or compound starch grains and thick-walled sclerenchymatous cells, but no cork or fragments of wood. Fragrant odor; taste warm, sweet, and aromatic. Ash not more than 5 per cent." *Br.*

The odor of this cinnamon is fragrant, the taste is highly aromatic, markedly that of cinnamon, and, in the specimens that we have seen, only slightly astringent. It also occurs in commerce much broken, in which state it commands a somewhat smaller price than in quills. The Saigon buds also are brought into the port of New York. The quality of Saigon cassia, as it is commonly termed in trade journals, is distinctly superior to that of other cassias, and the price which it commands much higher. It is obtained from an undetermined species of *Cinnamomum* but is sometimes ascribed to *Cinnamomum Loureirii* of Nees, the *Laurus Cinnamomum* of Loureiro, a tree which grows in Cochin-China and Japan. According to Siebold, the bark of the large branches is of inferior quality and is rejected; that from the smallest branches resembles the Ceylon cinnamon in thickness, but has a very pungent taste and odor, and is little esteemed, while the intermediate branches yield an excellent bark, about 2 mm. in thickness, which is even more highly valued than the cinnamon of Ceylon, and yields a sweeter and less pungent oil. It yields about 2 per cent. of a volatile oil, the oil of Nikkei, having an odor resembling that of cinnamon and consisting of citral, having a specific gravity at 15° C. (59° F.) of 0.9005, and containing about 27 per cent. of aldehyde, chiefly citral.

Ceylon cinnamon occurs "in closely rolled double quills, composed of

from 7 to 12 thin layers of separate pieces of bark, from 30 to 50 cm. in length and from 8 to 13 mm. in diameter; the bark attaining a thickness of 1 mm.; outer surface pale yellowish-brown, smooth, longitudinally striate with narrow yellowish groups of bast-fibers, and showing circular or irregular brownish patches, occasionally with perforations marking the nodes; inner surface light brown, with faint, longitudinal striations; fracture short with projecting bast-fibers; odor agreeably aromatic; taste sweetish and warmly aromatic. Under the microscope, sections of Ceylon Cinnamon usually show no cork but an almost continuous outer layer of stone cells, among which are small groups of bast-fibers resembling those found in *Saigon Cinnamon*; in the inner bark occur numerous bast-fibers singly or in small groups, medullary rays 1 to 2 cells in width, usually with raphides of calcium oxalate; parenchyma with either reddish-brown contents or more or less filled with starch grains; scattered throughout the parenchyma occur oil secretion cells and mucilage cells. The powder is light brown or yellowish-brown ; starch grains numerous, varying from spherical to polygonal, from 0.003 to 0.02 mm. in diameter, frequently in small aggregates; bast-fibers from 0.3 to 0.8 mm. in length, usually single, spindle-shaped, with attenuated ends, the walls being very thick and but slightly lignified; colorless stone cells resembling those of *Saigon Cinnamon*; numerous cellular fragments with yellowish-brown walls or contents; cork cells few or none; calcium oxalate in raphides, from 0.005 to 0.008 mm. in length. Ceylon Cinnamon yields not less than 0.5 per cent. of volatile extractive, soluble in ether. (See Part III, Test No. 12.) Ceylon Cinnamon yields not more than 6 per cent. of ash. The amount of ash insoluble in diluted hydrochloric acid does not exceed 2 per cent. of the weight of Ceylon Cinnamon taken." *U. S.*

When distilled Ceylon Cinnamon affords but a small quantity of essential oil, which, however, has an exceedingly grateful flavor. It is brought to this country from England, but it is costly. The inferior sorts are browner, thicker, less splintery, and of a less agreeable flavor, and are little if at all superior to the best Chinese. The finer variety of *Cayenne cinnamon* approaches in character that a. Love described, but is paler and in thicker pieces, being usually collected from older branches. That which is gathered very young is scarcely distinguishable from the cinnamon of Ceylon.

Chinese cinnamon, or *Cassia* (*Cinnamomum Cassia*, *Cassia Cinnamon*, *U. S.*, 1890), occurs in quills, usually single, sometimes double, very

rarely more than double, from 30 to 60 cm. long, 2 to 5 cm. wide, and 0.2 to 3 mm. thick. In some instances the bark is rolled very much upon itself, in others is not even completely quilled, forming segments more or less extensive of a hollow cylinder. It is of a redder or darker color than the finest Ceylon cinnamon, thicker, rougher, denser, and breaks with a shorter fracture. It has a stronger, more pungent and astringent but less sweet and grateful taste, and though of a similar odor, is less agreeably fragrant. It is the kind almost universally kept in our shops. Of a similar character is the cinnamon imported directly from various parts of

the East Indies. But under the name of cassia have also been brought to us very inferior kinds of cinnamon, collected from the trunks or large branches of the trees, or injured by want of care in keeping, or perhaps derived from inferior species. It is said that cinnamon from which the oil has been distilled is sometimes fraudulently mixed with the genuine. These inferior kinds are detected, independently of their greater thickness and coarseness of fracture, by their deficiency in the peculiar sensible properties of the spice. Chinese cinnamon is "in quills of varying length and about 1 mm. or more in thickness; nearly deprived of the corky layer; yellowish-brown; outer surface somewhat rough; fracture nearly smooth; odor fragrant; taste sweet, and warmly aromatic." *U. S.* 1890. Cassia is no longer official in the U. S. P., it having been dropped at the 8th Revision.

Powdered cinnamon is often grossly adulterated with sugar, ground walnut shells, galanga rhizome and various other substances. Galanga, according to Schmitz-Dumont, may be detected by the presence of small club-shaped, rod-shaped, partly bent, microscopic pieces of resinotannol. (*Zeit. oeff. Chew.*, 1903, No. 2.) Powdered cassia buds are frequently added to the inferior cinnamon powders, but can hardly be looked upon as an adulterant, as they contain a larger proportion of volatile oil than the lower grades of cinnamon.

The *Pharmacographia* gives the following tests for distinguishing powdered cassia from powdered cinnamon, and for recognizing the inferior varieties of cassia. Make a decoction of powdered cinnamon of known genuineness, and one of similar strength of the suspected powder; when cool and strained, test a fluidounce of each with one or two drops of tincture of iodine. A decoction of cinnamon is but little affected, but in that of cassia a deep blue-black tint is immediately

produced. The cheap kinds of cassia known as *cassia vera* may be distinguished from the more valuable Chinese cassia as well as from cinnamon by their richness in mucilage; this can be extracted by cold water; it is a thick glairy liquid, giving dense ropy precipitates with corrosive sublimate or neutral lead acetate, but not with alcohol.

Microscopic Structure.—Ceylon cinnamon usually consists simply of the inner bark, the outer coatings having been stripped off during its preparation for market. Three layers are distinguishable in the liber. " 1. The external surface, which is composed of one to three rows of large thick-walled cells, forming a coherent ring; it is only interrupted by bundles of bast fibres, which are obvious even to the unaided eye. 2. The middle layer is built up of about 10 rows of parenchymatous thin-walled cells, interrupted by much larger cells containing deposits of mucilage, while other cells not larger than those of the parenchyma itself are filled with essential oil. 3. The innermost layer exhibits the same thin-walled but smaller cells, yet intersected by narrow somewhat darker medullary rays, and likewise interrupted by cells containing either mucilage or essential oil, instead of bundles of bast fibres. Fibres mostly isolated are scattered through the two inner layers, the parenchyma of which abounds in small starch granules accompanied by tannic and on a longitudinal section the length of the liber fibres becomes more evident, as well as the oil-cells and mucilage cells." (*Pharmacographia*.)

The coarser cassia bark, or *cassia lignea*, usually has some of the external or corky layer adherent to it, and always the parenchymatous mesophleum or middle bark, but the inner bark constitutes the chief mass. Isolated bast fibers and thick-walled stone cells are scattered even through the outer layers of a transverse section. In the middle zone they are numerous, but do not form a coherent sclerenchymatous ring as in Ceylon cinnamon. The innermost part of the bast shares the structural character of cinnamon, with differences due to age, as, for instance, the greater development of the medullary rays. Oil cells and mucilage cells are likewise distributed among the parenchyma of the former. The finest cassia or Chinese cinnamon has the three layers described in Ceylon cinnamon, but is distinguished by the adherent outer parenchymatous and suberous layer. For an excellent description of the microscopical structure of the commercial cinnamon see Win-ton and Moeller, "*The Microscopy of Vegetable Foods*" Spaeth gives the microscopical characteristics of the several kinds of cinnamon, discusses the

adulterants of powdered cinnamon and the means of detection in *Ph. Centralh.*, 1908, pp. 724, 729. Rosenthaler and Reis give an excellent pharmacognostical study of Seychelles Cinnamon in *Ber. d. pharm. Gesellsch.*, Berl., 1909, p. 490.

Chemical Composition.—According to the analysis of Vauquelin, cinnamon contains a peculiar volatile oil, tannin, mucilage, a coloring matter, an acid, and lignin. The tannin is of the variety which yields a greenish-black precipitate with the salts of iron. Thos. R. Thornton (*A. J. P.*, 1895, 400) has examined the tannin of *C. Cassia*. He found it to amount to about 3.90 per cent., as an average of three different determinations on different samples. He found it impossible to extract the tannin by any one of several methods tried, and concludes that it either has the phlobophene (anhydride) character as it exists in the drug or acquires such character when brought into contact with water. Jas. A. Ferguson (1887), in the laboratory of the Philadelphia College of Pharmacy, determined the ash of several samples of Ceylon cinnamon, finding an average of 4 per cent., while in powdered cassia cinnamon he found 2.8 and 2.5 per cent. (*A. J. P.*, 1887, 278, 279.) The oil obtained from the Cayenne cinnamon was found to be more biting than that from the Ceylon. Bucholz found in 100 parts of *cassia lignea* 0.8 of volatile oil, 4.0 of resin; 14.6 of gummy extractive (probably including tannin), 64.3 of lignin and bassorin, and 16.3 of water, including loss.

This aromatic yields its virtues wholly to alcohol, and less readily to water. At the temperature of boiling alcohol very little of the oil rises, and an extract prepared from the tincture retains, therefore, the aromatic properties. For an account of the volatile oil, see *Oleum Cinnamomi*.

Uses.—Cinnamon is among the most grateful and efficient of the aromatics. It is warm and cordial to the stomach, carminative, distinctly astringent, and, like most other substances of this class, more powerful as a local than as a general stimulant. It is seldom prescribed alone, though, when given in powder or infusion, it will sometimes allay *nausea*, check *vomiting*, and relieve *flatulence*. It is chiefly used as an adjuvant, and enters into a great number of official preparations. It is often employed in *diarrhea*, in connection with chalk and astringents.

Dose, of powder, ten to twenty grains (0.65 to 1.3Gm.).

Off. Prep.—*Ceylon cinnamon*.—Aqua Cinnamomi, *Br.*; Pulvis Cinnamomi Compositus, *Br.*; Pulvis Cretae Aromaticus, *Br.*; Tinctura Cardamomi Composita, *Br.*; Tinctura Cinnamomi, *Br.*; Tinctura Lavandulae Composita, *Br.*

Off. Prep.—*Saigon cinnamon*.—Pulvis Aromaticus, *U. S.*; Fluid-extractum Aromaticum (from Aromatic Powder), *U. S.*; Tinctura Cardamomi Composita, *U. S.*; Tinctura Cinnamomi, *U. S.*; Tinctura Lavandulae Composita, *U. S.*; Cordiale Rubi Fructus, *N. F.*; Elixir Rubi Compositum, *N. F.*; Elixir Taraxaci Composita (from Tincture), *N. F.*; Pulvis Aromaticus Rubefaciens, *N. F.*; Pulvis Cretse Aromaticus, *N. F.*; Syrupus Cinnamomi, *N. F.*; Tincture Aromatica, *N. F.*; Vinum Aurantii Compositum, *N. F.*

Clematis. *Clematis recta* L. (*C. erecta* L.) *Upright Virgin's Bower. Clematite, Fr. Waldrebe, G.*—A perennial European plant. The leaves and flowers have an acrid, burning taste. When bruised in a mortar they irritate the eyes and throat, giving rise to a flow of tears and to coughing, and applied to the skin they produce inflammation and vesication; hence their old name of *Flammula Jovis*. The acidity is greatly diminished by drying. Storck found this clematis to be diuretic and diaphoretic, in doses of from one to two grains (0.065-0.13 Gm.) of the extract a day, or from thirty to forty grains (2-2.6 Gm.) of the leaves given in infusion three times a day, and to be useful, locally and internally, in *syphilitic, cancerous, and other foul ulcers*.

Other species of *clematis* have the same acrid properties; among these *C. flammula* L., or *sweet-scented virgin's bower*, which, though a native of Europe, is cultivated in our gardens, *C. vitalba* L., or *traveller's joy*, also a native of Europe, and several indigenous species, of which *C. virginiana* L., or *common virgin's bower*, *C. viorna* L., or *leather flower*, and *C. crispa* L. have been used as substitutes for *C. recta* L. All these are climbing plants. Rochebrune (*Toxicol. Africaine. i*) affirms that he has found in *C. flammula* L. an alkaloid, *clematine*, two milligrammes of which will produce in the guinea-pig copious and frequent urination, general tremors, great disturbance of respiration, feeble-ness and intermittency of the heart beat, followed in seven minutes by convulsions ending in coma and death.

From the bruised roots and stems of *C. vitalba* L., boiled for a few moments in water to diminish their acidity, and then digested in sweet oil for a little while, is made a preparation used locally in Europe for the itch. Twelve or fifteen applications are said to be usually sufficient. Gaube has found in this species an alkaloid, also named *clematine*, which forms with sulphuric acid a salt crystallizable in six-sided needles; also an acrid volatile oil analogous to mezereon in its properties, tannic acid, mucilage, and earthy salts. (*J. P. C., Aout, 1869.*)

Clove Bark. *Cortex Caryophyllatus. Cassia Caryophyllata.*—Under these names two barks occur in the market. Of these the most abundant comes from the West Indies,

and is derived from a tree, *Dicypellium caryophyllatum* Nees. (Fam. *Lauraceae*.) It is usually in large compound quills, 1 to 2 mm. thick, composed of numerous separate pieces rolled around one another and having a dark brown color, being more or less flaky on the outer surface and finely striate on the inner surface, a pungent taste, and an odor similar to that of cloves. The second variety of clove bark occurs in fragments, resembling the other form in odor and color but softer and lighter, and supposed to be derived from *Eugenia caryophyllaea*, Wight (Fam. *Myrtaceae*) which grows in Ceylon. This clove bark has aromatic properties not unlike those of the spice from which it derived its name, but it is much inferior and is not used in this country. Some authors have confounded with it a different bark, produced in the Moluccas and known by the Indian name of culilawan. (See *Culilawan*.) For description of a false clove bark, see *A. J. P.*, vol. xv.

Cnicus. *Cirsium arvense* (L.) Scop. (*Cnicus arvensis*, Hoffm.) *Canada Thistle*.—This European composite plant, to which have been attributed diaphoretic, emetic, and tonic properties, according to Herman J. Pierce (*A. J. P.*, Ixviii, 1896), contains a volatile alkaloid, and also *Cnicin*, $C_{42}H_{56}O_{15}$, which is said to possess emetic and emmenagogue properties.

Cocculus Indicus. *N. F. IV. Fish Berry. Indian Berry. Coque du Levant, Fr. Kokkelskorner, Fischkorner, Tollkorner, G. Oriental Berries.*

It is described in the 'N. F. as "the dried fruit of *Anamirta Cocculus* (Linne) Wight et Arnott (Fam. *Menispermaceae*)." "

This is a climbing shrub, with a. suberose or corky bark, and grows along the Malabar Coast, and in Eastern Insular and Continental India. By Roxburgh it was proved to be one source of *Cocculus*, which is, however, probably derived also from other plants, notably from the *Cocculus Plukentii*, DC. (now *Pachygone ovata* Miers.), of Malabar, and *C. laconus* DC. (now *Anamirta paniculate* Colebr.); of Celebes and the Moluccas. It was known to the Arabian physicians, and was imported into Europe from the Levant, from which circumstance it was called *Cocculuslevanticus*. It is now brought exclusively from the East Indies.

The fruit bears some resemblance to the bay laurel berry, but is not quite so large, and may be distinguished by the fact that in the *Cocculus Indicus* the kernel never wholly fills the shell. When the fruit is kept long, the shell is sometimes almost empty. The Edinburgh College directed that " the kernels should fill at least two-thirds of the fruit." It is described by the N. F. as " reniform, about 10 mm. in length and 6 mm. in breadth and thickness, blackish-brown, wrinkled; hilum and micropyle close together, separated by a shallow sinus and connected by an obscure ridge running around the convex side. Seed urn-shaped, its longitudinal and transverse sections crescent-shaped. Taste slightly bitter; the 'seed whitish-yellow and intensely bitter. *Cocculus Indicus* yields not more than 5 per cent. of ash." N. F.

According to Merck its main constituents are *menispermine*, *paramenispermine*, *picrotoxin*, $C_{30}H_{34}O_{13}$, *picrotoxic acid* and *cocculin*.

A *tincture of Cocculus Indicus* is official in the N. F. For Procter's formula for preparing a fluidextract, see *U. S. D.*, 17th ed., or *A. J. P.*, 1863.

Cocculus Indicus is used in India to stupefy fishes. Both its poisonous properties and any therapeutic virtues it may contain depend upon picrotoxin (see p. 1550). It has been used in medicine for the purpose of destroying vermin in the hair, but it is an extremely dangerous drug. For cases of poisoning see Sozinsky (*M. News*, 1883, xliii p. 485), Swift (*N. Y. M. J.*, 1897, lxvi, p. 664), and Haines (*P. M. T.*, 1884, xiv, p. 748). In spite of its highly toxic properties, *Merck's Index*, 1907, reports it as having nervine and sedative properties in doses of 1 to 3 grains (0.06-0.2 Gm.) doses of the powdered berries.

Coca. *Cocae Folia.* *U. S. P. VIII.* Br. 1898. *Coca Leaves.* *Cuca: Feuilles de Coca, Fr. Cocablatter, G. Coca del Peru, Ipadu, Sp.*—"The dried leaves of *Erythroxylon Coca* Lamarck (Fam. *Erythroxylaceae*), known commercially as Huanuco Coca, or of *E. Truxillense* Rushy, known commercially as Truxillo Coca, yielding when assayed by the process given below, not less than 0.5 per cent. of the ether-soluble alkaloids of Coca," *U. S. VIII.* "The dried leaves of *Erythroxylum Coca*, Lam., and its varieties." Br., 1898.

The *coca* plants are shrubs or small trees, some of the species reaching the height of fifteen or twenty feet. It is conjectured that the original habitat was in the Peruvian mountains, from 7° South to 10° North, but either spontaneously or through cultivation the coca shrubs have spread until they are found in the whole Eastern curve of the Andes, from the Straits of Magellan to the borders of the Caribbean Sea, growing on the moist sides of the mountains at the elevation of 1500 to 6000 feet, the climatic requisites being moisture and equable temperature, with a mean of about 17.7° C. (64° F.) The wild coca shrub commonly reaches the height of 12 feet, and some are 18 feet, but the cultivated coca is usually kept down to about 6 feet. The leaves are gathered three times a year; the first harvest, or preliminary picking, is taken at the time of the trimming of the bushes, from the cut-off twigs. Then about the end of June, a scanty crop is gathered, while the last' crop of the season is gathered in October or November. Harvesting must always take place in dry weather, so that the fresh leaves when spread out in layers two or three inches thick on the drying pavement can be collected in six or eight hours.

The coca plant, which is propagated from the seed in nurseries, begins to yield in eighteen months, and continues productive for half a century. The leaves, when mature, are carefully picked by hand so as to avoid breaking them or injuring the young buds, are slowly dried in the sun, and are then packed in bags (*cestos*) holding from twenty-five to one hundred and fifty pounds each. They were in general use among the natives of Peru at the time of the conquest, and have continued to be much employed to the present time. It is affirmed that nearly ten million dollars' worth, or forty million pounds, are annually produced, some plantations yielding three or four harvests a year. The importations into the United States have averaged for some years past about 1,000,000 pounds. For details as to method of cultivation, etc.,

see *T.G.*, Jan., 1886; also *C. D.*, 1897, 182'. Two varieties of the coca leaf occur in the commerce of the United States, namely, the so-called Huanuco coca, and the Truxillo coca, the Huanuco variety being produced in Bolivia, Huanuco, Brazil, Venezuela and Argentina, while the Truxillo coca is produced chiefly in Northern Peru. The great variation in the leaves and other portions of the coca plant, produced by its long-continued cultivation, has produced much doubt and discussion as to the specificity and characteristics of the plant; H. H. Rusby has made an elaborate study of the subject (*D. C.*, Nov., 1900).

Huanuco coca, has been for a long time believed to be obtained from *Erythroxylon Coca*; this belief is confirmed by Rusby and has been accepted by the Pharmacopoeial authorities. The plant was first described in 1786, in *Lamarck's Dictionary*, vol. ii, 393.

Truxillo coca is the product of the *E. Coca Spruceanum*, of Burck; the name "spruceanum" had, however, been used elsewhere before it was suggested by Burek, and in obedience to the ordinary rules of botanical nomenclature it was changed by Rusby, who regards it as a distinct species, to *E. Truxillense*.

Coca is cultivated in the British East and West Indies, and in Java, and the product is said to appear, in the London markets, under the names of Truxillo coca and Java coca. This coca is entirely distinct from the Truxillo coca of the American market, and does not reach the United States. The coca shrubs of India and Ceylon are the offspring of plants originally sent out from Kew Gardens, which plants were derived from seeds obtained in Huanuco, and were considered by Morris as representing a variety of *E. Coca* to which he gave the name of *E. Nova-Garantense*. According to Rusby, however, this plant is a distinct species, and the same as that previously described by Jacquin, from Colombia, under the name of *E. carthagenense* (the name *E. carthagenense* not being, as it is held in the Kew Index, a synonym of *E. areolatum*).

The leaves of the different varieties of coca do not, on the whole, resemble one another at all closely, but are distinguished from most other leaves by a slightly curved line on each side of the midrib, running from the base to the apex. This line has the appearance of a rib, but is really not of this character, having been produced during development by the peculiar folding of the leaf in the bud. The two commercial varieties were very well described in the *U. S. Pharmacopoeia VIII* as follows:

"*Huanuco Coca*.—Greenish-brown to clear brown, smooth and slightly glossy, thickish and slightly coriaceous, stoutly and very shortly petioled; blade 2.5 to 7.5 Cm. long and nearly elliptical, with a very short and abruptly narrowed basal portion and a short point, the margin entire; midrib marked above by a slight ridge, very prominent underneath, the remaining venation rather obscure, especially above; underneath, a conspicuous line of collenchyma tissue runs longitudinally on either side of the midrib and about one-third of the distance between it and the margin, the enclosed areola being of a slightly different color from the adjacent surface; odor characteristic; taste bitterish, faintly aromatic, followed by a numbness of the tongue, lips, and fauces.

"*Truxillo Coca*.—Pale green, thin, brittle and usually much broken, smooth, but not

shining, shortly and stoutly petioled; blade 1.6 to 5 Cm. long and one-third to one-half as broad, obovate to oblanceolate, narrowed from near the middle into the petiole, usually with a slight projecting point at the summit, the margin entire; underneath two irregular lines of collenchyma tissue, usually incomplete or obscure, and frequently wanting, run beside the midrib at about one-third the distance from it to the margin; odor more tea-like than that of Huanuco Coca; taste and numbing effect similar." *U. S. VIII.* " The midrib itself is prolonged into a minute horny apiculus, which, however, is frequently broken off. Most of the epidermal cells of the under surface are seen in transverse section to project in the form of small papillae." *Br.*, 1898.

Chemical Constitution.—In 1853, Wackenroder demonstrated the existence of tannic acid in coca leaves, and in 1859, Stanislaus Martin found in them a peculiar bitter principle, resin, tannin, an aromatic principle, extractive chlorophyll, a substance analogous to theine, and salts of lime. Previous to this (1855) Gardeke had isolated the crystalline alkaloid and given it the name of *erythroxyline*. Albert Niemann, of Goslar, made the first thorough investigation of the leaves, and gave to the alkaloid the name it now usually bears of *cocaine*.

Assay. U. S. VIII.—"Coca, in No. 60 powder, ten grammes; chloroform, ether, normal sulphuric acid V.S., ammonia water, distilled water, tenth-normal sulphuric acid V.S., fiftieth-normal potassium hydroxide V.S., cochineal or odeosin T.S., each, a *sufficient quantity*. Place the *Coca* in an Erlenmeyer flask, add 50 Cc. of a mixture of chloroform 1 volume and ether 4 volumes and insert the stopper securely. Allow the flask to stand ten minutes, then add 2 Cc. of ammonia water mixed with 3 Cc. of distilled water, and shake the flask well, at frequent intervals, during one hour. Then transfer as much as possible of the contents of the flask to a small percolator which has been provided with a pledge! of cotton packed firmly in the neck, and inserted in a separator containing 6 Cc. of normal sulphuric acid V.S., diluted with 20 Cc. of distilled water. When the liquid has passed through the cotton, pack the *Coca* firmly in the percolator with the aid of a glass rod, and, having rinsed the flask with 10 Cc. of chloroform-ether mixture, transfer the remaining contents of the flask to the percolator by the aid of several small portions (5 Cc.) of a chloroform-ether mixture, using the same proportions as before, and continue the percolation with successive small portions of the same liquid (in all 50 Cc.). Next, shake the separator well for one minute, after securely inserting the stopper, and when the liquids have completely separated, draw off the acid liquor into another separator. Add to the chloroform-ether mixture 10 Cc. of a sulphuric acid mixture, using the same proportions as before, agitate well and again draw off the acid liquid. Repeat this operation once more, drawing off the acid solution as before into the second separator, introduce a small piece of red litmus paper, add ammonia water until the liquid is distinctly alkaline, and shake out with three successive portions of ether (25, 20, and 15 Cc.). Collect the ether-solutions in a beaker, place it on a water-bath filled with warm water, and allow the ether to evaporate entirely. Dissolve the residue in 3 Cc. of ether, and let this also evaporate completely. To the alkaloidal residue add 4 Cc. of tenth-normal sulphuric acid V.S. and 5 drops of cochineal or iodeosin T.S., then titrate the excess of acid with fiftieth-normal potassium hydroxide V.S. Divide the number of cubic centimeters of fiftieth-normal potassium hydroxide V.S. used, by 5, subtract this number from 4 (the 4 Cc.

of tenth-normal sulphuric acid V.S. taken), and multiply the remainder by 0.03 and this product by 10, to obtain the percentage of ether-soluble alkaloids contained in the Coca." *U. S. VIII*. For methods of assaying coca leaves, see Lyons, *Ch. Ph.*, Sept., 1885; Squibb, *Ephem.*, 1887; Dohme, *Proc. A. Ph. A.*, 1893, 159; Prescott, *Organic Analysis; Proc. A. Ph. A.*, 1895, 268; P. J., 1896, 1901, 222, 254; *Ph. Ztg.*, 1901, 965.

In South America many of the Indians habitually chew the leaf of the coca plant generally mixed with some alkali, as ashes or lime. It is stated on good authority that they will go for days performing hard physical labor without any other food. It is, however, clearly proven that these leaves do not take the place of nutriment, but simply put off the sense of fatigue and hunger. Eventually, however, this habit undermines the health and finally the inveterate excessive coca-chewer can be recognized by his uncertain step, general apathy, sunken eyes surrounded by deep purple aureoles, trembling lips, green and crusted teeth, and excessively fetid breath, with peculiar blackness about the corners of the mouth. An incurable insomnia is apt to be developed, emaciation becomes extreme, dropsy appears, and even death results from a condition of general marasmus. It has been believed that the effects of coca chewing are different from those produced by the alkaloid cocaine and hence it has been by some argued that the coca leaf contains other active principles, but there is no difference between the results of the habit as practised by the South American Indian and the use of the alkaloid by depraved Caucasians, which cannot be readily explained on the ground of difference in the mode of taking the stimulant or racial variation. While there are other active substances present in the coca leaf, it is not manifest that they modify the action of the crude drug materially. For a study of the uses and effects of cocaine, see p. 362, and of tropa-cocaine, see p. 1649.

Coca has a slight bitter tonic effect as well as a stimulant action upon the central nervous system and has been used as a tonic in neurasthenia and other debilitated conditions. The danger of the formation of the habit, however, far outweighs any value the drug may possess, and the use of the crude preparation of coca seems to us hardly justifiable, except under the most extraordinary conditions. The *U. S. P.*, VIII, recognized a fluidextract, the dose of which was from thirty to sixty minims (2-3.9 mils), and a wine the dose of which was two to eight fluidrachms (7.5 to 30 mils).

Cochlearia. *Cochlearia officinalis* L. *Common Scurvy-grass, Herbe au Scorbut*, Fr. *Herba Cochleariae*, P. G. *Loffelkraut*, G. *Spoonwort*.—This annual or biennial cruciferous plant, is a native of northern and middle Europe and growing in Arctic America generally. The whole herb is active. It has, when fresh, a pungent, unpleasant odor if bruised, and a warm, acrid, bitter taste. These properties are lost by drying. They are imparted to water and alcohol by maceration, are retained by the expressed juice, and probably depend on a peculiar volatile oil, which is separable in very small quantity by distillation with water, and is probably produced by reaction between a fixed principle in the plant and water, under the influence of myrosin acting as a ferment. (*Chem. Cb.*, 1856, 124.) According to Hofmann, the oil is a sulphur-containing oil of the butylic series, having the formula $C_5H_9NS=C_4H_9CSN$

Common scurvy-grass has been much used in *scurvy*, and even in *chronic*

rheumatism. The fresh plant may be eaten as a salad, or used in infusion; the expressed juice has also been used.

Cocillana. *N. F. IV.*—It is described in the *N. F.* as "the dried bark of *Guarea Rusbyi* (Britton) Rusby (Fam. *Meliaceae*). In flat or curved pieces of variable size and from 3 to 5 mm. in thickness; outer surface shallowly or deeply fissured, according to age and thickness, gray-brown, often ashy-gray from lichen growths, or of a deeper brown where the cork has been removed; inner surface of medium brown color, strongly and coarsely longitudinally striate, the striae straight or wavy; inner bark usually much thicker than the outer, its fracture coarsely splintery-fibrous. Odor characteristic; taste slightly astringent, peculiar and slightly nauseous. Cocillana yields not more than 10 per cent. of ash." *N. F.* The bark of this large Bolivian tree, which was discovered by H. Rusby, is believed by him (T. G.) 1888) to contain an alkaloid; but by John W. Eckfeldt (*Med. Bull.*, 1891) its active principle is thought to be a glucoside. In doses of from twenty to fifty grains (1.3-3.2 Gm.) the bark causes vomiting, with prostration and some purging; also, it is said, much sneezing, dull frontal headache, and discharge from the nasal mucous membrane. The therapeutic action of the drug resembles that of ipecac, although as an expectorant it is somewhat more stimulant. (See *N. T. M. J.*, Dec., 1889, and April, 1890). It has been used in various forms of *bronchitis* with asserted success. Dose, of the drug, fifteen grains

Coelocline. *Xylopia polycarpa*, Oliver. (*Coelocline polycarpa*, D.C.) *Berberin Tree. Yellow dye Tree of Soudan.*—This small tree, of the Fam. *Anonaceae*, growing in Soudan, Sierra Leone, and certain parts of Western Africa, was described by William F. Daniell. (*P. J.*, Feb., 1857). When wounded, the tree exudes a juice which produces a yellow stain upon linen that cannot be washed out. The outer surface of the bark is greenish-gray interrupted by occasional blackish patches; the inner layers are of a golden yellow, and very fibrous, so that they can be separated in ribbon-like bands. The bark is moderately but disagreeably bitter, and stains the saliva yellow. Water extracts its color and bitterness. Stenhouse has ascertained that it contains *berberine*. The bark is much used in Africa for dyeing yellow. In Sierra Leone it is employed topically, in powder or decoction, for *obstinate ulcers*.

Coffee, *N. F. IV. Coffea Tosta. Roasted Coffee. Caffen. Semen Caffee. Cafe, Fr. Caffee, G. Caffè, It. Cafe, Sp. Bun, Ar. Copi Cotta, Cingalese. Kaeva, Malay.*—The *N. F.* describes it as "the dried ripe seeds of *Coffea arabica* Linne or *Coffea liberica* Bulliard (Fam. *Rubiaceae*), roasted until they develop a dark brown color and a characteristic aroma, and yielding not less than 1 per cent. of caffeine." *N. F.*

The *C. arabica* is a small evergreen tree from fifteen to thirty feet in height; native of Southern Arabia and Abyssinia, but cultivated in many parts of the world. The coffee berry is globular, umbilicate at top, at first green, then red, and ultimately dark purple. It is about as large as a cherry, and contains two seeds surrounded by a paper-like membrane, and enclosed in a yellowish-purple matter. These seeds, divested of their coverings, constitute coffee. The *Coffee* grains as seen in commerce are oval, having one side strongly convex, the other flat with a longitudinal groove upon the flat side and showing traces of the papery seed coat in the cleft. It has a

characteristic aroma and a pleasantly bitter taste. About the year 1690 it was introduced by the Dutch into Java, and in 1718 into their colony of Surinam. Soon after this latter period the French succeeded in introducing it into their West India Islands, Cayenne, and the Isles of France and Bourbon.

The tree is raised from the seeds, which are sown in a soil properly prepared, and, germinating in less than a month, produce plants which, at the end of the year, are large enough to be transplanted. These are then set out in rows at suitable distances, and in three or four years begin to bear fruit. It is said that they continue productive for from thirty to forty years. Though almost always covered with flowers and fruit, they yield most largely at two seasons, and thus afford two harvests during the year. Various methods are employed for freeing the seeds from their coverings; but that considered the best is, by means of machinery, to remove the fleshy portion of the fruit, leaving the seeds surrounded only by their papyraceous envelope, from which they are separated by peeling and winnowing mills. They appear in commerce as "oval, of variable size, having one side strongly convex, the other flat with a longitudinal groove, and showing traces of the papery seed coat in, the cleft. It has' a characteristic aroma and a pleasantly bitter taste. Percolate 1 Gm. of powdered Coffee with ether until exhausted and evaporate the percolate to dryness; the residue weighs not less than 0.1 Gm. (presence of at least *10 per cent. of fat*). Boil 1 Gm. of powdered Coffee with 10 mils of distilled water, filter and acidify the filtrate with one mil of diluted sulphuric acid, and then decolorize it by the cautious addition of potassium permanganate T.S. This decolorized solution shows no blue coloration upon the addition of iodine T.S. (starch). Shake 1 Gm. of Coffee with 20 mils of water; the strained liquid shows no colored or heavy deposit. Shake 1 Gm. of Coffee with 20 mils of alcohol; the strained liquid shows no colored or heavy deposit, nor is any color imparted to the alcohol (artificial colors or facings). Powdered Coffee, when examined under the microscope, exhibits numerous fragments of the seed coat made up of parenchyma and irregular stone cells, the latter from 0.2 to 1 mm. in length and from 0.015 to 0.05 mm. in width with walls having simple pores; numerous brownish endosperm cells having porous walls about 0.01 mm. in thickness and containing oil and aleurone grains; starch grains few or absent. Coffee yields not less than 3 per cent. nor more than 5 per cent. of ash." *N. F.*

Assay.—"To 6 Gm. of Coffee, in No. 60 powder, contained in a small flask, add 50 mils of purified petroleum benzin and agitate the mixture occasionally during one hour. Then allow it to settle and decant the benzin solution. Add 50 mils more of the petroleum benzin, shake the mixture occasionally during fifteen minutes, then filter off the benzin and dry the drug. Now transfer the Coffee residue to a bottle having a capacity of about 250 mils and pour upon it 120 mils of chloroform and 6 mils of ammonia water. Stopper the bottle securely and shake it vigorously at intervals during six hours. Then allow it to stand one hour, and filter off 100 mils of the chloroform solution. Transfer this to a beaker and evaporate the chloroform at a gentle heat. Dissolve the alkaloidal residue in 10 mils of a mixture of 1 mil of diluted sulphuric acid and 9 mils of distilled water, by aid of a gentle heat, and filter the solution through a small filter, not exceeding 5 cm. in diameter, into a separator. Wash the beaker and filter with successive small portions of acidulated water, until a few drops of the filtrate give no test for caffeine when tested with iodine T.S. To the

mixed acid washings, add a slight

excess of ammonia water, and shake out the caffeine with successive portions of chloroform, collecting the chloroformic solutions in a tared flask or beaker. Evaporate or distil off the chloroform at a temperature not exceeding 75° C. (167° F.) and add to the residue 5. mls of ether. Evaporate off the ether cautiously, then dry the residue to constant weight at a temperature not exceeding 80° C. (176° F.) and add 0.0025 Gm. to the final weight of caffeine to replace that lost in the petroleum benzin washing. The weight represents the amount of caffeine in 5 Gm. of Coffee." *N. F.*

In recent years, because of the spread of a leaf disease, the cultivation of the more hardy *Coffea liberica* has been undertaken in the Island of Ceylon. This may be distinguished from the *C. arabica* by the fact that the corolla is nine-cleft in the Liberian and from four to five-cleft in the Arabian. The seeds of the Liberica plant are much larger than those of the Arabica; are not greenish and have the groove deeply wrinkled along its edges.

The annual production of coffee for the world is about one million tons, of which the American countries produce in the neighborhood of nine-tenths, Brazil giving to commerce three-fourths of the world's supply. After South America, the chief producer of coffee is Java, that island sending into commerce nearly twice as much as the remaining Asiatic countries. The amount of coffee entering commerce from Africa is small. The character of coffee varies greatly, not only with the climate in which it is grown but with the circumstances of its cultivation and the character of the stock which produces it. The most esteemed varieties are those which are known as *Mocha*, and *Java*, but probably the bulk of the berry retailed as Mocha or Java is of South American origin. Coffee improves by age, losing a portion of its strength and acquiring a more agreeable flavor. It is said to be much better when allowed to ripen perfectly on the tree than as usually collected. The grains should be hard, and should readily sink in water. When soft, light, black or dark colored, or musty, they are inferior.

The composition is very complex. The principal constituents are (1) caffeine (identical with theine), (2) caffetannic acid, (3) fat, (4) carbohydrates, (5) albumenoids, (6) essential oil and aromatic substances. Parry (*Food and Drugs*, vol. I, 1911, p. 31) gives the following comparative figures for coffee before and after roasting:

	Raw (per cent.)	Roasted (per cent.)
Moisture ...	11.90 to 12.45	3.7 to 4.1
Ash	3.66 to 3.72	3.82 to 3.95
Cellulose ...	26.82 to 28.5	25.00 to 26.8
Caffeine	1.2 to 1.36	1.36 to 1.40
Sugar.	3.2 to 4.0	1.1 to 1.5

Among the adulterations of roasted coffee are the roasted or ground cereals; these are readily detected microscopically as well as by the positive reaction for starch in the decoction, which has been cautiously decolorized by the addition of potassium permanganate solution followed by diluted sulphuric acid. Coffee naturally contains no starch.

Chicory, dandelion and other similar roots used as adulterants may be detected microscopically, but a chemical method of detection has been proposed by LaWall and Forman (*A. J. P.*, lxxxv, p. 537 and *J. A. Ph. A.*, iii, p. 1669), which depends upon the determination of the ratio of reducing sugars to extractive matter in the aqueous decoction.

Mussaendacoffee, so called, is not a true coffee; but the seeds of *Gaertneravaginata* Lam. (Fam. *Loganiaceae*). (*P. J.*, Nov., 1889.)

Coffee has a faint peculiar odor and a slightly sweetish, somewhat harsh taste. The sugar which is present is a reducing sugar, probably glucose, and is almost completely caramelized in the roasting process. *Caffetannic acid* has been ascertained by Hiasiwetz to be a glucoside with the formula $C_{14}H_8O_7$ and resolvable into glucose and a peculiar crystallizable acid, $C_8H_8O_4$, named by him *caffaic acid* (*J. P. C.*, 1867, 307), and which may be obtained from coffee by boiling a solution of the extract with potassium hydroxide, treating the resulting liquid with sulphuric acid in excess, and extracting the caffeic acid with ether, which yields it somewhat impure by evaporation. (*Ibid.*, January, 1868, 75.) Caffeic acid has the constitution of a dihydroxy-cinnamic acid, and on fusion with potassium hydroxide yields protocatechuic and acetic acids. The *coffee fat*, which ranges in different varieties from 14 to 21 per cent., is, when purified, white, without odor, of a buttery consistence, melting at $37.5^\circ C.$ ($100^\circ F.$), and becomes rancid on exposure. According to Rochleder (*Wien. Akad. Ber.*, xxiv, 40), it contains glycerides of palmitic acid and of an acid of the composition $C_{13}H_{24}O_2$.

The caffeine, according to Payen, is present partly free and partly as a *potassium and caffeine chlorogenate*, but H. Gorter (*Lieb. Annal.*, ccclix, 217, ccclxii, 237), in investigations made upon Liberian coffee, stated that caffeine does not exist free in coffee, but is all combined. The compound is given the following formula: $C_{32}H_{36}C_{19}K_2(C_8H_{10}O_{12}N_4)_2 + 2H_2O$. It decomposes at $225^\circ C.$ ($437^\circ F.$), without melting. The yield is 3.3 per cent. The salt is scarcely decomposed by dry chloroform, but is easily decomposed by the presence of water and then gives up its caffeine. This explains the fact observed by the manufacturers of decaffeinated coffees, that dry coffee yields only a small amount of its caffeine to chloroform, but that the extraction takes place readily and almost completely if the coffee is simultaneously treated with water or steam.

Chlorogenic acid is given the formula, $C_{32}H_{38}O_{19}$, and is a colorless, crystalline compound melting at $206^\circ 0.$ ($402.8^\circ F.$), and with a marked laevorotatory power. It is hydrolized by alkalis into caffeic and quinic acids. When strongly heated it emits an odor of roasted coffee and by some is believed to be the principle to which the flavor of the beverage is to be attributed. It is stated that when acted on by sulphuric acid and manganese dioxide it is converted into quinone, being in this respect analogous to quinic acid. Another acid was found which the author named *caffalic acid*. The coffee also contained citric acid, trigonelline, a pectin and an oxydase.

Julian E. Walter gives the following results of the analyses of several kinds of unroasted coffee: Java, 0.89 per cent. caffeine; Liberian Java, 1.08 per cent. caffeine; Costa Rica, 1.24 per cent. caffeine; Mocha, 0.54 per cent. caffeine; Pea-berry or Fenroll, 0.77 per cent. caffeine; Rio, 1.12 per cent. caffeine. (*Ph. Rec.*, May 5, 1890, 176.) Bertrand (*Bull. des Sci. Pharm.*, iv) gives the following results of studies of the percentage of caffeine in various coffee berries: In *Coffea arabica* the percentage varied from 0.69 to 1.60. Of species other than the (*C. arabica*, *C. canephora* was found to be the richest in alkaloid, the berries yielding 1.97 per cent., while those of the *C. humboldtiana*, Baill., were remarkable by reason of their containing a bitter principle, cafamarin, but no caffeine at all, the berries of *C. mauritiana* contained only 0.07 per cent.

During the roasting process coffee swells to almost double its original volume, losing from 10 to 23 per cent. of its weight (*Ph. Cb.*, 1850, 687), and acquires a new, peculiar odor and a bitter taste. An active empyreumatic oil (*cafféol*, $C_8H_{10}O_2$) is developed during the process, probably at the expense of a portion of the caffeine. Much of the alkaloid, however, escapes change, and a portion of it is volatilized. The excellence of the flavor of roasted coffee depends much upon the manner in which the process is conducted, and the extent to which it is carried. It should be performed in a covered vessel, over a moderate fire, and the grains should be kept in constant motion. When they have acquired a chestnut-brown color, the process should cease. If too long continued, it renders the coffee bitter and acrid, or, by reducing it to charcoal, deprives it entirely of flavor. During a severe roasting the coffee loses a portion of caffeine, which sublimes, while in a slight roasting it loses none; yet 'ordinary coffee for drinking, prepared by percolation, contains rather more caffeine when prepared from strongly roasted than from slightly roasted coffee, because the caffeine is more easily extracted from the former. (Herman Aubert. See *A. J. P.*, 1873, 121.) Paul and Cownley found in preparing "low and medium roasted" coffee no perceptible loss of alkaloid, while in "over-roasted" coffee the loss amounted to one-third. The average of caffeine in roasted coffee they fix at 1.3 per cent. (*P. J.*, 1887, 822.) Seissir has devised a method for removing the caffeine from coffee. About 5 kilos of unroasted coffee berries are placed in a closed centrifugal drum which is surrounded by a hot-water jacket. After the addition of about 15 kilos of ethyl acetate, the drum is set in motion, so that the solvent and berries are thoroughly mixed, the temperature being maintained at 68° C. (154.4° F.). At the end of three hours the solvent is drawn off, and replaced by a further quantity of about 10 kilos, and the mixing and extraction are continued for a further two hours. The ethyl acetate is then run off, the berries are heated to 100° C. (212° F.) to remove the last traces of solvent, and finally dried at 40° to 46° C. (104°-114.9° F), the drum being rotated meanwhile. The ethyl acetate may be recovered by distillation, and the caffeine separated from the residue. The method is the subject of a French patent. (*Journ. Soc. Chem. Ind.*, 1909, 622.)

The *leaves* of the coffee plant possess properties analogous to those of the fruit, and are extensively used by the Malays. Stenhouse found them to contain caffeine in larger proportion than the coffee bean, and also caffeic acid. The leaves are prepared for use by drying over a clear fire and then powdering by rubbing in the hands. The powder is made into an infusion like common tea. The taste is like that of tea and

coffee combined. (*P. J.*, xii, 443; xiii, 207 and 382, and xvi, 1067.)

The effects of coffee are due chiefly, if not solely, to the caffeine which it contains. Some writers, however, believe that the volatile oil, *cafféol* (*cafféone*) possesses stimulating properties. The evidence of this point, however, is so contradictory as to render conclusions impossible. (See Reichert, *M. News*, 1890, Ivi; Erdmann, *A. E. P. P.*, 1902, xlvi; Geiser, *A. E. P. P.*, liii, p. 112.)

As a medicine coffee has been almost entirely replaced by the alkaloid caffeine. The infusion is, however, sometimes administered by rectal injection in cases of narcotic poisoning. The disturbances of digestion which follow excessive coffee drinking are not considered by J. Burmann to be due to caffeine, but to a volatile toxic substance formed during roasting and only partly volatilized, named *cafféotoxin*, which can be eliminated by subjecting roasted coffee to successive treatments with steam under pressure of several atmospheres (*J. P. C.*, 1913, 8, 281.)

Syrup of coffee of the N. F. III was prepared by pouring 500 mls [or 16 fluidounces] of boiling water upon 250 Gm. [or 8 oz. troy] of roasted coffee, in moderately coarse powder, covering and boiling for five minutes, then straining and adding water through the strainer to make 500 mls [or 1 pint]. Then 800 Gm. [or 24 oz. troy] of sugar is dissolved in the strained liquid, by agitation without heat, and enough water added to make 1000 mls [or 2 pints]. Two tablespoonfuls of this syrup may be added to a cup of hot water or milk. It is also used with carbonic acid water.

COLCHICI CORMUS. U. S., Br.

COLCHICUM CORM Colch. Conn. [Colchici Radix, U. S. 1890, Colchicum Root]

"The dried corm of *Colchicum autumnale* Linne (Fam. *Liliaceae*), yielding not less than 0.35 per cent. of colchicine." *U. S.* "Colchicum Corm is the fresh corm of *Colchicum autumnale*, Linn., collected in early summer; or the same deprived of its coats, sliced transversely, and dried at a temperature not exceeding 65° C. (149° F)." *Br.*

Bulbus s. Tuber Colchici; Meadow-Saffron Root; Bulbe de Colchique, *Fr. Cod.*; Bulbe de Colchique, de Safran batard. *Fr.*; Zeitlosenknollen, *G.*; Bulbo di colchico, *It.*; Bulbo de colquico, *Sp.*

COLCHICI SEMEN. U. S. (Br.)

COLCHICUM SEED Colch. Sem. [Colchid Semen P. I.]

"The dried seeds of *Colchicum autumnale* Linne (Fam. *Liliaceae*), yielding not less than 0.45 per cent. of colchicine." *U. S.* "Colchicum

Seeds are the dried ripe seeds of *Colchicum autumnale*, Linn." *Br.*

Colchici Semina, *Br.*; Colchicum Seeds; Semences de Colchique, *Fr. Cod.*; Semence de Colchique, *Fr.*; Semen Colchici, *P. G.*; Zeitlosensamen, *G.*; Semi di colchico, *It.*; Semilla de oolquico, *Sp.*

Colchicum autumnale, often called *meadow saffron*, is a perennial bulbous plant, the leaves of which appear in spring, and the flowers in autumn. Its manner of growth is peculiar, and deserves notice as connected in some measure with its medicinal efficacy. In the latter part of summer, a new bulb, or *corm*, as the part is now called, begins to form at the lateral inferior portion of the old one, which receives the young offshoot in its bosom and embraces it half round. The new plant sends out roots from its base, and is furnished with a radical spathe, which is cylindrical, tubular, cloven at top on one side, and half under ground. In September, from two to six flowers, of a lilac or pale-purple color, emerge from the spathe, unaccompanied by leaves. The corolla consists of a tube from 10 to 12 cm. long, concealed for two-thirds of its length in the ground, and of a limb divided into six segments. The flowers perish by the end of October, and the rudiments of the fruit remain under ground until the following spring, when they rise upon a stem above the surface, in the form of a three-lobed three-celled capsule. The leaves of the new plant appear at the same time, so that in fact they follow the flower instead of preceding it, as might be inferred from the order of the seasons in which they respectively show themselves. The leaves are radical, spear-shaped, erect, numerous, about 12 cm. long, and 2.5 cm. broad at the base. In the meantime, the new corm has been increasing at the expense of the old one, which, having performed its appointed office, perishes; while the former, after attaining its full growth, sends forth shoots, and in its turn decays. The old corm in its second spring, and a little before it perishes, sometimes puts forth one or more small corms, which are the sources of new plants. The usual method of propagating colchicum is by planting the bulbs about August or September in deep rich soil, about 2 or 3 inches below the surface and about 3 inches apart in the row. (*D. C.*, 1912, p. 134.)

C. autumnale is a native of the temperate parts of Europe and of Northern Africa, growing in moist pastures and meadows. Attempts have been made to introduce its culture into this country, but with no great success, though small quantities of the corm, of apparently good quality, have entered commerce. The flowers possess virtues similar to those of the corm and are recognized by the French Codex.

COLCHICI CORMUS.—The medicinal virtue of the corm depends much upon the season at which it is collected. Early in the spring it is too young to have fully developed its peculiar properties, and late in the fall it has become exhausted by the nourishment afforded to the new plant. The proper period for its collection is from the early part of June, when it has usually attained perfection, to the middle of August, when the offset appears. It may be owing, in part, to this inequality at different seasons that entirely opposite reports have been given of its powers. Krapf ate whole corms without inconvenience; Haller found them entirely void of taste and acrimony, and we are told that in Carniola the peasants use them as food with impunity in the autumn. On the other hand, there can be no doubt of its highly irritating and poisonous nature, when fully developed, under ordinary circumstances. Perhaps soil and climate may have some influence in modifying its character.

Christison found the roots collected in April to be more bitter than those gathered in July, and conjectures that the (longer) opinion of their superior efficacy at the latter season may not be well founded. Sehroff states, as the result of his observation, that the autumnal root is much stronger than that dug in the summer. (See *A J. P.*, xxix, 324.)

The corm is often used in the fresh state in the countries where it grows, as it is apt to be injured in drying, unless the process is carefully conducted. The usual plan is to cut the corm, as soon as possible after it has been dug up, into thin transverse slices, which are spread out separately upon paper or perforated trays and dried with a moderate heat. The reason for drying it quickly after removal from the ground is that it otherwise begins to vegetate, and a change in its chemical nature takes place; and such is its retentiveness of life that, if not cut in slices, it is liable to undergo a partial vegetation even during the drying process. Houlton recommends that the corm be stripped of its dry coating, carefully deprived of the bud or young bulb, and then dried whole. It is owing to the high vitality of the bud that the corm is so apt to vegetate. During desiccation there is great loss of weight, 70 per cent. being the average for a number of years in the laboratory of Alien & Hanburys, in London.

The recent bulb or corm of *C. autumnale* resembles that of the tulip in shape and size, and is covered with a brown membranous coat. Internally it is solid, white and fleshy, and, when cut transversely,

yields, if mature, an acrid milky juice. There is often a small lateral projection from its base, which is the bud for the development of a new plant; this bud is frequently broken off in drying. When dried, and deprived of its external membranous covering, the corm is of an ash-brown color, convex on one side, and somewhat flattened on the other, where it is marked by a deep groove extending from the base to the summit. As found in commerce, it is always in the dried state, sometimes in segments made by vertical sections of the bulb, but generally in transverse circular slices. The U. S. Pharmacopoeia describes the corm as follows: "Usually in reniform, transverse or in ovate, longitudinal slices; from 2 to 5 mm. in thickness; flat surfaces whitish, slightly roughened, and of a crystalline appearance under a hand lens; epidermis thin, light brown and finely wrinkled; fracture short and mealy, odor slight; taste bitter and somewhat acrid. The powder is light brown or grayish-brown; starch grains numerous, single or 2- to 6-compound, the individual grains varying from spherical or ovoid to polygonal, and marked with a triangular or star-shaped, central cleft, the grains being from 0.003 to 0.03 mm. in diameter; tracheae few and with spiral or scalariform thickenings; occasional fragments of epidermal cells with thin, reddish-brown walls. Colchicum Corm yields not more than 6 per cent. of ash.

“Assay.—Proceed as directed under *Colchici Semen*, using 15 Gm. of Colchicum Corm." U.S.

"Fresh corm about thirty-five millimetres long and twenty-five millimetres broad, somewhat conical, hollowed on one side where a new corm is in process of development, and rounded on the other; covered with a thin brown membranous outer coat, and an inner reddish-yellow one; internally white and solid, and when cut yielding a whitish, turbid juice of a disagreeable odor and bitter taste. Dried slices two or three millimetres thick, yellowish at their circumference, somewhat reniform in outline; firm, whitish, amylaceous; breaking readily with a short fracture. No odor; taste bitter." *Br.*

The cut surface is white and of an amylaceous aspect. Examined with the microscope, the corm is seen to be composed of large irregular cells, full of ovoid, angular, sometimes compound, starch grains, and interspersed with spiral vessels in vascular bundles. The odor of the recent corm is said to be hircine. It is diminished, but not lost, by drying. The taste is bitter, hot, and acrid.

Colchicum corm contains the alkaloid *colchicine*, $C_{22}H_{25}NO_6$, which was made official in the U. S. P.; see *Colchicina*. Colchicine is the active principle and as much as 0.4 per cent. is found in good specimens of the corm; the official requirement is that not less than 0.35 per cent. shall be present, to be determined by assay. See *Assay for Colchicum Seed*, p. 371.

A. T. Thompson states that the milky juice of fresh colchicum produces a fine blue color if rubbed with the tincture of guaiac, and that the same effect is obtained from an acetic solution of the dried corm. He considered the appearance of this color, when the slices were rubbed with a little distilled vinegar and tincture of guaiac, a proof that the drug was good and had been well dried. J. M. MacLagan has shown that this change of color is produced with the albumen, which is not affected if previously coagulated; so that the value of the test consists simply in proving that the drying has not been effected at a heat above $82.3^{\circ} C.$ ($180^{\circ} F.$), or the temperature at which albumen coagulates. It is probable that this color reaction is not due to the albumen itself, but to an oxidizing enzyme or oxydase which would be susceptible to the same decomposing influences as albumen. A very deep or large notch in the circumference of the slices is an unfavorable sign, as it indicates that the bulb has been somewhat exhausted in the nourishment of the offset. The decoction yields a deep blue precipitate with solution of iodine, white precipitates with lead acetate and subacetate, mercurous nitrate, and silver nitrate, and a slight precipitate with tincture of galls. The value of colchicum is best tested by its bitterness. For method of assaying colchicum, by K. Schwickerath, see *Ph. Rund.*, 1893, 282. Important improvements have been made in the assay by Bredemann. (*Ap. Ztg.*, 1903, 18, Nos. 93, 94, 95.)

COLCHICI SEMEN.—The seeds of the meadow-saffron ripen in summer, and should be collected about the end of July or beginning of August. They never arrive at maturity in plants cultivated in a dry soil or in confined gardens. (Williams.) They are officially described as follows: "Ovoid or irregularly globular, more or less pointed at the hilum; from 2 to 3 mm. in diameter; when fresh, several seeds cohering, externally dark brown, finely pitted; tough and of almost bony hardness; internally whitish or light brown; nearly inodorous; taste bitter and somewhat acrid. Under the microscope, transverse sections of Colchicum seed show a seed-coat of a few more or less collapsed cells

with thin reddish-brown walls; an endosperm, making up most of the seed, consisting of cells with rather thick, porous walls, the lumina containing oil globules and aleurone grains, the latter being from 0.003 to 0.015 mm. in diameter; a small embryo, the beaked portion, or caruncle, containing numerous, somewhat ovoid, ellipsoidal or polygonal starch grains, from 0.005 to 0.016 mm. in diameter. Colchicum Seed yields not more than 8 per cent. of ash." *U. S.*

"About two and a half millimetres in diameter, subglobular, slightly pointed at the hilum, rough and of a dull reddish-brown color, minutely pitted, very hard and tough. Endosperm oily; its cells with thickened walls and large pits. No odor; taste bitter and acrid." *Br.*

They are chiefly composed of a gray horny endosperm constituted of very thick-walled cells, and surrounded by a closely adherent testa. The leafless embryo is very small, and is situated close to the surface opposite the strophiole. Williams, of Ipswich, England, first brought them into notice in 1820 as superior to the corm. Schroff, however, has found that their activity is inferior to that of the dried corm dug in autumn. (*A. J. P.*, xxix, 324.) A fluid-extract and tincture of the seeds are directed in the U. S. Pharmacopoeia. Their dose is slightly less than that of the similar preparations made from the corm. The seeds and powder are very seldom adulterated. Judd, however, reports examining a powder which contained fully 50 per cent. of powdered foenugreek seed. (*Bull. A. Ph. A.*, 1909, p. 193.)

The U. S. Pharmacopoeia IX directs that colchicum seed should contain not less than 0.45 per cent. of colchicine, to be determined by the following process:

Assay of Colchicum Seed.—"Introduce 15 Gm. of Colchicum Seed, in No. 60 powder, into a 500 mil flask, and add 10 mils of solution of lead subacetate and 290 mils of distilled water. Weigh the flask and contents, and digest the mixture at from 60° to 70° C. (140°-158° F.) for three hours, with occasional agitation. Cool, add distilled water to restore the original weight and filter off 200 mils. Add 0.75 Gm. of sodium phosphate to the clear filtrate, shake the mixture frequently during half an hour, and filter off 100 mils representing" 5 Gm. of Colchicum Seed. Shake out the alkaloid from the filtrate with chloroform until completely extracted, as shown by testing with iodine T.S. (in place of the usual mercuric potassium iodide T.S.), and evaporate the chloroform solution;

add about 1 mil of alcohol and again evaporate. Repeat this operation once more and dry the residue to constant weight at 100° C. (212° F.). To this weighed residue contained in a flask add 5 mils of tenth-normal sulphuric acid V.S. and 5 mils of distilled water and heat the mixture for ten minutes at 70° C. (158° F.). Now filter the liquid through a pledget of purified cotton, wash the flask and cotton with distilled water, reject the filtrate and washings and remove as much of the water from the cotton as possible. Dissolve any insoluble residue that may remain on the cotton by washing it first with a little alcohol and then with ether; collect the alcohol-ether washings in the flask, evaporate, and dry the residue to constant weight at 100° C. (212° F.). Deduct this weight from the weight of residue previously obtained. The difference will be the weight of colchicine obtained from 5 Gm. of Colchicum Seed (see Proximate Assays, Part III)." *U.S.*

Uses.—The investigations into the physiological action of Colchicum have not as yet yielded a very clear explanation of its therapeutic effects. Dixon and Maiden (*J. P.*, 1908, xxxviii, p. 50) have found that it is an active stimulant to the unstriated muscle, increasing intestinal and uterine contractions and bronchial tonus. After large doses it depresses the vasomotor system, causing a marked fall in the blood pressure. When injected subcutaneously in somewhat smaller doses it produces a transient decrease in the number of leukocytes followed after twenty-four hours by an enormous increase, the alterations being especially notable in the number of polymorphonuclear corpuscles. These effects appear to be the result of an action upon the bone marrow. Jackson and Blackfan (*J. A. M. A.*, 1906, xlvii) find an increased output of uric acid under its influence, but they believe this is due rather to an increased formation than a more active elimination, but Denis (*J. P. Ex. T.*, 1915, vii, 609) was unable to detect any change in the amount of uric acid either in the urine or blood.

The poisonous properties of colchicum were known to the ancients, but, while it is generally supposed that the hermodactyls were derived from some species of the genus, the use of meadow-saffron cannot be certainly traced back further than the sixteenth century. Although it has from time to time been recommended for various complaints, it is used to-day only in the treatment of *gout*. There is considerable clinical evidence that full doses of colchicum administered during the acute attack of a *podagra* will often abort it. The treatment, however, is not

without serious danger-and most clinicians urge caution in the use of colchicum during the attack. It appears also to be of service in those more chronic conditions of disturbed metabolism known variously as uric acid diathesis or *lithemia*.

In preparing colchicum pharmaceutically, if it be desired to retain the colchicine unchanged, both acids and alkalies should be avoided and as far as possible also heat. As pointed out below, under various conditions colchicine may be decomposed into colchiceine, colchicinic acid, and various allied products. Whether these derivatives of colchicine possess the therapeutic virtues of the natural alkaloid is uncertain, but Fuehner (*A. E. P. P.*, 1913, lxxii, p. 228) has shown that colchiceine is very much less toxic than colchicine.

When taken internally in therapeutic dose, colchicum usually produces no other symptoms than intestinal pains and looseness of the bowels. In some rare cases it is said to give rise to copious diuresis or diaphoresis instead of purging. When larger amounts are exhibited, the purging is more pronounced, and there may be also vomiting. With these symptoms there may be some depression, which seems to be due to the gastro-intestinal irritation rather than to the direct action of the poison. In an overdose, it may produce dangerous and even fatal effects. Excessive nausea and vomiting, abdominal pains, purging and tenesmus, great thirst, sinking of the pulse, coldness of the extremities, and general prostration, with occasional symptoms of nervous derangement, such as headache, delirium, and stupor, are among the results of its poisonous action. A peculiarity of its influence is that when its dose is increased beyond a certain point there is not a corresponding increase in the rapidity of the fatal issue. Tills is probably because it kills not by a direct influence upon the heart or the nervous system, but by causing gastro-enteritis. On post-mortem examination the alimentary mucous membrane is found much inflamed.

Dose, of the dried corm and seed, from two to eight grains (0.13-0.52 Gm.), which may be repeated every four or six hours until its effects are obtained.

Off. Prep.—*Colchicum corm.*—Extractum Colchici Cormi, *U. S. (Br.)*; Vinum Colchici, *Br.*; Fluidextractum Colchici Cormi, *N. F.*; Vinum Colchici Cormi, *N. F.*

Off. Prep.—*Colchicum seed*.—Fluidextractum Colchici Seminis, U. S.; Tinctura Colchici Seminis, U. S. (Br.); Vinum Colchici Seminis (from Fluidextract), N. F.

Collinsonia. *Collinsonia canadensis* L. *Horse-weed. Horse-balm. Richweed. Heal-all. Stone-root. Knot-root. Knot-weed. Guerit-tout, Baume de Cheval*, Fr. *Collinsonie*, G.—A labiate plant, which grows in woods from Canada to the Carolinas* The whole plant has a strong disagreeable odor, and a warm pungent taste. C. N. Lochman (*A. J. P.*, 1885, 228) found in the root a resin, tannin, starch, mucilage, and wax; in the leaves resin, tannin, wax, and volatile oil. The alkaloid discovered by H. J. Lohmann in the root of the *Collinsonia canadensis* appears to have been a magnesium salt. (See D. C., 1902.) *Collinsonia* is tonic, astringent, diaphoretic, and diuretic. It is said to be locally irritant. A decoction of the fresh root has been used in *catarrh of the bladder, leucorrhoea, gravel, and dropsy*.

COLOCYNTHIS. U. S. (Br.)

COLOCYNTH Colocyn. [Bitter Apple, Colocynth Apple]

"The dried pulp of the fruit of *Citrullus Colocynthis* (Linne) Schrader (Fam. Cucurbitacea), without the presence or admixture of more than 5 per cent. of seeds or more than 2 per cent. of epicarp." U. S. "Colocynth Pulp is the dried pulp of the fruit of *Citrullus Colocynthis*, Schrad., freed from seeds." Br.

Colocynthidis Pulpa, Br., Colocynth Pulp, Bitter Gourd, Apple, or Cucumber, Poma Colocynthidia; Coloquinte, Fr. *Cod.*; Puipe de Coloquinte, Fr.; Fructua Colocynthidis, P. G.; Coloquintenapfel, Koloquintenmark, Koloquinten, G.; Coloquintide, It.: Coloquintida. Sp.

Colocynth is another one of those drugs which has given a great amount of trouble to manufacturers because the definition of the U. S. Pharmacopoeia, in previous revisions, simply stated that it was the "peeled dried fruit." Notwithstanding the fact that at the end of the description there was a statement that "the seeds should be separated and rejected" the powdered drug consisted frequently of the seeds as well as pulp. In order to avoid any misunderstanding the U. S. Pharmacopoeia has followed the British authority and defined Colocynth as the dried pulp. As it is not commercially possible to exclude the seeds entirely, a few being imbedded in the pulp itself, the

Pharmacopoeia wisely allows a minimum of 5 per cent. of seeds. It is estimated that every 100 pounds of colocynth fruit will yield 30 pounds of pulp and about 70 pounds of seeds. Tunmann (*Suedd. Apoth. Zeit.*, 1907, p. 503) states that the seeds do not contain medicinally active constituents. Francis (*Proc. A. Ph. A.*, 1906, p. 336), on the other hand, says that if the seeds are first deprived of their fixed oil with benzin, dried and then extracted with 75 per cent. alcohol, the extract is almost as active as the U. S. P. product.

Citrullus Colocynthis, or *bitter cucumber*, is an annual plant, bearing considerable resemblance to the common watermelon. The stems, which are herbaceous and beset with rough hairs, trail upon the ground, or rise upon neighboring bodies, to which they attach themselves by their numerous tendrils. The leaves, which stand alternately on long petioles, are triangular, many-cleft, variously sinuated; obtuse, hairy, of a fine green color on the upper surface, rough and pale on the under. The flowers are yellow, and appear singly at the axils of the leaves. The fruit is a globular pepo, of the size of a small orange, yellow and smooth when ripe, and contains, within a hard, coriaceous rind, a white, spongy pulp, enclosing numerous ovate, compressed, white or brownish seeds.

The plant is a native of Turkey, and abounds in the islands of the Archipelago. It grows also in various parts of Africa and Asia. Burckhardt, in his travels across Nubia, found the country covered with it; Thunberg met with it at the Cape of Good Hope, and Ainslie says that it grows in many parts of Lower India, particularly in sandy places near the sea. It is said to be cultivated in Spain, the island of Cypress, Morocco and in the neighboring countries, and even to have been collected in Japan. Colocynth from the maritime plain between the mountains of Palestine and the Mediterranean is chiefly shipped from Jaffa, and is known as *Turkish Colocynth*. It is said to be of superior quality. The fruit is gathered in autumn, when it begins to become yellow, and, having been peeled, is dried quickly in a stove or in the sunshine. Thus prepared, it is imported from the Levant. Small quantities are said to be imported into England from Mogador in the form of brown, unpeeled globular gourds. The so-called Persian colocynth of the London markets is very small, and has apparently been compressed in a fresh state, so that the position of the seeds is perceptible through the dry pulp. The microscopic structure and the proportion of the pulp to the seed appear to be the same as in other colocynths. (P. J.) xvi, 107.) Colocynth has been grown in New Mexico,

but, according to Sayre, the American colocynth possesses only about two-thirds the cathartic action of the Trieste variety.

Properties.—As found in commerce, colocynth is in whitish, globular berries, from 6 to 7 cm. in diameter, very light and spongy, and abounding in seeds which constitute three-fourths of their weight. The seeds are somewhat 'bitter, but possess little activity, and, according to Captain Lyon, are even used as food in the north of Africa. Nachtigal confirms this statement of Captain Lyon's, but with the qualification that, before being eaten, the seeds are deprived of their coating by some mechanical means, and the kernels are heated to the boiling point, then washed with cold water, dried, and powdered. Fluckiger found a bitter principle in the testa, which accounts for its rejection as food, though rendering improper the rejection of the seed in preparing the extract. He found in the kernels about 45 per cent. of fixed oil and 18 per cent. of albumen. (*A. J. P.*, 1872, 538.) They should be separated and rejected, the pulpy matter only being employed. The U. S. Pharmacopoeia thus describes colocynth; "Fruits, before the removal of the seeds, nearly globular, from 4 to 7 cm. in diameter, usually more or less crushed and in broken pieces, with occasional patches of the nearly smooth epicarp; yellowish-white or brownish; light, spongy; separable longitudinally when entire into three carpels, each containing, near the outer surface, the ovoid, compressed, yellowish seeds; odor slight; taste intensely bitter. The powder is yellowish-white or buff, consisting chiefly of fragments of parenchyma cells and an occasional fragment with tracheae; very few lignified tissues of the seed-coat, showing the characteristic stone cells which are nearly isodiametric, irregular, with either straight or undulate walls that are strongly lignified and possess simple pores; globules of fixed oil and aleurone grains very few. Powdered Colocynth must be made from colocynth pulp containing not more than 5 per cent. of seeds and, upon extraction with purified petroleum benzin, yields not more than 2 per cent. of fixed oil. Colocynth yields not more than 15 per cent. of ash." *U. S.*

"White, spongy, light fragments. The powdered Pulp exhibits abundant debris of large, thin-walled parenchymatous cells but no starch, and not more than an occasional sclerenchymatous cell or group of such cells. No odor; taste intensely bitter. Yields not more than 2 per cent. of fixed oil to *petroleum spirit*. Ash not less than 9 per cent." *Br.*

Barclay considers the estimation of ash in powdered colocynth useful in

proving its freedom from seeds. The pulp yields from 8.6 to 14 per cent. of ash, the seeds from 2 to 4 per cent., the whole apple 4.6 per cent. (*Am. Drug.*, 1896, 152.) Water and alcohol extract the virtues of colocynth. It is a matter of importance to be able to determine whether the drug miller who usually powders colocynth is careful to reject the seeds. If the seeds have been ground with the dried pulp, the microscope will show the presence of numerous albuminous granules derived from the cotyledons. (W. T. dark, *P. J.*, vii, 509.) These are best found by putting a small amount of the powder on the glass slide, adding a drop of water, and gently rubbing the cover glass over it; fragments of the double-walled embryo sac show on the outer side elongated, more or less hexagonal, thin-walled cells, and on the inner side irregular, tabular, thick-walled cells. If powdered colocynth contains a large number of starch granules it has probably been adulterated. Power and Moore (*Tr. Chem. Soc.*, xcvi, p. 99) have separated from colocynth an alkaloidal principle which has a violent purgative effect, but this is not the only active principle of the crude drug, because both ether and chloroform extracts of the resin, when free from the alkaloidal principle, were still purgative. They find also alpha-elaterin, but none of the active beta-elaterin. (See *Elaterinum*.) Vauquelin obtained the bitter principle of colocynth in a separate state, and called it colocynthin. According to Meissner, 100 parts of the dry pulp of colocynth contain 14.4 parts of colocynthin, 10.0 of extractive, 4.2 of fixed oil, 13.2 of a resinous substance insoluble in ether, 9.5 of gum, 3.0 of pectic acid (pectin), 17.6 of gummy extract derived from the lignin by means of potassium hydroxide, 2.7 of calcium phosphate, 3.0 of magnesium phosphate, and 19.0 of lignin, besides water. Walz supposed that he had found another peculiar principle, colocynthitin. It was obtained by treating with ether the alcoholic extract previously exhausted by water, decolorizing the ethereal solution with animal charcoal, evaporating to dryness, and dissolving the residue in anhydrous alcohol, which deposited it in crystals on spontaneous evaporation. It is white and tasteless, and is probably a resin. (*N. Jahrbuch der Pharm.*, xvi, 10.) Colocynthin is obtained by boiling the pulp in water, evaporating the decoction, treating the extract thus procured with alcohol, evaporating the alcoholic solution, and submitting the residue, which consists of the bitter principle and potassium acetate, to the action of a little cold water, which dissolves the latter and leaves the greater part of the former untouched. Bastick obtained it by exhausting the pulp with cold water, heating the solution to ebullition, adding lead subacetate so long as a precipitate was produced, filtering the liquor when cold, adding diluted

sulphuric acid gradually until it no longer occasioned a precipitate, boiling to expel free acetic acid, filtering to separate lead sulphate, evaporating cautiously nearly to dryness, extracting the colocynthin from the residue by strong alcohol, which left the salts, and finally evaporating the alcoholic solution.

The following process, employed by Walz, yields it in a purer state. Colocynthin is exhausted by alcohol of sp. gr. 0.84, the tincture evaporated to dryness, the residue treated with water, and the solution precipitated first with lead acetate and afterwards with lead subacetate. The yellow filtered liquor is then treated with hydrogen sulphide to separate the lead, and, after filtration, with solution of tannic acid, which throws down a compound of tannic acid and colocynthin. This is dissolved in alcohol, the tannin thrown down by lead subacetate, the excess of lead separated, and the liquid digested with animal charcoal, filtered, and evaporated. The residue, washed with anhydrous ether, is pure colocynthin. This is yellowish, somewhat translucent, brittle and friable, fusible by a heat below 100° C. (212° F.), inflammable, more soluble in alcohol than in water, but capable of rendering the latter intensely bitter. Mouchon states that it is insoluble in ether. It is neither acid nor alkaline; but its aqueous solution gives with infusion of galls a copious white precipitate. Ahrends (*Neue Arzneimittel*, 1909) gives the synonym of this principle as *citrullin* and gives the formula as $C_{56}H_{84}O_{23}$. Its formula, according to Walz, is $C_{56}H_{42}O_{23}$. Upon the same authority it is a glucoside, being resolved by the action of sulphuric acid into sugar and a peculiar resinous substance termed *colocynthein*, to which he gives the formula $C_{44}H_{32}O_{13}$. Henke doubts the probability of colocynthin being a glucoside, and states that it is uncrystallizable; he reviews the methods of previous investigators, and obtained by his own process but 0.66 per cent. of colocynthin. (*A. Pharm.*, 1883, p. 200; *A. J. P.*, 1883, p. 301.) According to Johannson, colocynthin, when heated with diluted sulphuric acid, yields colocynthein, elaterin, and bryonin. (*A. J. P.*, 1885, p. 451.) An infusion of colocynth, made with boiling water, gelatinizes upon cooling. Neumann obtained from 768 parts of the pulp, treated first with alcohol and then with water, 168 parts of alcoholic and 216 of aqueous extract. (See also paper by George Wagner, *Proc. A. Ph. A.*, 1893, 179.)

Uses.—The pulp of coloeynth is a powerful drastic, hydragogue cathartic, producing, when given in large doses, violent griping, and

sometimes bloody discharges, with dangerous inflammation of the bowels. Death has resulted from a teaspoonful and a half of the powder. (Christison.) Even in moderate doses it sometimes acts with much harshness, and it is therefore seldom prescribed alone. By some writers it is said to be diuretic. It was frequently employed by the ancient Greeks and the Arabians, though its drastic nature was not unknown to them. Among the moderns it is occasionally used in obstinate dropsy, and in various affections depending on disordered action of the brain. In combination with other cathartics it loses much of its violence, but retains its purgative energy, and in this form is extensively employed. The compound extract of colocynth is a favorite preparation with many practitioners, and, combined with calomel, extract of jalap, and gamboge, it forms a highly efficient and safe cathartic, especially useful in congestion of the portal circle and torpidity of the liver. (See *Pilules Catharticae Composite*.) It is best administered in minute division, effected by trituration with gum or farinaceous matter. The active principle has sometimes been employed, and, in the impure state in which it is prepared by the process of Emile Mouchon, may be given in the dose of a grain (0.065 Gm.).

Thunberg states that the fruit of *C. Colocynthis*, at the Cape of Good Hope, is rendered so mild by being properly pickled that it is eaten both by the natives and by the colonists; but, as it is thus employed before attaining perfect maturity, it is possible that the drastic principle may not have been developed.

Dose, one to five grains (0.065-0.32 Gm.).

Off. Prep.—*Extractum Colocynthis*, U. S.; *Extractum Colocynthis Compositum* (from Extract), U. S., Br.; *Pilula Colocynthis Composita*, Br.; *Pilula Colocynthis et Hyoscyami* (from Compound Pill), Br., (from Extract), N. F.; *Pilulee Antidyspepticas* (from Compound Extract), N. F.; *Pilulse Cathartics' Vegetabiles* (from Compound Extract), N. F.; *Pilulse Colocynthis Composite* (from Extract), N. F.; *Pilulae Colocynthis et Podophylli* (from Compound Extract), N. F.; *Pilulse Laxativae Post Partum* (from Compound Extract), N. F.

Coltsfoot. N. F. IV. *Farfara. Coltsfoot Leaves. Tussilago Leaves. Folio, Farfarae, P. G. Tussilage, Pas d'ane, Fr. Huflattig, Rosshuf, G.*—"The dried leaves of *Tussilago Farfara*, Linne (Fam. *Compositae*), without the presence of more than 5 per cent. of other parts of the plant or other foreign matter." N. F. Coltsfoot is a low perennial herb, indigenous to Europe and growing in wet places from Quebec to Pennsylvania

and westward to Minnesota. It possesses a horizontal rhizome from which, early in the spring, arise several leafless, erect, simple, unifloral scapes or flower-stems and bearing appressed scale-like bracts of a brownish-pink color. The flower, which stands singly at the end of the scape, is large, yellow, compound. The leaves do not make their appearance until after the flowers. The flowers have an agreeable odor, which they retain after desiccation. The dried root and leaves are inodorous, but have a rough, bitterish, mucilaginous taste.

The leaves are described as "petioles long, pubescent; blades very brittle, nearly orbicular or broadly ovate-reniform, from 8 to 15 cm. in length and nearly as broad, deeply cordate at the base, angulately lobed and dentate with red-brown teeth, palmately five- to nine-veined; young leaves white floccose all over, the older leaves with upper surfaces dark green and nearly smooth, the younger densely white floccose. Odor indistinct; taste mucilaginous, faintly herbaceous, bitter. The powder, when examined under the microscope, exhibits numerous multicellular, non-branching hairs, usually curved and twisted together, the lower cells about 0.035 mm. in width, the terminal cells much elongated, about 0.012 mm. in width and at times with spiral bands; broadly elliptical stomata about 0.05 mm. in length and associated with finely striated epidermal cells, the latter having wavy vertical walls; non-porous sclerenchymatous fibers few with walls from 0.006 to 0.01 mm. in thickness; parenchyma cells containing chloroplastids; tracheae few, spiral, annular or with simple pores. Coltsfoot yields not more than 20 per cent. of ash." *N. F.* Boiling water extracts their virtues. C. S. Bondurant (*A. J. P.*, 1887, 340) examined coltsfoot chemically. He found evidences of a bitter glucoside. Klobb isolated two phytosterols from coltsfoot flowers. (*P. J.*, 1909, 999.) Coltsfoot exercises little sensible influence upon the human system. It is, however, demulcent, and is sometimes used in *chronic coughs, consumption* and other *affections of the lungs*. The expectorant properties which it was formerly thought to possess are not obvious. The leaves were smoked by the ancients in *pulmonary complaints*, and in Germany they are said to be substituted for tobacco. In the *N. F.* they are used in a pectoral tea. Cullen used the fresh juice in scrofula, several ounces daily. Dose, of the dried leaves, one to two drachms (3.9-7.5 Gm.), which may be conveniently given in decoction.

Colubrina.—*Mabee bark*, yielded by the *Ceanothus reclinatus* L'Herit. (*Colubrina reclinata*, Brongn.) (Fam. *Rhamnaceae*) of South America, has been analyzed by Elborne and Wilson, who find in it a glucoside. It is used in the West Indies as a stomachic. (See *P. J.*, April 11, 1885.)

Colutea. *Colutea arborescens* L. *Bladder Senna*. *Baguenaudier*, *Sene Indigene*, Fr. *Falsche Senna*, G.—A leguminous shrub growing spontaneously in the southern and eastern parts of Europe, and cultivated in gardens. The leaflets are purgative, and in some parts of Europe are used as a substitute for senna, which is said to be sometimes adulterated with them. Barbey (*P. J.*; 1895, 261) isolated *coluteic acid*, which occurs in white crystals, insoluble in water, soluble in alcohol, chloroform, and carbon disulphide. Bladder senna is comparatively very feeble. It is administered in infusion or decoction, of which the *dose* is about half a pint, containing the virtues of from one to three ounces of the leaves.

Combretum. *Jungle-weed.*—The roasted leaves and stalks of the *Combretum sundaicum* (Miquel) have been used in China in the treatment of the *opium habit*. Harrison (*P. J.*, lxxx, 52) was unable to find any alkaloid or glucoside in the plant, and Stanislaus (*J. A. Ph. A.*, 1912) confirmed the absence of active principle, but found a considerable proportion of tannic acid. The method of taking is as follows: Fifty Gm. of the dried herb is macerated with 4 liters of water, the filtrate evaporated to 1 liter. To one-half of this is added the accustomed daily dose of opium. Of this mixture the patient is given one fluidounce (30 mls) every three or four hours, the equivalent amount of combretum decoction being added after each dose is removed.

Heffner has reported favorably upon its use, but H. C. Wood, Jr., (*J. A. Ph. A.*, 1912), was unable to note any beneficial action from it which might not be justly ascribed to the tannic acid which it contains.

The *Combretum Raimbaultii* is a shrub native to West Africa, where it is known under the name of *Kinkelibah* and is used by the natives in the treatment of *black-water fever* and was introduced a number of years ago into Europe by a missionary, Father Raimbault. Dammermann has reported favorably on its value in this condition (*D. M. W.*, 1906, p. 921), but Heckel was unable to find any active constituent except a tannin. (*Jahresber, d. Pharm.*, 1891, p. 64.) Other species of the combretum appear also to have been used for the same purpose, notably the *C. Altum* Guill. et Perr. (*C. micranthum*, G. Don).

Commelina. *Day-flower.*—Under the name of *Yerba del Pollo*, *Commelina tuberosa* L. is said to be very largely used. in Mexico in the treatment of internal hemorrhage, especially from the womb. From thirty to sixty grains (2.0-3.9 Gm.) of the extract may be taken in the course of one day. (See *A. J. P.*, 1897, 290.) The North American species, *Commelina communis* L., has also had hemostatic properties attributed to it. For chemical and microscopical study, see *A. J. P.*, July, 1898.

Commiphora. *Commiphora Berryi* Engl. (Fam. *Burseraceae*.) Mulzi Kilivary.—This Indian thorn yields a gum resin in abundance. (*P. J.*, Aug., 1899.)

Comptonia. *Myrica asplenifolia*. (*Comptonia peregrina* L., Coulter). *Sweet Fern. Ferngale. Meadow-fern.* (Fam. *Myricaceae*.)—A shrubby indigenous plant, named from the resemblance of its leaves to the spleenwort fern. It grows in sterile soil, from Nova Scotia to North Carolina and Michigan. All parts of it possess a resinous, spicy odor. R. T. Chiles has found in it tannic and gallic acids, volatile oil, extractive, gum, resin, and a substance resembling saponin. (*A. J. P.*, xlv, 306.) H. K. Bowman found it to contain 8.20 per cent. of tannin. (*A. J. P.*, 1869, 193.) It is said to be tonic and astringent; its decoction is used in diarrhea.

Condurango. *N. F. IV. Cundurango. Cortex Condurango*, P. G.—This drug some years ago attracted a great deal of attention as a reputed remedy in *cancerous disease*, but further experience has demonstrated its uselessness. It appears, however, to be used largely in South America as an alterative in *chronic syphilis*, has

been recognized by the German Pharmacopoeia, and so merits a brief notice here. According to an official investigation (*A Report on the Origin and Therapeutic Properties of Cundurango*, by Ruschenberger, Washington, 1873) made by Passed Assistant Surgeon Joseph G. Ayers, U. S. N., there are at least ten different plants known in the republic of Colombia as condurango. The variety which has been used in cancer, and which may be considered as genuine *condurango*, is the *condurango blanco*, the product of an asclepiadaceous vine from ten to thirty feet in length and from one to two inches in diameter. The plant is the *Marsdenia Condurango* of G. H. Reichenbach. The bark is prepared by pounding the stem with a mallet, to separate it, and then drying it in the sun. In the N. F. it is described as "the dried bark of *Marsdenia Condurango* (Triana) Reichenbach films (Fam. *Asclepiadaceae*). In quills or transversely curved pieces, usually from 4 to 13.5 cm. in length; bark 1 to 6 mm. in thickness; outer surface light gray-ish-brown to dark brown, nearly smooth and with numerous lenticels, or more or less scaly and considerably roughened; the scales soft, occasionally with brownish-black apothecia of a fungus; inner surface grayish-white or light brown, longitudinally striate; fracture short-fibrous and granular. Odor slightly aromatic, especially marked in the fresh drug; taste bitter and aromatic. Under the microscope, sections of Condurango show a corky layer consisting of several rows of thin-walled cells, frequently with yellowish-brown contents; a layer of phelloderm of eight to ten rows of cells, containing starch grains and membrane crystals of calcium oxalate, the latter in prisms, from 0.01 to 0.035 mm. in length; a primary cortex of collenchyma containing chloroplastids, starch grains, or rosette aggregates of calcium oxalate, from 0.015 to 0.04 mm. in diameter; a

pericycle or pericambium of tangentially elongated parenchyma cells, with groups of bast fibers and laticiferous vessels in an interrupted circle; middle bark with large groups of stone cells varying from nearly isodiametric to elongated, sometimes very irregular in form; inner bark with medullary rays one or two cells in width, numerous lactiferous cells accompanied by small groups of sieve cells, parenchyma containing either starch grains or rosette aggregates of calcium oxalate, and an occasional isolated bast fiber or small group of stone cells. The powder is light yellowish-brown, consisting chiefly of groups of stone cells and parenchyma containing calcium oxalate crystals and starch grains; stone cells chiefly in large groups, the individual cells being more or less irregular in shape and with very thick porous walls, the lumina being usually filled with air; calcium oxalate chiefly in rosette aggregates, occasionally in single prisms, mostly from 0.015 to 0.02 mm. in diameter; starch grains mostly simple, frequently two- to four-compound, the individual grains being from 0.003 to 0.015 mm. in diameter; bast fibers non-lignified; very long and from 0.01 to 0.035 mm. in width; fragments of thin-walled latex tubes from 0.015 to 0.025 mm. in diameter and filled with a granular substance; fragments of cork grayish or light yellowish-brown. Macerate 1 Gin. of the powdered bark in 5 mls of cold water; filter and heat the filtrate in a test tube; it becomes cloudy, but on cooling assumes its original transparency. Condurango yields not more than 12 per cent. of ash." *N. F.* Thomas Antisell (*A. J. P.*, xliii, 289) found in it tannin, extractive matter, and a yellow resin, to which he attributes whatever of virtue the plant may possess. *Vulpius* (*P. J.*, 1885, 1066) found in it *condurangin*, a glucoside, very closely allied to vincetoxin of Tanret, and, like it, converted by warming when in concentrated solution into a tolerably stiff jelly. For Barthe's method of isolating it, see *A. J. P.*, 1892, 640. Merck gives the

following constituents of condurango: *Alpha-condurangin*, $C_{20}H_{32}O_6$; *Beta-condurangin*, $C_{18}H_{24}O_7$; *Conduransterin*, $C_{30}H_{50}O_2$, and also a trace of an alkaloid resembling strychnine in action. Carrara (*A. J. P.*, 1892) obtained from the so-called condurangin of commerce two principles: One insoluble in water, soluble in benzene, a light, almost white, powder, melting at from 60° - 61° C. (140° - 141.8° F.), and of the composition $C_{20}H_{32}O_6$. Both compounds are decomposed by acids, yielding a brown pitchy substance, insoluble in water. Boehm (*M. M. W.*, iv, p. 1775) regards condurangin as a derivative of cinnamic acid. According to Firbas, condurangin in solution can be recognized by freeing from alcohol with gentle warmth, precipitating with a saturated solution of sodium chloride, dissolving the precipitate in chloroform, and adding a liquid composed of equal parts of sulphuric and hydrochloric acids and alcohol. On warming, the mixture assumes a green color, which turns a beautiful greenish-blue on the addition of a trace of ferric chloride. This Lafon reaction is given also by adonidin, oleandrin, sapotoxin and digitoxin. Brunton (*J. P.*, vol. v) reached the conclusion that *Condurango blanco* was inert, but Kobert found condurangin to be a violent poison, causing convulsions followed by paralysis; he believes it to be a mixture of several principles, (*S. Jb.*, 1889, No. 9.) H. Chiriboga states that three drachms of the bark taken by himself in the form of decoction produced considerable activity of the circulation, copious diaphoresis, increased secretion of urine, and even some vertigo and disturbance of vision, Under the name of *Guayaquil condurango* a drug has appeared in the European markets composed of pieces of bark and fragments of woody branches, believed to be derived from an asclepiadaceous plant closely related to the genus *Gonolobus*. *Mexican condurango* is composed of split stems or thin adherent bark, and is thought to be yielded by an Aristolochia. For full description, see *Ph. Rund.*, May, 1888. Prof. P. E. Hoinmell recommends *Mistura condurango et ulmi* and *Fluidglycerate of condurango* for the internal administration of the drug. (See *Proc. N. Jersey Pharm. Assoc.*, 1913, 80; also *M. R.*, 1913, 231.) *Fluidextract of condurango* is official in the National Formulary. *Dose*, one fluidrachm (3.9 mils).

CONFECTIO PIPERIS. Br.

Electuarium Piperis; Electuaire de Poivre, *Fr.*; Pfeffer-latwerge, *G.*

"Black pepper of commerce, in powder, 100 grammes; Caraway Fruit, in powder, 150 grammes; Purified Honey, 750 grammes. Mix." *Br.*

This preparation was intended as a substitute for Ward's Paste, which acquired some reputation in Great Britain as a remedy in piles and ulcers of the rectum. To be of service, it must be continued, according to Brodie, for two, three, or four months. Its stimulating properties render it inapplicable to cases attended with much inflammation.

Dose, from one to two drachms (3.9-7.7 Gm.), repeated two or three times a day.

CONFECTIO ROSAE GALLICAE Br.

CONFECTION OF ROSES

Conserva Rosarum; Conserve de Rose, *Fr. Cod.*; Conserve de Rose rouge, *Fr.*; Rosen-Conserve, *G.*

Confection of Rose was unfortunately dropped from the U. S. P. IX, but was introduced into the National Formulary IV. (See Part III.)

"Fresh Red-Rose Petals, 250 *grammes*; Refined Sugar, 750 *grammes*. Beat together in a stone mortar," *Br.*

"Red Rose, in No. 60 powder, eighty *grammes* [or 2 ounces av., 360 grains]; Sugar, in fine powder, six hundred and forty *grammes* [or 22 ounces av., 252 grains]; Clarified Honey, one hundred and twenty *grammes* [or 4 ounces av., 102 grains]; Stronger Rose Water, one hundred and sixty cubic centimeters [or 5 fluid-ounces, 197 minims], to make about one thousand *grammes* [or 35 ounces av., 120 grains]. Rub the Red Rose with the Stronger Rose Water previously heated to 65° C. (149° F.), then gradually add the Sugar and Clarified Honey, and beat the whole together until a uniform mass results." *U. S. VIII.*

In the British process the unblown petals only are used, and these should be deprived of their claws; in other words, the rose-buds should be cut off a short distance above their base, and the lower portion rejected. In the last four editions of the U. S. Pharmacopoeia, dried roses have been substituted for the fresh, as the latter are not brought to our market. The process is very similar to that of the French Codex. We have been informed, however, that confection of rose is still made in Philadelphia on a large scale from the fresh petals of the *R. centifolia* and others, by beating them into a pulp with sugar, as in the British process. An excuse for this deviation from the official formula is, that the confection thus made has greater adhesiveness than the official, and is therefore better fitted for the formation of pills. Confection of Rose is slightly astringent; it is used almost exclusively as a vehicle, and is admirably adapted as an excipient and to impart consistence to the pilular mass.

Off. Prep.—Pilula Hydrargyri, *Br*

CONFECTIO SENNAE. Br.

CONFECTION OF SENNA

Electuarium Sennae Compositum, Electuarium Lenitivum; Electuaire de Sene compose, *Fr. Cod.*; Electuaire lenitif, *Fr.*; Electuarium e Senna, *P. G.*; Sennalatwerge, *G.*; Elettuario lenitivu. *It.*

Confection of Senna was improperly dropped from the U. S. P. IX, but the National Formulary IV introduced the U. S. P. VIII preparation.

"Senna Leaves, in powder, 100 grammes; Coriander Fruit, in powder, 40 grammes; Figs of commerce, 160 grammes; Tamarinds, 120 grammes; Cassia Pulp, 120 grammes; Prunes of commerce, 80 grammes; Extract of Liquorice, 15 grammes; Refined Sugar, 400 grammes; Distilled Water sufficient to produce 1000 grammes. Boil the figs and prunes gently with three hundred and fifty grammes of Distilled Water in a covered vessel for four hours; add more Distilled Water to make up the quantity to its original weight, and then incorporate the Tamarinds and Cassia Pulp; digest for two hours; rub the softened pulp of the fruits through a hair sieve, rejecting the seeds and other hard parts; to the pulp thus obtained add the Refined Sugar and Extract of Liquorice, dissolving them by the aid of gentle heat; while the mixture is still warm, add to it gradually the mixed Senna and Coriander powders; mix the whole thoroughly; make the weight of the resulting Confection one thousand grammes, either by evaporation or by the addition of more Distilled Water." *Br.*

"Senna, in No. 60 powder, one hundred grammes [or 3 ounces av., 231 grains] : Cassia Fistula, bruised, one hundred and sixty grammes [or 5 ounces av., 282 grains]; Tamarind, one hundred grammes [or 3 ounces av., 231 grains]; Prune, sliced, seventy grammes [or 2 ounces av., 205 grains]; Fig, bruised, one hundred and twenty grammes [or 4 ounces av., 102 grains]; Sugar, in fine powder, five hundred and fifty-five grammes [or 19 ounces av., 252 grains]; Oil of Coriander, five grammes [or 77 grains]; Water, a sufficient quantity, to make one thousand grammes [or 35 ounces av., 120 grains]. Digest the Cassia Fistula, Tamarind, Prune and Fig with five hundred cubic centimeters [or 17 fluid-ounces] of Water in a covered vessel, by means of a water-bath, for three hours. Separate the coarser portions and rub the pulpy mass, first through a coarse hair sieve, and then through a muslin cloth. Mix the

residue with one hundred and fifty cubic centimeters [or 5 fluidounces] of Water, and, having digested the mixture for a short time, treat it as before, and add the product to the pulpy mass first obtained. Then, by means of a water-bath, dissolve the Sugar in the pulpy liquid, and evaporate the whole in a tared vessel, until it weighs eight hundred and ninety-five grammes [or 31 ounces av., 250 grains]. Lastly, add the Senna and the Oil of Coriander, and incorporate them thoroughly with the other ingredients while they are yet warm." *U. S. VIII.*

Confection of Senna, when correctly made, is an elegant preparation, and keeps well if properly protected. The U. S. P. VIII process differed from that of 1860 in preparing the pulps, as suggested in former editions of this Dispensatory, instead of taking them already prepared. An improvement was made in the process of the U. S. P. 1890 by replacing the coriander seed of the former Pharmacopoeias with oil of coriander; it is almost impossible to powder coriander fine enough to avoid hard particles except by drying it to such an extent as to deprive it injuriously of its volatile oil, and the plan of using the oil directly has therefore been adopted. The oil of coriander should be dropped upon a portion of the powdered senna contained in a mortar or suitable vessel and this lightly triturated with the rest of the powdered senna so as to distribute it uniformly; the mixture should then be added to the pulpy mass and the official directions then carried out. It was formerly not uncommon to omit the cassia pulp in this preparation, as the pods were not always to be found in the market; but, as this is next to the senna the most active ingredient, the omission was to be regretted. Cassia fistula is now readily procured in commerce, and there can be no excuse for its omission. It has also been proposed to substitute the fluidextract of senna for the crude drug- (*A. J. P.*, xliii, 123); but, as the fluidextract is of such uncertain quality, the leaves themselves are preferable.

A very good, pleasant laxative, admirably adapted to cases of habitual costiveness, especially in pregnant women, and in persons affected with piles.

Dose, one to two drachms (3.9-7.7 Gm.), at bedtime.

CONFECTIONES

CONFECTIONS

Electuaries; Conserves, Electuaires, Saccharoles mous, *Fr.*; Conserven, Latwergen, *G.*; Elettuario, *It.*; Electuario, *Sp.*

Under the general title of Confections, the Pharmacopoeias include all those preparations having the form of a soft solid, in which one or more medicinal substances are incorporated with saccharine matter, with a view either to their preservation or more convenient administration. But two confections, Rose and Senna, were retained in the Eighth Revision of the U. S. Pharmacopoeia and in the Ninth Revision both were dropped and relegated to the National Formulary IV. The old division into Conserves and Electuaries has been abandoned; but, as there is some ground for the distinction, we shall make a few general remarks upon each division before proceeding to the consideration of the individual preparations.

Conserves consist of undried vegetable substances and refined sugar beaten into a uniform mass. By means of the sugar, the vegetable matter is enabled to resist for some time the decomposition to which it would otherwise be exposed in the undried state, and the properties of the recent plant are thus retained to a certain extent unaltered. But, as active medicines even thus treated undergo some change, and those which lose their virtues by desiccation cannot be long preserved, the few conserves now used are intended rather as convenient vehicles of other substances than for separate exhibition. The sugar used in their preparation should be in fine powder.

Electuaries are mixtures consisting of medicinal substances, especially dry powders, combined with syrup or honey, in order to render them less unpleasant to the taste, and more convenient for internal use. They are usually prepared extemporaneously; and it is only when their complex nature renders it convenient to keep them ready made, or some peculiarity in the mode of mixing the ingredients requires attention, that they become proper objects for official direction. Their consistence should not be so soft, on the one hand, as to allow the ingredients to separate, nor so firm, on the other, as to prevent them from being swallowed without mastication. Different substances require different proportions of syrup. Light vegetable powders usually require twice

their weight, gum-resins two-thirds of their weight, resins somewhat less, mineral substances about half their weight, and deliquescent salts not more than one-tenth. Should the electuary become dry and hard, more syrup should be added, so as to give it the requisite consistence. If the dryness result from the mere evaporation of the aqueous part, water should be added instead of syrup, and the same remark is applicable to the conserves. To prevent the hardening of electuaries, the French writers recommend the use of syrup prepared from brown sugar, which is less apt to crystalline than that made from the refined. Molasses would answer the same purpose, but its taste might be objectionable. Some employ honey, but this is not always acceptable to the stomach. Glycerin and syrupy glucose might sometimes be used with advantage.

Confectio Aromatica, Aromatic Confection, Electuarium Aromaticum; Electuaire (Confection) aromatique, Fr.; Aromatische Latwerge, Getwurzlatwerge, G.—" Take of Aromatic Powder four troyounces; Clarified Honey, four troy-ounces, or a sufficient quantity. Rub the Aromatic Powder with Clarified Honey until a uniform mass of the proper consistence is obtained." U. S., 1870.

This confection affords a convenient means of administering' the spices contained in it, and an agreeable vehicle for other medicines. The confection is given in debilitated states of the stomach. The dose is from ten to sixty grains (0.65-3.9 Gm.).

Confectio Aurantii Corticis, Confection of Orange Peel, Conserva Aurantii; Conserve d'Ecorce d'Orange, Fr.; Apfelsinenschalen-Con-serve, G.—" Take of Sweet Orange Peel, recently separated from the fruit by grating, twelve troy ounces; Sugar [refined], thirty-six troyounces. Beat the Orange Peel with the Sugar, gradually added, until they are thoroughly mixed." U. S., 1870.

This confection is not used as frequently as it deserves to be. It is, when well made, a grateful aromatic vehicle or adjuvant for tonic and purgative powders.

Confectio Opii, Confection of Opium, which was the modern substitute for the mediaeval preparations known as *theriaca* and *mithridate*, has been finally dropped from both Pharmacopoeias. One grain of opium was contained in about thirty-six grains of the former United States confection, and in about forty grains of the British. The following is the

U. S. Pharmacopoeia (1870) formula: " Take of Opium, in fine powder, two hundred and seventy grains; Aromatic "Powder, six troyounces; Clarified Honey, fourteen troyounces. Rub the Opium with the Aromatic Powder, then add the Honey, and beat the whole together until thoroughly mixed." U. S., 1870.

Conium. N. F. IV (U. S. P. VIII). Hemlock. Poison Hemlock. Spotted Hemlock or Parsley. Fool's Parsley. St. Bennett's Herb. Spotted Cow-'bane. *Herba Cicutae* (Majoris). *Cigue officinale*, ou *Grande Cigue* (Feuille), Fr. Cod. *Feuilles de grande Cigue*, Fr. *Herba Conii*, P. G. *Schierlingskraut*, *Schierlingsblatter*, *Schierling*, *Gefleckter Schlierling*, G. *Foglie di cicuta maggiore*, It. *Cicuta major*, Sp.—Formerly the fruit of the *Conium maculatum* was official in both the United States and British Pharmacopoeias and the leaves in the British Pharmacopoeia. The fruit has now been introduced into the National Formulary IV, where it is described as "the full grown, but unripe fruit of *Conium maculatum* Linne (Fam. *Umbelliferae*), carefully dried and preserved, and yielding not less than 0.5 per cent. of confine. After being kept for more than two years, Conium is unfit for use. Broadly ovoid, greenish-gray, the two mericarps of most of the fruits separated, each about 3 mm. in length and about 1.5 mm. in diameter, ovoid, somewhat curved, the inner, flattened side marked by a deep longitudinal groove, the outer, convex side with five, pale yellow, somewhat crenate ribs, the intervening surfaces wrinkled but otherwise smooth; pericarp without oil tubes. Odor slight, but when triturated with a solution of potassium hydroxide, strong, disagreeable, and mouse-like; taste characteristic, disagreeable, afterwards somewhat acrid. Transverse sections of the mericarp, when examined under the microscope, exhibit a pentangular outline, the angles projecting and forming the ribs, four of the sides being almost equal in length, the fifth or commissural side being about twice as long as one of the dorsal sides and usually concave near the middle; a distinct fibro-vascular bundle at each angle composed of thick-walled fibers about 0.013 mm. in diameter and a few tracheae; epidermis consisting of one

layer of cells which are sometimes slightly cen-trifugally developed, hairs are absent; pericarp thin, without vittae, enclosing a single seed and extending inwardly on the commissural side for about one-third the diameter of the section; the inner epidermis of the pericarp composed of two layers of cells with yellowish-brown walls, the outer layer with cells from 0.06 mm. to 0.12 mm. in tangential length and with thickened radial and inner walls, the inner layer with thin-walled cells from 0.03 to 0.06 mm. in tangential length and about 0.03 mm. in radial diameter; the seed coat composed of small, thick-walled cells about 0.015 mm. in radial diameter; often obliterated; a large endosperm or central portion being somewhat pentangular-rounded in outline, with a deep channel on the commissural side and composed of polygonal parenchyma cells; the latter contain globules of fixed oil and aleurone grains with rosette aggregates of calcium oxalate. The powdered drug is greenish-gray and, when examined under the microscope, exhibits numerous angular or rounded, light colored fragments of endosperm tissue, composed of parenchyma cells containing fixed oil, aleurone grains and rosette aggregates of calcium oxalate, the latter from 0.002 to 0.006 mm. in diameter; a few more or less curved groups of lignified fibers; fragments of the seed coat with yellowish-brown walls; a few rounded starch grains about 0.005 mm. in

diameter; spiral or annular tracheae few; numerous oil globules on mounting the powder in hydrated chloral T.S. Conium yields not more than 8 per cent. of ash." N. F. Conium fruit (*Conii fructus*) is sometimes incorrectly called *conium seed*. The hemlock leaves (*Conii folia*) were described as "the fresh leaves and young branches of *Conium maculatum* Linn., collected when the fruit begins to form." Br., 1898.

Conium maculatum is an umbelliferous plant, having a biennial spindle-shaped whitish root, and an herbaceous branching stem, from three to six feet high, round, hollow, smooth, shining, slightly striated, and marked with brownish-purple spots. The lower leaves are tripinnate, more than a foot in length, shining, and attached to the joints of the stem by sheathing petioles; the upper are smaller, bipinnate, and inserted at the division of the branches; both have channelled footstalks, and incised leaflets, which are deep green on their upper surface and paler beneath. The flowers are very small, white, and disposed in compound terminal umbels. The general involucre consists of from three to seven lanceolate, reflected leaflets, whitish at their edges; the partial involucre of three or four leaflets, oval, pointed, spreading, and on one side only. There are five petals, cordate, with their summits inflected, and nearly equal. The stamens are spreading, and about as long as the corolla; the styles diverging.

Conium is a native of Europe, and has become naturalized in America from Quebec to Pennsylvania, where it is also cultivated for medicinal purposes. The term *cicuta*, which has often been applied to this plant, belongs to a different genus. It grows usually in clusters along the roadsides or in waste grounds, and is found most abundantly near old settlements. It flowers in June and July. The whole plant, especially at this period, exhales a fetid odor, compared by some to that of mice, by others to that of the urine of cats, and narcotic effects result from breathing for a long time air loaded with the effluvia. The plant varies in narcotic power according to the weather and climate, being most active in hot and dry seasons and in warm countries. The hemlock of Greece, Italy, and Spain is said to be much more energetic than that of the north of Europe. As a rule, those plants are most active which grow in a sunny exposure. The proper season for gathering the leaves is when the plant is in flower, and Fothergill asserts, from experiment, that they are most active about the time that the flowers begin to fade. The footstalks should be rejected, and the leaflets quickly dried, either in the hot sun, or on tin plates before a fire, or by a stove-heat not exceeding 48.8° C. (120° F.). They should be kept in boxes or tin cases, excluded from the air and light, by exposure to which they lose their fine green color and become deteriorated. The same end is answered by pulverizing them, and preserving the powder in opaque and well-stoppered bottles. But little reliance can be placed on the dried leaves, as, even when possessed of a strong odor and a fine green color, they may be destitute of the narcotic principle. When rubbed with potassium hydroxide they should exhale the odor of coniine. The fruit retains its activity much longer than the leaves. Commercial conium occasionally contains other umbelliferous plants, or it may be almost wholly composed of such plants, and even anise has been used as an adulterant to the fruit. (See *Anise*.)

The dried leaves of conium have a strong, heavy, narcotic odor, less disagreeable than that of the recent plant. Their taste is bitterish and nauseous; their color a dark

green, which is retained in the powder. A slight degree of acidity possessed by the fresh leaves is said to be dissipated by drying. Water distilled from the fresh leaves has the odor of conium, and a nauseous taste, but does not produce narcotic effects. Upon destructive distillation, the leaves yield a very poisonous empyreumatic oil. Geiger first obtained the active principle in a separate state, the volatile alkaloid coniine or conine. As it exists in the plant in combination with an acid it is not readily volatilized, but it freely comes over with the distillate when an alkali has been previously added. The acid of conium, Peschier believed to be peculiar, and named *coniic acid*, but other observers assert that it is *malic acid*. For methods of isolating conium, see *U. S. D.*, 19th ed., p. 393. The seeds contain most of this principle; but even in these it exists in very small proportion. From six pounds of the fresh or nine of the dried seeds, Geiger obtained about an ounce of coniine, while from 100 pounds of the fresh herb only a drachm, and from the dried leaves none. Farr and Wright (*P. J.*, 1896, 273) confirm the views of Harley and Manlius Smith and affirm that green fruits are alone reliable. The volatility and tendency to undergo decomposition of coniine probably has its effect even in the dried unripe seed, otherwise it is difficult to explain the fact that in thirteen analyses of commercial conium fruit made by Farr and Wright, the average alkaloidal contents were 0.674; while the average of sixteen analyses of samples collected by themselves was 2.13. (*P. J.*, Feb., 1904.) For a method of assaying conium fruit, by Schwickerath, see *Ph. Rec.*, 1893, 282. The N. F. IV adopted the following assay process, requiring that conium should yield not less than 0.5 per cent. of coniine:

Assay.—" Place 15 Gm. of Conium, in No. 40 powder, in a 250 mil Erlenmeyer flask, add 150 mils of purified petroleum benzin and then 15 mils of solution of sodium hydroxide, insert the stopper securely, and shake the flask vigorously at frequent intervals during six hours. Allow the mixture to settle and decant 100 mils of the clear benzin solution (representing 10 Gm. of the drug) into a separator; extract the alkaloid by shaking with successive portions of weak hydrochloric acid until a few drops of the last washing gives no precipitate with iodine T.S. Collect the acid washings and concentrate by evaporation on a water bath to 10 mils, cool and transfer the liquid to a separator, then cautiously add sodium carbonate in excess. Extract the alkaloid by shaking out with successive portions of 15 mils each of purified petroleum benzin. Separate the benzin washings and filter into a beaker. Then add exactly 10 mils of tenth-normal sulphuric acid V.S. and stir thoroughly for two minutes so as to mix the acid and benzin solution. Evaporate the benzin layer in a current of warm air, at a temperature not exceeding 60° C. (140° F.), and as soon as the benzin has disappeared, cool, add five drops of cochineal T.S. or methyl red T.S. and titrate the acid solution with fiftieth-normal potassium hydroxide V.S. Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 0.0126 Gm. of coniine. Calculate the amount of coniine neutralized by the acid, and multiply the result by ten to obtain the percentage of coniine in the drug." *N. F.*

Harley has found in the root three proximate principles, one a very bitter resin, which he names conamarine, and the two others crystallizable bodies, named respectively *rhizoconin*, and *rhizo-conolein*. They are all neutral, and, so far as known, medicinally inert. (See *P. J.*, Aug., 1867.)

Coniine, $C_8H_{17}N$, has been thoroughly studied by Hofmann (1881), who established the correct formula as given, instead of $C_8H_{15}N$, as it was formerly assumed, and Ladenburg (1886) effected its synthesis from allyl pyridine by reduction with sodium in alcoholic solution:



This reaction gives *a-normal propyl piperidine*, which is optically inactive, but by the crystallization of its tartrate splits into *coniine* (dextrorotatory) and a very similar laevorotatory coniine, just as racemic acid splits into dextrorotatory and laevorotatory tartaric acid.

Coniine is in the form of a yellowish oily liquid, of sp. gr. 0.862, of a very acrid taste, and a strong penetrating odor, compared to that of the urine of mice, and recalling the odor of fresh hemlock, though not identical with it. In volatility it resembles the essential oils, readily rising with the vapor of boiling water, -but when unmixed requiring for ebullition a temperature of $166^\circ C.$ ($330.8^\circ F.$). It is freely soluble in alcohol, ether, and the fixed and volatile oils, and slightly so in water. It unites with about one-fourth of its weight of water to form a hydroxide. It reddens turmeric, and neutralizes the acids, forming with them soluble salts, some of which are crystallizable. With tannic acid it forms an insoluble compound. Like ammonia, it occasions a white cloud when approached by a rod moistened with hydrochloric acid; and the resulting hydrochloride is crystallizable, and not in the least deliquescent. The hydrochloride may also be obtained as a brilliant crystalline mass by dissolving coniine in anhydrous ether and passing dry hydrochloric acid gas through the solution. The salt is very soluble in water and alcohol, but insoluble in ether. It can be heated to $90^\circ C.$ ($194^\circ F.$) without decomposition, and melts at $218^\circ C.$ ($424.4^\circ F.$). Coniine coagulates albumin, and precipitates the salts of aluminum, copper, zinc, manganese, and iron. It also precipitates silver nitrate, but in excess redissolves the precipitate. Most of its salts are decomposed by evaporation. When exposed to the air, it speedily assumes a deep brown color, and is ultimately converted into a resinous matter, and into ammonia, which escapes. Under the influence of heat this change takes place with much greater rapidity. The presence of coniine may be detected in an extract or other preparation of hemlock by rubbing it with potassium hydroxide, which instantly develops its peculiar odor. It is a most energetic poison.

In association with coniine in the hemlock are found also the following bases: *Ethyl-piperidine*, $C_7H_{15}N$ or $C_5H_{10}(C_2H_5)N$; *Methyl-coniine*, $C_9H_{12}N$ or $C_5H_9(C_3H_7)N(CH_3)$; *Conhydrine*, $C_8H_{17}NO$ or $C_5H_9(CHOH.CH_2CH_3)NH$; *Pseudo-conhydrine*, $C_8H_{17}NO$ or $C_5H_9(CH_3.CH_2OH.CH)NH$. *Methyl-coniine*, first obtained by Kekule and von Planta in commercial coniine, is of minor importance.

Conhydrine is crystallizable, fusible below $100^\circ C.$ ($212^\circ F.$), and volatilizable at a higher temperature, diffusing an odor much like that of coniine. Water dissolves it considerably, ether and alcohol freely; and the solution has a strong alkaline reaction. Its formula is given as $C_8H_{17}NO$. By the action of P_2O_5 or fuming hydrochloric acid

upon conhydrine, is obtained *coniceine*, $C_8H_{15}N$, and water. It may be separated from coniine by exposing the mixed alkaloids to a freezing mixture, expressing, and then repeatedly crystallizing from ether. (*Gmelin*, xiii, 169.) E. Merck obtained a small quantity of a new alkaloid from the high boiling portion of crude coniine. The isolation was accomplished by fractional distillation in vacuo and recrystallization. The alkaloid crystallizes in needles, is easily soluble in water, alcohol, ether, benzene, and chloroform, fuses at about $98^\circ C.$ ($208.4^\circ F.$), and boils at 230° to $232^\circ C.$ (446° - $449.6^\circ F.$). According to Ladenburg, the alkaloid is an isomer of conhydrine, having the formula $C_8H_{27}NO$, and for this reason the name *pseudo-conhydrine* was selected. (Chem. Cb., 1891, 414; see also P. J., 1891, 1170.)

Paraconiine.—Coniine was supposed to have been artificially produced by Hugo Schiff. From the reaction of butyric aldehyde with an alcoholic solution of ammonia, he obtained two bases, one of which, dibutyraldine, yielded, on distillation, first a neutral oily substance, and afterwards a strong alkaline base, which proved to have the physiological properties of natural coniine, but was optically inactive, while true coniine is dextrorotatory. Since the change in the formula of true coniine it will be seen that the base *paraconiine*, which is $C_8H_{15}N$, is not even isomeric with coniine.

Uses.—Hemlock or conium is supposed to be the narcotic used by the Athenians to destroy the life of condemned individuals, and by which Socrates and Phocion died. It was also used by the ancients as a medicine, but fell into entire neglect until Storck employed and extravagantly praised it. Though fatal to some animals, hemlock is eaten with impunity by others, as horses, goats, and sheep.

The alkaloids of conium all have the same physiological properties, although there is a difference in the degree of their power. Their most important effect is a paralysis of the peripheral endings of the motor nerves. In the account of the death of Socrates reference is made to loss of sensation as one of the prominent symptoms of his poisoning and there is evidence that the drug has an effect upon the sensory as well as upon the motor nerves, but the dominant action is certainly upon the motor system. Hayashi and Muto (*A. E. P. P.*, 1901, xlvi) have shown that the phrenic nerve is more susceptible to the drug than the other motor nerves of the body. It is evident, therefore, that if given in sufficient dose to control spasms, conium would stop the movements of the diaphragm and therefore cause death through asphyxia.

The drug has, however, been used in spasmodic disorders, such as *whooping cough*, *paralysis agitans*, and *acute mania* and by some with asserted good results. It was in the days of superstitious medicine believed to exercise an alterative effect in scrofulous and similar diatheses, but was long ago abandoned for this purpose.

Coniine acts precisely as does hemlock, and may be used for the same purposes. The *dose* is from one-fortieth to one-twelfth of a grain (0.0015-0.005 G-m.). Its solution has been used locally in the spasmodic contraction of the *orbicularis oculi* and *ophthalmia*, with *photophobia* in scrofulous children. For these purposes from one-half to one per cent. may be employed.

Various salts, including the *hydrochloride* and the *benzoate* have been prepared, but the hydro-bromide is the one most frequently used. This occurs in colorless prismatic needles, soluble in water and alcohol, less so in ether and chloroform, inodorous and almost tasteless, and are not deliquescent. It should, be kept in the dark, otherwise it assumes a red tint. The salt has been used in the treatment of *whoopingcough*. The usual dose of this salt is from one-sixtieth to one-twelfth of a grain, but in tetanus as high as one-sixth of a grain (0.01 Gm.) has been given. In sciatica- it has been employed hypodermically in quantities of one-twelfth of a grain (0.005 Gm.) with good results. (*Report, de Pharm.*, 1876, p. 369; 2v. R., 1876, 1879, pp. 18, 178.) For an account of Harley's experiments to determine the relative value of different preparations of conium, see *U. S. D.*, 18th ed., p. 451. He concluded that the green fruit, as the basis of tinctures and extracts, is superior to any other part of the plant, and the spirituous extract of the green fruit should be substituted for the almost worthless extract of the former Br. Pharm. (*P. J.*, 1871, p. 585.)

Dose, of conium, three to five grains (0.2 to 0.32 Gm.).

Connarus. *Connarusguianerisis* Lamb. Seribele.—The seeds and root bark of this plant (Fam. *Connaraceae*), from French Guinea, are used aa taenifuges; two ounces of the seeds in decoction, without straining. (Maclaud, *P. J.*, 1896, 243.)

Contrayerva. *Contrayerba. Contrayerve*, Fr. *Bezoarwurzel, Giftwurzel*, G.—The root of *Dorstenia Contrajerva* L. (Fam. *Urticaceae*), a native of Mexico, the West Indies, and Peru. The term *contrayerba*, in the language of the Spanish Americans, signifies counterpoison or antidote, and was applied to this root under the impression that it had the property counteracting all kinds of poison. The probability is that the root sold as *contrayerva* is derived from several species of *Dorstenia*, among which, besides *D. Contrajerva*, two others are mentioned by Houston, *D. Houstoni* L. and *D. Drakena* L., the former growing near Campeachy, the latter near Vera Cruz, According to Pereira and Martius, the *contrayerva* of the shops is the product of *D. brasiliensis* Lam., and is brought from Brazil.

The root, as found in commerce, is oblong, an inch or two in length, of varying thickness, very hard, rough, and solid, of a reddish-brown color externally, and pale within; and has numerous, long, slender, yellowish rootlets attached to its inferior part. The odor is aromatic; the taste warm, slightly bitterish, and pungent. The rootlets have less taste and odor than the tuberous portion. The sensible properties are extracted by alcohol and boiling water. The decoction is highly mucilaginous. The tincture reddens infusion of litmus, and precipitates on the addition of water. Mussi (*L'Orosi*, 1894, 259) investigated this plant and found two substances, which he called provisionally *cajapine* and *contrayerbine*. *Contra-yerva* is a stimulant tonic and diaphoretic, and has been given in *low fevers, typhoid dysentery, and diarrhea*, and other diseases requiring gentle stimulation. *Dose*, of powdered root, half a drachm (2 Gm.). In the root of the *Gabbon ivy* (*Dorstenia klaineans?*) Heckel and Schlagdenhauffen have found a coumarin-like body, *pseudocoumarin*. (*Ph. Cb.*, xliii.)

Convallaria Flowers. *N. F. IV. Convallariae Flores. Lily-of-the-Valley Flowers.*—It is described in the N. F. as "the dried inflorescence of *Convallaria majalis* Linne (Fam. *Liliaceae*), without the presence of more than 5 per cent. of foreign matter. From 15 to 25 cm. in length, peduncle dull-green or suggesting purplish-green, and more or less angled; flowers white, when old drying to a brownish color, usually from ten to twenty in number, borne in a more or less secund raceme on recurved pedicels which are usually from a half longer than their flowers to twice their length, each pedicel subtended by a whitish, ovate, acute bract about half its length; flowers from 6 to 8 mm. in length and rather broader, bell-shaped, six-parted, the segments ovate, obtuse, and slightly recurved; stamens six, included, adnate to the base of the corolla; style columnar, three-grooved. Odor agreeable; taste sweetish, then somewhat acrid. The powdered drug is light yellowish-brown and, when examined under the microscope, exhibits ellipsoidal or nearly spherical pollen grains with a smooth exine layer and occasionally with a convex rupture through the walls; calcium oxalate in raphides up to 0.04 mm. in length; fragments of tissue from the corolla composed of nearly isodiametric parenchyma cells with broadly elliptical stomata up to 0.04 mm. in length; fragments from the anther lobes, many of the coils having reticulate walls; few fragments of the short filaments with cells containing calcium oxalate; fragments of the stigma, rough and warty, with adhering pollen grains; portions of the bracts composed of thin-walled elongated cells, a few vascular bundles and stomata; tissue of the peduncle and pedicel composed of fragments of the epidermis with cells tapering at each end about 0.20 mm. in length and 0.03 mm. in breadth with elliptical stomata between the ends; sub-epidermal cells with yellowish-green plastids; tracheae about 0.021 mm. in width, spiral and with simple pores; sclerenchymatous fibers few, with lignified walls and simple pores. *Convallaria Flowers* yield not more than 12 per cent. of ash." *N. F.* For constituents and uses, see *Convallaria Root*.

Convallaria Root. *N. F. IV. (U. S. P. VIII.) Convallariae Radix. Lily-of-the-Valley Root. Liliium Convallium. Muguet, Fr. Cod. Maiblumen, G. Convallaria, Mughetto, It. Convalaria, Lirio de los valles, Sp.*—It is described by the N. F. as "the dried rhizome and roots of *Convallaria majalis* Linne (Fam. *Liliaceae*). Rhizome horizontal, elongated, usually branched, cylindrical, variable in length, from 1 to 3 mm. in diameter; externally yellowish-white or pale brown, with a few circular stem scars, and from the under and side portions at the nodes usually arise from three to five thin, tortuous, dark brown, branching roots; fracture short or fibrous; internally whitish. Odor faint; taste sweetish, becoming bitter and acrid. Under the microscope, transverse sections of the rhizome of *Convallaria Root* show an epidermal layer with a thick outer layer of cutin; a hypodermal layer of a single row of collenchyma; a cortex made up of about twenty rows of parenchyma cells, some of which contain starch and raphides of calcium oxalate; a prominent endodermis, the radial and inner walls of which are strongly thickened and lignified; inside the endodermis is an interrupted circle of collateral fibro-vascular bundles, the woody portion of which has in cross section the shape of the letter V; inside the circle of bundles is another interrupted circle of fibro-vascular bundles of the concentric type, the sieve tissue being surrounded by the xylem; the parenchyma cells of the pith separated by large intercellular spaces. Under the microscope, transverse sections of the root of *Convallaria* show a hairy epidermal layer, a hypodermis of a single row of cells; a

cortex of about six rows of cells, some of which contain starch, raphides of calcium oxalate, and oil; the cells of the endodermal layer resemble those of the rhizome; fibrovascular bundles mostly five. The powder is dark brown, tending to cake on standing, consisting chiefly of cellular fragments and a few starch grains and raphides of calcium oxalate; cells of endodermis with slightly oblique ends and considerably thickened, lignified porous walls; fragments of tracheae with spiral and scalariform thickenings, or with porous walls; starch grains single or compound, mostly nearly spherical, and from 0.003 to 0.012 mm. in diameter; raphides of calcium oxalate few, from 0.02 to 0.045 mm. in length. Convallaria Root yields not more than 10 per cent. of ash." *N. F.*

The ordinary lily of the valley of the gardens is primarily a native of Europe, but may be found in America escaped from gardens, and a plant which grows wild in the higher Alleghenies from Central Virginia to South Carolina seems to be identical with it. G. F. Walz found in lily of the valley *convallarin* and *convallamarin*. (*A. J. P.*, 1859, p. 5,77.) Convallarin is in colorless, rectangular prisms, scarcely soluble in water, but sufficiently so as to render the solution acrid and to cause it when shaken to foam like soap and water. It is easily dissolved by alcohol. Its composition is represented by the formula $C_{34}H_{62}O_{11}$, and it is a glucoside, decomposed by long boiling with diluted acids into sugar and *convallaretin*. Convallamarin is a white powder, very bitter and afterwards sweetish, soluble in water and alcohol, but not in ether. This also is a glucoside. Its composition is $C_{23}H_{44}O_{12}$, and it is decomposed by heating with diluted sulphuric acid into sugar and *convallamaretin*, the formula of which is $C_{20}H_{36}O_8$. For preparing convallamarin, Tanret modifies Waiz's method, as follows. An alcoholic tincture made from the whole plant is precipitated with lead subacetate and filtered; the excess of lead is removed with diluted sulphuric acid, avoiding the use of more than is necessary, and, after neutralizing, the tincture is distilled, the last portion of alcohol being driven off in the open air; then the cooled and filtered liquor is treated with tannin, care being taken to keep the liquid neutral by cautiously adding a diluted solution of sodium carbonate. A compound of tannin and convallamarin is precipitated, which, after washing, is dissolved in 60° alcohol, the solution decolorized with charcoal, decomposed with zinc oxide, filtered, and evaporated to dryness. In this way convallamarin is obtained nearly white, and having the appearance of ordinary digitalin. To free it from the salts that are sometimes carried down by the tannin precipitate, it is a good plan to redissolve it in 90° alcohol, filter, and then evaporate. One kilo-gramme of the fresh plant collected in the first days of August yielded two grammes of convallamarin. (*P. J.* 1882, p. 423.) Taken internally the flowers are said to be emetic and cathartic, and their extract purges actively in the *dose* of half a drachm. They were formerly used in *epilepsy* and against *worms*. The *root*, which is also bitter, has similar purgative properties, and in powder is said to be sternutatory. Haensel obtained 0.058 per cent. of an aromatic volatile oil from the leaves of *Convallaria majalis*. (*Ph. Centralh.*, 1901, 495.)

Convallaria has long been used in Russia as a popular remedy for the relief of *dropsy*. While there is considerable divergence of statements as to the exact effects of this drug upon the circulation, it seems to be well established that it arrests the frog's heart in systole and produces the other phenomena characteristic of the digitalis

group of drugs. *Dose*, of either the flowers or root, five to ten grains (0.32-0.65 Gm.).

Convallaria Polygonatum L. (*Polygonatum uniflorum* Gilib.; now *P. officinale* (L.) All.) *Sealwort*. *Solomon's Seal*. *Sceau de Salomon*, *Gcnouillet*, Fr. *Weisswursel*, *Salomon's Siegel*, G. (Fam. *Liliaceae*).—A perennial, herbaceous European plant, whose root is inodorous. It is said to be emetic. In former times it was used externally in *bruises*, especially those about the eyes, in *tumors*, *wounds*, and *cutaneous eruptions*, and was highly esteemed as a cosmetic. At present it is not employed. The berries and flowers are said to be acrid and poisonous. *Polygonatum uniflorum* L. (All.) (*C. multiflora* L.), which grows in Europe and Asia, is analogous to the preceding in properties. (See John H. Rauch, *In. Dis.*, 1849.)

Convolvulus. *Convolvulus panduratus* L. (Now *Ipomoea fastigiata*, Sweet) *Wild Potato*. *Man-root*. *Man of the Earth*. *Wild Jalap*.—This native climber has a perennial root, which is very large, two or three feet in length, about three inches thick, branched at the basal portion, externally of a brownish-yellow color, and with numerous longitudinal fissures, internally whitish and milky, and of a somewhat acrid taste. It is feebly cathartic and diuretic (*N. Y. Journ. of Med.*, x, 375), and was formerly used in *strangury* and *calculous diseases*. Forty grains (2.6 Gm.) of the dried root are said to purge gently.

COPAIBA. U. S., Br.

COPAIBA Copaib. [Balsam of Copaiba, Copaiva]

"An oleoresin derived from South American species of *Copaiba* (Fam. *Leguminosae*)." U. S. "Copaiba is the oleo-resin obtained by incision from the trunk of various species of *Copaifera*, Linn." Br.

Balsamum *Copaiferarum*; Balsam *Copaiba*, Balsam *Capivi*; *Copahu*, Fr. *Cod*.; *Oleoresine* (Baume) de *Copahu*, Fr.; Balsamum *Copaivae*, P. G.; *Copaiva*; *Copaivabalsam*. G.; Balsamo di *Copaive*, It.; *Copaiba*, Balsamo de *Copaiva*, Sp.

Copaiba was first noticed in a work published by Purchas, in England, in 1625. The next reference to it was by Cristoval d'Acuna, in 1638. In 1648, Maregraf and Piso gave a detailed account of the tree which produces it, and the methods of gathering" it. Jacquin in 1763 described a species of *Copaifera*, growing in Martinique, which he named *C. officinalis*. As this was believed to be the same plant with the one observed by Marcgraf in Brazil, it was adopted in the Pharmacopoeias, but their identity was denied; and Desfontaines proposed for Jacquin's species the title of *C. Jacquini*, in honor of that botanist. It is now known that many species of *Copaiba* (*Copaifera*) exist in South America, and all of them, according to Martius, yield copaiba. Besides *C.*

officinalis (L.) Jacquin, the following yield Copaiba: *C. guianensis* (Deaf.) O. Kuntze, *C. Langsdorffii* (Desf.) O. Kuntze, and *C. coriacea* (Mart.) O. Kuntze.

The juice is obtained by making a square chamber in the stems of the trees, reaching to the very center; and the operation is said to be repeated several times during the same season. It is asserted that a single tree will yield about forty liters. As it flows from the wound, it is clear, colorless, and very thin, but it soon acquires a thicker consistence, and a yellowish tinge. It is most largely collected in the provinces of Para and Maranh, in Brazil, and is brought to this country from the port of Para, in small casks or barrels. Large quantities of it come from Maracaibo, in Venezuela, and from other ports on the Caribbean Sea, whence it is brought in casks, demijohns, cans, jugs, etc. The drug is also exported from Angostura, Cayenne, Rio Janeiro, and some of the West India islands.

C. officinalis is a native of Venezuela, and grows in the province of Carthagena, mingled with the trees which afford the balsam of Tolu. It grows also in some of the West India islands, particularly Trinidad and Martinique. This is the source of the Maracaibo or Venezuela Copaiba, which is also obtained in part from *C. guianensis*. This variety of Copaiba is distinguished by being dextrogyrate, more viscid and darker in color.

Numerous varieties of true South American copaiba exist in commerce, known under the name of the various ports of shipment. The most important of these varieties besides Maracaibo is the Para or Maranh Copaibo, which is derived from *C. Langsdorffii* and *C. coriacea*, which is characterized by being optically laevo-gyrate. The other varieties are Bahia, Carthagena, Maranh, and Cayenne. Each one of these varieties has been referred (see *P. J.*, 1901, Ixvi, 325) to a special species of the genus *Copaiba*, but there is little reason for supposing that this reference is accurate, and there is much reason for believing that various trees contribute to a single variety of copaiba. The following table, according to the researches of Umney and Bennett, shows the specific gravities and percentage of oil of the five most important of these copaibas:

Name.	Sp. gr.	Per cent. of oil.	Resin.
Bahia	0.938	49.7	Soft.
Carthagens	0.970	41.3	Brittle.
Maracaibo	0.969	42.5	{ Firm. but not easily pulverized.
Maranham	0.990	41.8	Brittle.
Para	0.920	62.4	Very soft.

All of the above varieties answered to the solubility and Gurjun balsam tests.

It will be noticed that the Para and Bahia specimens examined by Umney failed to comply with the tests of the U. S. Pharmacopoeia (1890), and yet, supposing that the oil represents the chief therapeutic principle of copaiba, these varieties lead all the others. The German Pharmacopoeia requires that the specific gravity shall be 0.98 to 0.99, and that the acid number shall fall between 75.6 and 84, and the ester number be not more than 8.4. Dieterich. (*P. J.*, April, 1899, and March, 1900.) *Surinam copaiba* is a yellowish or brownish-yellow liquid, of varying consistence; it may be distinguished from Maracaibo copaiba by the fact that one drop of it dissolved in 1 mil of acetic anhydride gives a fine blue color on the addition of a drop of sulphuric acid. (*P. J.*, Nov., 1904.)

According to E. Keto, copaiba of Maracaibo has a density of 0.999; a coefficient of acidity of 85.4; of etherification of 6.7; while that of Para has a density of 0.92; a coefficient of acidity of 19.4; of etherification of 7.4.

Properties.—Copaiba is a clear, transparent liquid, usually of the consistence of olive oil, of a pale yellow color, a peculiar not unpleasant odor, and a bitterish, hot, nauseous taste. Its sp. gr. varies ordinarily from 0.950 to 1.000, but has been known to be as low as 0.916. (Procter, *A. J. P.*, xxii, 292.) It is insoluble in water, but entirely soluble in absolute alcohol, ether, and the fixed and volatile oils. Strong alkaline solutions dissolve it perfectly; but the resulting solution becomes turbid when largely diluted with water. With the alkalis and alkaline earths it forms compounds, in which the resin of the copaiba acts the part of an acid. It dissolves magnesia, especially with the aid of heat, and even disengages carbon dioxide from the magnesium carbonate. If triturated with a sixteenth of its weight of magnesium oxide and a little water and set aside, it gradually assumes a solid consistence, and a similar change is produced with calcium hydroxide. Solid Copaiba or Mass of Copaiba was official in the U. S. P., 1890, and is now official in the National

Formulary IV, Part III. See also U. S. Dispensatory, 19th edition, p. 398. The essential constituents of copaiba are volatile oil and resin, with at times small quantities of acids. As it contains no benzoic acid, it cannot properly be called balsam of copaiba. The substances which it most closely resembles, both in composition and in properties, are the turpentine. (See *Oleum Copaiba*.) For a description of an apparatus for distilling the volatile oil, see a paper by R. A. Cripps in C. D., 1892, 282. Cripps found commercial copaiba to contain the following percentages of volatile oil: 40.95, 45, 45.3, 46.4, 47.8, 48.2, 49.6, 50.4, 50.8, 53.3, 59.6. J. C. Umney (*A. J. P.*, 1893, 544) found in African copaiba 39 per cent. of an oil of 0.918 specific gravity and with a rotation of +20° 42', the last character distinguishing it from the other varieties which yield laevorotatory oils.

The official description of Copaiba is as follows: "A pale yellow to brownish-yellow, more or less viscid liquid, either without fluorescence or with only a slightly greenish fluorescence; having a peculiar, aromatic odor, and a persistent, bitter, and acrid taste. It is insoluble in water and partly soluble in alcohol. Soluble, showing not more than a slight opalescence,

in dehydrated alcohol, carbon disulphide, or in fixed or volatile oils; completely soluble in chloroform or ether and also soluble in an equal volume of petroleum benzin, a further addition of the solvent producing a flocculent precipitate. Specific gravity: 0.940 to 0.995 at 25° C. (77° F.). When heated on a water bath, no odor of oil of turpentine is evolved; and when all of the volatile oil has been driven off, a hard and brittle resin remains, weighing not less than 36 per cent. of the original weight of the Copaiba taken (*paraffin or fatty oils*). To about 1 G-m. of Copaiba, accurately weighed, add 50 mils of alcohol and 1 mil of phenolphthalein T.S., then titrate the solution with half-normal potassium hydroxide V.S. It shows an acid value of not less than 28 nor more than 95. Dissolve 3 or 4 drops of the volatile oil separated from Copaiba by distillation with steam, in 3 mils of glacial acetic acid, mix the solution with 1 drop of a freshly prepared aqueous solution of sodium nitrite (1 in 10), and carefully underlay this with 2 mils of sulphuric acid. The acetic layer is not colored pink (*gurjun balsam*). Shake 5 mils of Copaiba with 15 mils of alcohol and then heat the mixture to boiling for one minute; no oil separates after cooling and allowing it to stand for one hour (*paraffin oils*). The volatile oil separated from Copaiba by distillation with steam does not boil below

250° C. (482° F.), and shows an angle of rotation in a 100 mm. tube of not less than -7° at 25° C. (77° F.). (*African Copaiba*); *U. S.*

" A more or less viscous liquid, generally transparent and occasionally fluorescent, yellow to golden brown. Specific gravity 0.975 to 0.995. Entirely soluble in *absolute alcohol*; soluble in four times its volume of *petroleum spirit*, the solution yielding only a slight filmy deposit on standing. Aromatic, characteristic odor; taste acrid, somewhat bitter, persistent. Loses about 45 per cent. of its weight when heated for forty-eight hours to 100° C. (212° F.). Forms a transparent solution with one-third of its volume of *solution of ammonia*. Four drops carefully added to a mixture of 5 millilitres of *glacial acetic acid* with four drops of nitric acid do not yield a purplish or violet color (absence of gurjun balsam). 1 gramme dissolved in 25 millilitres of *absolute alcohol* requires for neutralisation not less than 2.7 millilitres of N/2 *alcoholic solution of potassium, hydroxide, solution of phenolphthalein* being used as indicator (presence 'of a due proportion of acid resins). The volatile oil distilled from it responds to the tests described under 'Oleum Copaibae.' "
Br.

The *resinous* mass which remains after the distillation of the oil is hard, brittle, translucent, greenish-brown, and nearly destitute of odor and taste. By mixing it with the oil in proper proportion, we may obtain a liquid identical or nearly so with the original juice. This resinous mass is of an acid character, and yields a series of amorphous salts; it may be obtained pure by exposing a mixture of 9 parts of copaiba and 2 parts of aqueous ammonia (sp. gr. 0.95) to a temperature of 10° C. (50° F.). In this way crystals of *copaivic acid*, $C_{20}H_{30}O_2$, are obtained. This acid agrees with the *abietic acid* of rosin in composition, but not in properties. Copaivic acid is readily soluble in alcohol, and especially in warmed copaiba itself; much less soluble in ether. When recrystallized from alcohol, copaivic acid fuses at 116° to 117° C. (241°-242.6° F.). (*A. J. P.*, 1879, p. 305.)

An analogous substance, *oxycopaic acid*, $C_{20}H_{28}O_3$, was found in 1841 by H. von Fehling in Para copaiba, and Strauss, in 1865, extracted meta-copaivic acid, $C_{22}H_{34}O_4$, from Maracaibo copaiba. Copaivic acid forms crystallizable salts with alkalies, and *sodium copaiivate*, $NaC_{20}H_{29}O_2$, made by combining molecular quantities of the acid and soda, is asserted by Zlamal and Roquette to be more efficient

than any other preparation of copaiba. Tschirch (*Harze und Harzbehalter*, 1900, p. 297) obtained from Maracaibo balsam a crystalline resin acid corresponding in many respects with Strauss's metacopaivic acid, to which, however, he gave the formula $C_{11}H_{16}O_2$, finding a melting point 89° to 90° C. (192.2° - 194° F.) as against 205° to 206° C. (401° - 402.8° F.) for Strauss's acid. Para balsam was found by Tschirch to contain two crystallizable resin acids together with several uncrystallizable ones. African copaiba balsam he found to contain a characteristic acid to which he gave the name *illurinic acid* and the formula $C_{14}H_{20}O_2$ or possibly $C_{21}H_{30}O_3$. Keto, who worked out the preceding results jointly with Tschirch, has since published some additional results. (*J. P. C.*, 1902, p. 381.) He finds in Para balsam the two crystallizable acids referred to above, one of which he names *paracopaibic acid* with the formula $C_{20}H_{32}O_3$ and fusing point 142° to 145° C. (287.6° - 293° F.), and the other *homoparacopaibic acid*, $C_{18}H_{28}O_3$, fusing at 111° to 112° C. (231.8° - 233.6° F.). To *illurinic acid* mentioned by Tschirch he gives the formula $C_{20}H_{28}O_3$ and the melting point 128° C. (262.4° F.).

Copaiba, upon exposure to the air, acquires a deep color, a thicker consistence, and greater density, and, if spread out upon an extended surface, ultimately becomes dry and brittle. This change is owing partly to the volatilization and partly to the oxidation of the essential oil. As it is the soft resin that results from the oxidation of the oil, it follows that the proportion of this resin increases with age. Considerable diversity must, therefore, exist in the drug, and in its physical properties and in the proportions of its ingredients, according to its age and degree of exposure. Similar differences also exist in the copaiba procured from different sources. Thus, that of the *West Indies*, when compared with the *Brazilian*, which is the variety above described, and in common use, is of a thicker consistence, of a deeper or darker yellow color, less transparent, and of a less agreeable, more terebinthinate odor. They differ also, as observed by Buignet, in their action on polarized light, in which they differ not only

in degree, but sometimes also even in direction. (*J. P. C.*, Oct., 1861, pp. 266-7.) It is not impossible that differences may exist in the drug according to the circumstances of its collection. The species of *Copaifera* from which the oleoresin is collected, as well as the age of the tree, its position, and the season of collection, must also have influence over the

product. It is highly probable that the resinous matter results from the oxidation of the oil in the cells of the plant, and that the less elaborated the oleoresin may be, the larger proportion it will contain of the oil. It is said that a volatile oil flows abundantly from a tree near Bogota, which is employed to adulterate the copaiba collected in that vicinity and shipped from Maracaibo and other neighboring ports. *African Copaiba*, or *Balsam of Illurine*, which reached the London market first in 1891, from West Africa, is a brownish substance, having a consistency similar to the Maracaibo copaiba, and a greenish fluorescence. Its aromatic odor is entirely different from that of copaiba; its taste is biting, with an after-taste of bitterness. According to Keto (/. P. C., 1902, 381), its density is 0.9905; its coefficient of acidity 55.5; of etherification 8.3. It is soluble in chloroform and petroleum benzin, also in ether, with which it makes an opalescent liquid. Its solution in absolute alcohol, or alcohol of 95 per cent. is not limpid. From it Keto separated *illurinic acid*. Its volatile oil is of a pale yellow color, with a strong odor entirely different from that of copaiba. The residue which remains after the distillation consists of two resins, one soluble, the other insoluble, in alcohol. This oleoresin probably shares the medicinal properties of true copaiba, and is the product of *Hardwickia Mannii* Oliver, a tree closely allied to the true copaibas. (See *Apoth. Zeit.*, 1894, p. 9.)

Adulterations.—Copaiba is often adulterated with a fixed oil, especially castor oil, which, in consequence of its solubility, cannot, like the others, be detected by alcohol. Various plans have been proposed for recognizing the castor oil. The simplest is to boil a drachm of the copaiba in a pint of water until the liquid is wholly evaporated. If the copaiba contains a fixed oil, the residue will be more or less soft, according to the quantity present; otherwise it will be hard. Magnesium carbonate, potassium hydroxide, and sulphuric acid have also been proposed as tests. In the old Edinburgh Pharmacopoeia it was stated that copaiba "dissolves a fourth part of its weight of magnesium carbonate, with the aid of a gentle heat, and continues translucent." The presence of a small proportion of any fixed oil renders the mixture opaque. One part of potassium hydroxide dissolved in two of water forms a clear solution with nine parts of pure copaiba, and the liquid continues clear when moderately diluted with water or alcohol; but the presence of one-sixth of fixed oil in the copaiba occasions more or less opacity in the liquid, and half the quantity causes the precipitation of white flakes in a few hours. (Stolze.) Turpentine, which is said to be sometimes added to copaiba, may be detected by its odor, especially if the copaiba be heated.

According to Redwood, most of the proposed tests of the purity of copaiba are liable to fallacy, and the best measure of its activity is the quantity of volatile oil it affords by distillation. Castor oil, Venice turpentine, linseed oil, or gurjun balsam may be detected by means of petroleum benzin, which makes a clear solution with pure copaiba, but if either of the substances mentioned be present a milky mixture, which soon settles into two layers, is formed, the copaiba solution being on top. (*A. J. P.*, July, 1873; *Proc. A. Ph. A.*, xxiv, 191, xxvi, 286.) Maisch has found that ten volumes of petroleum benzin, instead of three as proposed by Wayne, must be added to one of copaiba to get the best results from this test. Indeed, it has been shown that pure copaiba will sometimes show turbidity when mixed with petroleum benzin. (*A. J. P.*, 1877, p. 131.) Some years since, a substance was imported into New York, under the name of *red copaiba*, which did not possess a single characteristic of the genuine drug. It was of a thick, semi-fluid consistence, not unlike that of balsam of Tolu, as it often reaches us, of a brown color similar to that of the same balsam, though darker, and of an unpleasant yet somewhat aromatic odor, recalling that of liquidambar, but less agreeable. Its origin is unknown. Hager recommends the use of absolute alcohol, which he says completely dissolves, without turbidity, all the varieties of copaiba except the Para, whose solution on standing clears itself by the deposition of a few white flakes. J. M. Fulton asserts that some pure copaibas are not entirely dissolved by absolute alcohol. (*A. J. P.*, 1877.) For additional tests and criticisms by Beckurts and Brueche, see *A. Pharm.*, 1891, p. 90; also *Proc. A. Ph. A.*, 1892, 635. For Hager's test, see *C. D.*, 1894, 740. Dodge and Olcott (*Am. Drug.*, 1895, 5) describe a test to detect gurjun balsam in copaiba, which Kebler regards as the most reliable yet proposed; it is as follows. Four drops of the suspected sample, dissolved in half a fluidounce of glacial acetic acid, will, if pure, remain colorless and clear, or but slightly cloudy, if from four to six drops of pure nitric acid be dropped into the solution. If the sample be pure gurjun balsam, the mixture will have a deep purple color; if a mixture of the two balsams, the depth of color will vary according to the amount of the adulterant, as small a proportion as 2 per cent. being discoverable; a modification of this test is now official. (See also *A. J. P.*, 1896, 143, and 1897, 394.) For a valuable paper on Copaiba by A. R. L. Dohme, see *Proc. A. Ph. A.*, 1904, 322.

Uses.—Copaiba is gently stimulant, diuretic, laxative, and in very large doses often actively purgative. It produces, when swallowed, a sense of

heat in the throat and stomach, and extends an irritant action not only throughout the alimentary canal, but also to the urinary passages, and in fact, in a greater or less degree, to the whole mucous membrane, for which it appears to have a strong affinity. The urine acquires a peculiar odor during its use, and its odor may be detected in the breath. It sometimes occasions an eruption upon the skin resembling that of measles, and attended with disagreeable itching and tingling, or even violent pemphigus. (*N. Y. M. J.*, Jan., 1873, p. 416.) Nausea and vomiting, painful purgation, strangury and bloody urine, and a general state of fever are caused by excessive doses. As a remedy it has been found useful in *catarrhs*, particularly those of a chronic character. Thus, it is given with occasional advantage in *leucorrhoea*, *chronic cystitis*, *chronic diarrhoea*, *hemorrhoids*, and *chronic bronchitis*. The complaint, however, in which it is most employed is *gonorrhoea*. It should not be administered in the first stages, when the inflammation is severe and acute, nor is it applicable to very chronic forms of the disorder, such as gleet. It was formerly much esteemed as a vulnerary and as an application to ulcers, but it is now seldom used externally. Ruschenberger recommends it locally in *chilblains*. (*Med. Examiner*, i, 77.)

Both the volatile oil and the resin are eliminated by the kidneys in an altered condition; if to the urine of a person taking the drug, nitric acid be added, a precipitate is thrown down, which may be mistaken for albumin. The volatile oil is more active than is the resin, which is not, however, inert. Wilks, of Guy's Hospital, London, speaks of the resin with great confidence as a hydragogue diuretic in obstinate *dropsy*, given in the dose of fifteen or twenty grains three times a day.

It may be given dropped on sugar, but in this form is often so exceedingly offensive as to render some concealment of its nauseous qualities necessary. A less disagreeable form is that of emulsion, prepared by rubbing the copaiba first with mucilage, or the yolk of an egg, and sugar, and afterwards with some aromatic water, as that of mint or cinnamon. The *volatile oil*, which is official in the British Pharmacopoeia, may be given in the dose of ten or fifteen minims (0.6-0.9 mil) in emulsion, or, as is almost universally preferred, in capsules.

Dose, of copaiba, from fifteen minims to a fluidrachm (1.0-3.75 mils) three times a day, or a smaller quantity repeated more frequently.

Off. Prep.—Massa Copaibae, *N. F.*; Mistura Copaibas, *N. F.*; Mistura Copaibae et Opii, *N. F.*; Oleum Copaibae, *Br.*

Copal.—The *copals* are a class of hard resins used principally in varnish manufacture. They are of various origins, both geographically and botanically. Their principal characteristics are their hardness, high melting point and comparative insolubility unless subjected to destructive distillation. There are three chief varieties: (1) *Fossil copal*, found in the ground in localities where the trees yielding it have entirely disappeared. (2) *Semi-fossil copal*, collected from the ground in the neighborhood of living copal trees. (3) *Fresh copal*, found on living trees, either as the result of natural exudation or from artificial incisions. The fresh copal is of least value and the fossil copal is most highly prized.

East African copals, known in commerce as *Animi gum* or *resin*, are fossil varieties coming from Zanzibar, Madagascar and along the East African Coast. American copals are collected in South America and probably originated from trees related to those which produced the East African copals, although the product is softer. *Kauri* or *cowrie copal* or Kauri gum, as it is often called, is found in New Zealand exclusively. M. Kahan has investigated *Acera copal* and *Benin copal* (*Arch. d. Pharm.*, 1910, ccxiviii, p. 443) and gives the percentages of the various constituents found.

A study of South American varieties of copal has been made by S. Machenbaum (*Arch. d. Pharm.*; 250, Nos. 1-6 and 13), in which the constituents are stated to be *copalic acid*, *copalolic acid*, *copalo-resene*, *copalmic acid*, volatile oil and ash.

Fossil copal from Guiana has been studied by J. C. Essner (*Annal. Chim. Anal.*, xvii, p. 166), who gives the following constants: Sp. gr. 1.089; colorless portion, acid value 118, saponification value 127, iodine value 84.3; yellow portion, acid value 125, saponification value 151, iodine value 81.5.

Zanzibar copal is obtained from several species of *Trachylobium*. The trunk and limbs are covered with a clear resinous exudation, portions of which, after solidifying, drop to the ground and are collected, while other portions are broken from the tree. This kind of resin is always smooth, and is exported to India. Another variety, with an indented, goose-flesh surface, known in the English market as *anime*, is dug from the earth, and though the product of forests now extinct, originated probably from the same tree. (*P. J.*, 1869, G54.) It is in roundish, irregular, or flatfish pieces, sometimes several pounds in weight, often rough over the surface, probably from the impression of sand in its soft state, colorless, or brownish-yellow, more or less transparent, very hard, with a shining, conchoidal fracture, inodorous and tasteless. By heat it melts and emits gases, loses from 15 to 20 per cent. of weight, and is altered so as to become more soluble in ether, alcohol, or oil of turpentine, and in this way copal varnishes are usually made. It is not a proximate principle, but consists of various resins united in different proportions. According to Unverdorben and Filhol, some five different resins can be obtained by the successive action of solvents. *Sierra Leone copal* comes from Western Africa. According to Daniell (*P. J.*, xvi, p. 369), this is derived from the *Copaifera Guibourtiana* Benth., a large tree growing preferably in

mountainous regions. The drug is mostly collected, not from the tree itself, but from the beds and borders of streams, into which it is washed down, during the rains, from the hillsides, in the soil of which it had been deposited.

The Sierra Leone copal is described by Daniell as occurring "in small round tears, or irregular conical and smooth nodulated masses, seldom exceeding in size an ordinary duck egg. They are covered, to a greater or less extent, by a peculiar white efflorescence, which increases by age. Their color graduates from a pale green to a lemon or dull yellow."

Inhambane copal has been shown to be the product of *Copaifera Gorskiana* Benth. and seeds sent to Kew Gardens in 1886 germinated, and the plant has been widely introduced into both the East and West Indies, and into Australia. (*P. J.*, xix, 508.)

A variety of copal comes from the East Indies. This has been ascribed to *Vateria acuminata* Hayne (Fam. *Dipterocarpaceae*), but is probably the product of a *Trachylobium*; at least a specimen of this resin was collected by Perottet from the *Trachylobium Hornemannianum* Hayne, which he found growing in the Isle of Bourbon. This tree is a native of Madagascar, and probably of the neighboring parts of Africa, and Perottet was informed that the copal of India is taken thither by the Arabs of Muscat, who obtain it from the east coast of Africa. (*J. P. C.*, 3e ser., i, 406.) It is described by Schindler as of a globular form, softer and more transparent than the other varieties, with a surface always clear, and having an agreeable odor when heated. It is readily and freely dissolved by the oils of turpentine and rosemary when pure, but not by these fluids when rendered resinous by age. It is more readily fusible than the others, and makes the best varnish.

The West India copal is in flat pieces, seldom weighing more than three ounces, rarely containing insects, very hard, of a rough appearance, of a yellowish color, and without odor or taste. It is much less readily dissolved by oil of turpentine than the East India variety, swells but does not dissolve in oil of rosemary and is slightly soluble in absolute alcohol. Another kind, probably also American, is in convex or concave pieces, about a pound in weight, often containing insects and other impurities. In solubility it resembles the last mentioned variety, in fusibility is intermediate between it and the East Indian, and is altogether inferior. (*P. J.*, 1850.) For an account of the present views on the nature of copal resins, see Tschirch, *Die Harze und die Harsbehalter*, Leipzig, 1900.

For descriptions of the so-called Manila copal and Kauri copal which are derived from the conifers, see p. 1417.

Copal lotion.—Under the trade name *Adhaesol* there appears on the market a lotion containing: Copal, 350 parts; benzoin, 30 parts; tolu, 30 parts; ol. thyme, 20 parts; alpha-naphthol, 3 parts; ether, q. s., 1000 parts. It is used as an antiseptic varnish in *diphtheritic affections* of the throat.

Coptis. *N. F. IV. Goldthread. Coptide*, Fr. *Gelbe (Kleinste) Niesswurz*, G.—"The dried plant of the *Coptis trifolia* (Linne) Salisbury (Fam. *Ranunculaceae*)."
N. F. This plant inhabits the northern region of this continent and of Asia, and is found in Greenland and Iceland. It delights in the dark shady swamps and cold morasses of northern latitudes and alpine regions, and abounds in Canada and in the hilly districts of the Northern United States.

Dried goldthread, as brought into the market, is "in loose, matted masses consisting of long, much branched rhizomes and their small roots together with the leaves. Rhizomes orange or golden-yellow; leaves evergreen, long and slenderly petioled, trifoliate, the segments broadly obovate-cuneate, crenately lobed and toothed with sharp-pointed teeth, prominently veined, smooth, coriaceous, dark green and shining but often drying to a dull brownish hue; flowers, if present, small, solitary, terminating slender scapes, sepals five to seven, oblong, obtuse, deciduous; petals five to six, pale yellow, small club shaped; stamens numerous. Odor faint; taste purely bitter without astringency. The powdered drug is yellowish-green and, when examined under the microscope, exhibits numerous, mostly simple, starch grains, somewhat rounded, up to 0.007 mm. in diameter; fragments of leaf epidermis, composed of cells with wavy vertical walls and broadly elliptical stomata, the latter up to 0.024 mm. in length; fragments of the nerved scales from the nodes, composed of cells with yellow walls; leaf parenchyma cells containing chloroplastids; few, simple, thick-walled hairs from the midrib of the leaf, from 0.035 to 0.075 mm. in length; elongated, epidermal cells from the roots having yellow walls and filled with reddish contents; fragments of epidermal and sub-epidermal cells from the rhizome, similar to those from the root, but without reddish contents, often filled with a yellowish content; groups of elongated parenchyma cells about 0.06 mm. in length and about 6.01 mm. in width, many being filled with starch grains; tracheae with bordered pores or spiral markings, about 0.02 mm. in width; narrow thin-walled, porous sclerenchyma fibers. *Coptis* yields not more than 8 per cent. of ash." *N. F.* It imparts a bitterness and yellow color to water and alcohol, but most perfectly to the latter, with which it forms a bright yellow tincture. The infusion is precipitated by silver nitrate and lead acetate. (Bigelow.) It affords no evidence of containing either resin, gum, or tannin. The plant undoubtedly contains berberine, which, according to F. F. Mayer (*A. J. P.*, 1863) and

E. Z. Gross (*A. J. P.*, 1873), is associated with another alkaloid. Gross states that coptine differs from berberine in its colorless crystals, and by forming with mercuric potassium iodide (Mayer's reagent) a crystalline instead of flocculent precipitate. (See also John J. Schuiz, *A. J. P.*, 1884, 261.)

Goldthread is a simple tonic bitter. In New England it is employed as a local application in aphthous ulcerations of the mouth, but it probably has no other virtues in flits complaint than such as are common to the simple bitters. It may be given in substance, infusion, or tincture. The dose of the powder is from ten to thirty grains (0.65-2.0 Gm.) ; of a tincture made with an ounce of the root to a pint of diluted alcohol, one fluidrachm (3.75 mls), and of the *N. F.* fluidextract thirty minims (2 mls).

The *Coptis Teeta* of Wallich, which grows in the mountainous regions bordering on Assam, is much used as a tonic by the natives and by the Chinese. It is analogous in

properties to *C. trifolia* Salisb., and is said to contain 8¹/₂ per cent. of berberine. It has been brought into use in British India. It is highly commended by Twining as a stomachic tonic. (P. J., 1870, 161.) *Coptis anemonifolia* Sieb. and Zucc. also contains berberine, and has been used in Japan in intestinal catarrh. (*Sei-i-Kwai*, 1892.)

Corallorhiza. *Corallorhiza odontorhiza*(Willd.) Nutt. *Coral-root.* (Fam. *Orchidaceae.*)—This is a parasitic leafless herb, sending up from a coral-like rhizome a simple scape or flower stem, from six to sixteen inches high, furnished with sheaths instead of leaves, of a light brown or purplish color, and bearing small, greenish-brown flowers in a long spike. The plant grows throughout the United States east of the Mississippi. The rhizome is the part used. It is much branched and toothed, and of a brown color, and its resemblance to coral gave name to the plant. It has a strong peculiar odor, and an astringent bitterish taste. It is much valued by the eclectics as diaphoretic in *fevers*; *dose*, of powder, thirty grains (2 Gm.) every two hours.

CORIANDRUM. U. S. (Br.)

CORIANDER Coriand. [Coriander Seed]

"The dried ripe fruit of *Coriandrum sativum* Linne (Fam. *Umbelliferae*), without the presence or admixture of more than 5 per cent. of other fruits, seeds, or foreign matter." U. S. "Coriander Fruit is the dried ripe fruit of *Coriandrum sativum*, Linn." Br.

Coriandri Fructus, Br.; Coriander Fruit; Coriandre, Fr. *Cod.*; Koriander, G.; Coriandro, It.; Cilantro, Sp.

Coriandrum sativum is an annual plant, with an erect branching stem rising about two feet, and furnished with compound leaves, of which the upper are thrice ternate, with linear pointed leaflets, the lower pinnate, with the pinnae cut into irregular serrated lobes like those of parsley. The flowers are white or rose-colored, and in compound terminal umbels; the fruit globular, and composed of two concavo-convex mericarps. *C. sativum* is a native of Italy, but at present grows wild in most parts of Europe, having become naturalized in consequence of its extended cultivation. The flowers appear in June, and the fruit ripens in August. It is a singular fact that all parts of the fresh plant are extremely fetid when bruised, while the fruit becomes fragrant by drying. This is the official portion. The chief supplies come from Russia, Morocco, Holland, and Hungary. Attempts have been made to cultivate the plant in Vermont. The amount annually imported into the United States is over 1,000,000 pounds. The drug not infrequently contains a

large admixture of earthy and stony substances as well as stems and similar inert matter. Bloine reports finding a sample of Coriander that contained 20 per cent. of flaxseed. LaWall has found leguminous starch in a specimen of powdered Coriander, probably from vetch seed which is sometimes accidentally present.

The fruit is officially described as follows: "Mericarps usually coherent; cremocarp nearly globular, from 3 to 5 mm. in diameter; externally light brown or rose colored; summit with 5 calyx teeth and a short stylopodium, each mericarp with 5 prominent, straight, longitudinal, primary ribs and 4 indistinct, undulate secondary ribs; mericarps easily separated, deeply concave on the inner or commissural surface and showing in transverse section 2 vittae (oil tubes) on the inner surface of each. Under the microscope, sections of Coriander show an epidermis of small cells with thick walls; a layer of several rows of thin-walled more or less collapsed parenchyma separated from a broad zone of strongly lignified, sclerenchymatous fibers which extend as a continuous ring in the mesocarp of each of the mericarps; 2 or 3 layers of large, tangentially elongated, thin-walled parenchyma cells, frequently with numerous large lysigenous intercellular spaces; inner epidermis of large tabular cells, the inner yellowish walls being considerably thickened and closely coherent to the brownish cells of the seed-coat; commissural surface with 2 large, elliptical vittae; the cells of the pericarp separated from the seed-coat and forming a large elliptical cavity; endosperm distinctly reniform in outline and consisting of tabular or polygonal thick-walled cells containing numerous large aleurone grains each with a rosette aggregate or prism of calcium oxalate. The powder is light brown, consisting chiefly of fragments of endosperm and lignified tissues of the pericarp; calcium oxalate crystals numerous,

from 0.003 to 0.01 mm. in diameter, mostly in rosette aggregates, either isolated or in aleurone grains; sclerenchymatous fibers irregularly curved, having thick, yellowish, lignified walls and numerous simple pores; numerous globules of fixed oil; fragments of light yellow vittae few, associated with elongated polygonal epidermal cells. Coriander yields not less than 0.5 per cent. of volatile extractive, soluble in ether (see Part II, Test No. 12). Coriander yields not more than 7 per cent. of ash." *U. S.*

" Nearly globular, about five millimetres in diameter, uniform brownish-yellow in color, and glabrous. Mericarps usually closely united, and

crowned by the calyx teeth and stylopod. Primary ridges wavy and inconspicuous; secondary ridges straight and more prominent. In transverse section, two vittas on the commissural surface of each mericarp. Aromatic odor, especially when bruised; taste agreeable." *Br.*

The aromatic taste and odor of coriander depend on a *volatile oil*, which may be obtained separate by distillation. One pound of the seeds yields forty-two grains of the oil. (Zeiler.) This is colorless or pale yellow, with an agreeable odor of coriander, a mild aromatic taste, and a sp. gr. varying from 0.87 to 0.88. Its main constituent, according to Semmler (*Ber. d. Chem. Ges.*, xxiv, 206), is what was first called *coriandrol*, but is now recognized as right rotatory *linalool*, C₁₀H₁₈O, boiling between 194° and 198° C. (381.2°-388.4° F.). Besides this, about 5 per cent. of *dextro-pinene* was isolated, boiling between 156° and 160° C. (312.8°-3200 F.). It is one of the most permanent volatile oils, long resisting oxidation. The fruit's virtues are imparted to alcohol by maceration, and less readily to water.

Uses.—Coriander is a rather feeble aromatic. It is almost exclusively employed in combination with other medicines, either to cover their taste, to render them acceptable to the stomach, or to correct their griping qualities. It was well known to the ancients.

Dose, twenty to sixty grains (1.3-3.9 Gm.).

Off. Prep.—*Confectio Sennae, Br., N. F.*; *Syrupus Rhei, Br.*; *Syrupus Sennae, (from Oil), U. S.*; *Tinctura Rhei Composita, Br.*; *Tinctura Sennae Composita, Br.*; *Fluidextractum Stillingiae Compositum, N. F.*; *Infusum Gentianae Compositum, N. F.*

Coriaria. *Coriaria myrtifolia* L. *Currier's Sumach. Redoul, Sumach des Corroyeurs* Fr. *Gerberstrauch; G.* (Fam. *Coriariaceae*).—This is a shrub growing wild in Southern Europe, which is sometimes cultivated in gardens on account of its handsome foliage. The leaves, which are used for dyeing black, were at one time employed to a considerable extent in France in the adulteration of senna. They have recently been reported both in Europe and in America as an adulterant of sweet marjoram, the *coriaria* leaves being finely broken to facilitate admixture. The presence of *coriaria* in marjoram may be inferred by strewing a specimen of the broken up leaves upon the surface of a dilute ferric chloride solution, which does not affect the fragments of marjoram but which quickly stains the *coriaria* fragments a deep greenish-black, owing to their high tannin content. The fruit, resembling berries in form, are black, and about the size of a pea. Both these and the leaves are poisonous in large doses, and several instances of death are on record from eating the fruit. (Merat and De

Lens.) Riban (*J. P. C.*, 1864, p. 487) separated from the fruit a glucoside *coriamyrtin*. He obtained it by treating the juice with lead acetate, precipitating the lead with hydrogen sulphide, concentrating the lead with a nitrate to a syrupy consistency and extracting with ether. It occurs as extremely bitter, white crystals, fusing at 220° C. (428° P.), sparingly soluble in water but freely so in alcohol and other organic solvents. Its empirical formula is C₃₀H₃₆O₁₀. Marshall (*J. P. Ex. T.*, 1912, iv, p. 135) studied the substance supplied by Merck under the name of coriamyrtin which, however, he believed to be different from that described by Reban, because it was soluble in water. The lethal dose was 1 mgm. per kilo. He found that it was a stimulant to the medullary centers, increasing the blood-pressure and respiration and slowing the pulse; in large doses it caused cerebral convulsions. Coriamyrtin has been employed as a stimulant in *collapse* in doses of one-sixtieth of a grain (0.001 Gm.).

Tolocopetale, a Mexican drug, is said to be the product of a *Coriaria*, probably *C. myrtifolia*, containing *coriarin* and *coriamyrtin*, and to be actively poisonous.

Toot-poison. Tu-tu.—In New Zealand a poisonous plant, known as the *toot-plant*, has proved very destructive to the domestic animals. W. Lauder Lindsay found it to resemble either *Coriaria ruscifolia* of Linnseus or *C. sarmentosa* Forst., and in its action on the system to be an irritant narcotic. For an elaborate account of the *toot-plant*, and its poisonous effects, see *Brit. and For. Med. Chir. Rev.*, 1865, 153, and 1868, 465. From these it appears that more than one species of *Coriaria* inhabit New Zealand, *C. thymifolia* Humb. et Bonpl. and *C. angustissima* Hook. f., besides the *ruscifolia*; though Lindsay appears to think that the two former may be merely varieties of the third. It is not only cattle that are poisoned by the plant, but not infrequently also children, and occasionally even an adult. The cattle are probably, in general, poisoned by eating the young shoots. W. S. Key attributes poisonous qualities to an oil (*Chem. News*, 1890, xxii), but it has been shown by T. Hill Easterfield and B. C. Aston that the three New Zealand species of coriaria contain a glucoside, *tutin*; C₁₇H₂₀O₇, which is not identical with coriamyrtin, and which, according to Marshall, is toxic, especially to the medulla oblongata and the basal ganglia of the brain. (*Proc. Chem. Soc.*, xvi, 213.) It is affirmed by T. H. Hartwick (*P. J.*, vol. xv, 22) that goats are not poisoned by the tu-tu, and that they have even been used to eradicate the plant by browsing, also that the berries when ripe are not only not poisonous to man, but, if care is taken to reject the seeds, are a grateful and refreshing fruit. The prominent symptoms of the poisoning in man are giddiness, stupor, and coma, with or without delirium or convulsions. Occasionally the delirium resembles that of alcoholic intoxication, in other instances approaches that of acute mania, and is attended with violent muscular action. Loss of memory is a characteristic of the convalescence. The toxicity of *tutin*, which was demonstrated by Marshall, has been confirmed by Ford (*J. P. Ex. T.*, 1910, ii).

Cork. *Suber. Liege*, Fr. *Kork*, G.—The great use made of this substance in pharmacy and the arts justifies a brief notice of it. It is chiefly produced by *Quercus Suber* L. (Fam. *Cupuliferae*), but is obtained also from the *Q. occidentalis* F. Gay. It consists of the exterior layers of the bark beneath the epidermis, which acquire in these species an extraordinary development, becoming thick, and of that peculiar spongy

consistence which characterizes cork. The tree begins to yield cork when fifteen or sixteen years old, and every six or eight years—the interval requisite for the renewal of the suberose layers by the living portions of the bark beneath—furnishes a fresh supply, even for a century and a half, before it perishes. There are four constituent layers of the bark: the epidermis, the cork, the cellular envelope, and the bast which lies upon the wood. Each of these increases year by year; but the cork thus naturally produced is not valued. The commercial product is the result of an artificial injury to the bark. The exterior layers are removed, and the bast exposed. In the interior of this, at a variable distance from the surface, a layer of the proper cork is now formed, apparently by a change in the substance of the bast, the outer portions of which perish, while annually a new layer is added to the cork already existing, until it acquires a thickness which will justify its removal. Incisions are made in such a way that the cork is removed in large concave plates, which are then flattened under pressure, and dried. At present cork comes into commerce from Portugal, Spain, France, Italy, Tunis, Algeria, and Morocco. About one million of quartels of it are said to be produced annually. The value of the cork imported into the United States in 1914 was \$3,851,794.; and in 1915 \$2,761,895.

A cork has recently come into the United States commerce from Nicaragua. It has been found by E. F. D. Baker to be obtained from the roots of the *Anona*, a tree closely resembling in appearance the ordinary cottonwood of the United States.

In selecting cork for use, those parts should be preferred which are soft and of uniform consistence, and in the choice of the larger plates those should be selected which are thick, flexible, elastic, finely porous, and of a reddish color. Boiling hot alcohol extracts from rasped cork tissue some 10 per cent. of soluble principles. From the hot alcohol solution a substance crystallizes which was first noticed by Ghevreui under the name of *cerin*. According to Kugler (*Dissertation on Suberin*, Halle, 1884), besides cellulose and lignocellulose, cork contains two constituents, *cerin*, to which he gives the formula $C_{20}H_{32}O$, and *suberin*, which is a fat, and contains stearic acid and *phellonic acid*, $C_{22}H_{42}O_3$. This constituent, suberin, prevents the penetration of liquid into the cork, and is only extracted by alcoholic alkali solutions. When treated with nitric acid, cork yields a peculiar acid, which has been denominated *suberic acid*. This is a dibasic acid homologous with oxalic acid, and has the formula $C_3H_{14}O_4$. It is formed by the oxidation of many other substances, such as the oils from linseed, castor bean, cocoa, nut, almond, spermaceti, etc.

Stanislaus Martin has called attention in France to the use of refuse corks in Paris, where they are collected by the scavengers, and sold to persons whose business it is to revive them, recutting such as are of unsuitable shape, filling up the interstices with mastic, and covering them over with some powder which may give them a fresh appearance. Corks are sometimes bleached with sulphurous acid, and the odor of hydrogen sulphide has been noticed in prescriptions which have been compounded, when such corks have been used in the dispensing bottle. (*P. J.*, 1881, 1080.) Mohr has found that old corks may be regenerated by allowing them to soak for twenty-four hours in hot water, washing well several times, allowing to stand for a few hours in a mixture of one part of hydrochloric acid and fifteen parts of hot water, and finally

washing well in pure water. (See also *A. J. P.*, 1875, 467.) It is easy to conceive that a cork at one time used to enclose arsenical or other deadly solution may become saturated with the poison, and afterwards impart enough of it to another liquid, if not to produce dangerous effects on the health, at least to give to tests evidence of its presence, and thus lead to serious suspicions. No cork, therefore, which has been used in a bottle containing a poisonous substance should be employed a second time.

Cornus. *N. F. IV. Dogwood Bark. Ecorce de Cornouiller a grandes fleurs, Fr. GrossbluthigeCornelrinde, G.*—This drug, which was at one time official in the U. S. P., is described by the N. F. as "the dried bark of the root of *Cornus florida* Linne (Fam. *Cornaceae*). In irregular, chip-like pieces, or portions of quills, usually less than 5 cm. in length and from 1 to 4 mm. in thickness; externally of a dingy-brown color, lightly fissured and thinly scaly, or reddish where the corky layer has been removed; inner surface varying from pinkish-brown to red-purple, usually harsh to the touch from numerous short striae; fracture short, the surface whitish with yellow striae, except the inner layer, which is light purple. Odor slight; taste bitter and astringent. *Cornus* yields not more than 10 per cent. of ash," *N. F.*

The barks of two other indigenous dogwoods are sometimes substituted for that of *C. florida* L. Each of these is a shrub with opposite leaves, the flowers in flat spreading cymes, and the fruit globular and bright red. *C. circinata* L'Her. is further distinguished by its branches being greenish and warty; its leaves round-oval, abruptly pointed, and woolly underneath. *C. Amomum* Mill. (*C. sericea* L.), Silky cornel or Swamp Dogwood, is to be recognized by its purplish branches, and by the fact that the branchlets, stalks, and lower surface of the elliptical pointed leaves are silky and downy. (See also *Chem. News*, 1908, 191.)

These dogwoods are found in all portions of the United States east of the Mississippi.

Dogwood bark was used many years ago as an antiperiodic in *intermittent fever*, but it is only a feeble, astringent tonic. Formerly from one to two ounces of the powder were given in the interval between the paroxysms of intermittent fever. The N. F. IV also recognizes its fluidextract. The dose of this fluidextract is from half a fluidrachm to a fluidrachm (1.8-3.75 mils).

Coronilla. *Coronilla scorpioides* Koch (Fam. *Leguminosae*).—In 1886 Cardot, in a thesis (Nancy) announced that the *Coronilla scorpioides* (Medic.) Koch, a papilionaceous plant of Southern France, is an active cardiac poison. In 1889 Schlagdenhauffen and Reeb (*Rev. Gen. de Clin. et de Therap.*, July, 1889) isolated a glucoside, *coronillin*, to which they assigned the formula $C_7H_{12}O_5$. It was a yellowish powder, soluble in water, acetone, and amyl alcohol; slightly soluble in chloroform and ether. Heated with diluted hydrochloric acid an amorphous resin was separated, *coronillein*. This also occurs as a yellow powder, but is not bitter to taste. It is insoluble in water, but dissolves in alcohol, acetone, and chloroform. The physiological studies by Gley, by Schlagdenhauffen and Reeb, and by Maramaldi (*R. T.*; cxxxvi) have demonstrated that coronillin acts upon the heart in a manner similar to digitalis. In small doses it slows the pulse through stimulation of the inhibitory ganglia, and in

larger quantity increases the tonicity and contractility of the heart, eventually leading to systolic spasm of the ventricle. This action upon the heart is accompanied by increase in the arterial pressure, followed after a time by lowering of the pressure, which apparently is the result of failure of diastole, causing the amount of blood forced out of the heart at each systole to be insufficient to fill the arteries. The drug also depresses the spinal cord, and lowers the respiratory movements by an action which is believed by Maramaldi to be partly centric and partly peripheral. Death is produced by cardiac arrest.

Locally, coronillin appears to be actively irritant. In Maramaldi's experiments it failed to assert its physiological action when administered to the dog by the mouth, a result believed by the investigator to be due to its decomposition by the acid in the stomach. As it has been found by various clinicians to be active in man when given by the mouth, it is probable that the comparative feebleness of human gastric juice permits of its absorption unchanged. The dose given by various clinicians has varied greatly, probably because of differences in purity of the various samples used; of the commercial coronillin the *dose* is commonly stated at present to be one and one-half grains (0.096 Gm.) from four to six times a day, but it must be noted that Schlagdenhauffen affirms that three-fourths of a grain (0.048 Gm.) is a toxic dose. *Coronilla varia* of Europe also probably contains coronillin. (V. Poulet, *B. G. T.*, 1891.)

Corylus. *Corylus rostrata* Ait. *Beaked Hazel*. —This is a small indigenous shrub of the Fam. *Betulaceae*, growing especially in mountainous districts. The nut is invested with a scaly involucre, projecting beyond it like a beak, and thickly covered with short spicules like those of *Mucunapruriens* DC. (Fam. *Leguminosae*.) These spicules have been employed by Huebener as an anthelmintic. They operate in the same way as cowhage, and may be administered in the same manner and dose. (See *A. J. P.*, xiv, 280.)

According to Baruttan and Davidsohn (*M. M. W.*, 1909, p. 2482), the *hazel-nut* contains an alcoholic soluble substance which acts as a stimulant to the uterine muscle. An alcoholic extract is placed upon the market under the name of *mensan* which these authors have found useful in the treatment of *uterinehemorrhages* due to chronic endometritis. The dose employed was a tablespoonful twice a day.

Corydalis. *N. F. IV. Turkey Corn. Squirrel Corn. Bicuculla.*—"The dried tubers of *Bicuculla canadensis* (Goldie) Millspaugh, usually somewhat mixed with the dried bulb-like portions of *Bicuculla Cucullaria* (Linne) Millspaugh (Fam. *Fumariaceae*), and without the presence of more than 5 per cent. of other parts of the plants or other foreign matter." *N. F.* It is described in the *N. F.* as "the tubers are spheroidal and frequently vertically depressed, the flattened surface more or less concave, up to 15. mm. in diameter; usually single, rarely two or more in a cluster; externally, minutely pitted or nearly smooth; grayish-brown, grayish-black, or amber-colored and more or less translucent; one of the flattened surfaces with a triangular scar from detached roots, the other usually with remains of the slender rhizome; fracture, hard and horny, exhibiting a yellowish, waxy interior, or somewhat tough and granular, exhibiting a yellowish-white interior. The grains of the granulate bulb of *Bicuculla Cucullaria* are

ovoid or triangular-ovoid and up to 12 mm. in length; the larger grains distinctly concave on one surface, with a scar at the apex from the detached petiole, and usually attached to the short root-stock in clusters of three; the smaller grains usually separated from the root-stock, with an acute apex, and a scar at the base; externally, yellowish or grayish-brown, usually translucent; fracture hard and horny, exhibiting a grayish, waxy interior, or granular and tough, exhibiting a whitish interior. Nearly odorless; taste slightly bitter." N. F. It is said to yield its active properties to water and alcohol. It contains *corydaline*, *corycavine*, *bulbocapnine*, and *corydine*, all alkaloidal principles. Corydaline, $C_{22}H_{27}O_4N$, is a tertiary base; corycavine, $C_{33}H_{23}O_4N$, is a difficultly soluble base; bulbocapnine, $C_{19}H_{19}O_4N$, which is present in largest amount, was originally called corydaline; corydine is a strong base found in the mother liquors of bulbocapnine. The total amount of alkaloids in the dried bulbs is about 5 per cent. according to Gadarner, who found in addition to the foregoing crystalline alkaloids, corybulbine and several amorphous bases which were not named. The chemistry of these numerous bases is somewhat confused and needs further research work. It is used in the N. F. Compound Elixir of Corydalis, the Fluidextract of Corydalis, and the Compound Fluidextract of Stillingia.

"The powdered drug is light yellow or yellowish-gray and, when examined under the microscope, exhibits numerous oval, ovoid or oblong, simple starch grains, the broad end of the grain sometimes truncate, up to 0.06 mm, in length and frequently with a cleft or horseshoe-shaped fissure in the small end of the grain; occasionally in two-compound grains; altered starch grains up to 0.09 mm. in length; numerous angular or rounded parenchyma cells isolated or in groups and containing more or less altered starch grains the outlines of which are indistinct; tracheae few with reticulate, simple pores, annular or spiral markings; fragments of epidermal cells with thin brownish walls; sclerenchyma fibers very few or absent; few characteristic sclerotic cells from the root-stock of *Bicuculla Cucullaria*, irregular in outline, mostly elongated up to about 0.75 mm. in length and 0.1 mm. in width, walls heavily lignified and about 0.02 mm. in thickness and porous, occurring isolated or in groups of from two to four; very few sclerotic cells from the rhizome of *Bicuculla canadensis*, mostly isodiametric, uniformly smaller than in *Bicuculla Cucullaria* and with walls about 0.012 mm. in thickness, not distinctly irregular in outline; very few rosette aggregates of calcium oxalate, up to 0.02 mm. in diameter, from the portions of rhizome of *Bicuculla canadensis*. An infusion prepared by placing 5 Gm. of powdered Corydalis in 100 mls of hot distilled water, stirring occasionally during ten minutes and then filtering, is of a light amber color, and gives a precipitate with potassio-mercuric iodide T.S. and a dark blue color with iodine T.S. Corydalis yields not more than 8 per cent. of ash." N. F.

For further information concerning the composition of corydalis, see *U. S. D.*, 19th ed., p. 1414.

The tubers of bicuculla are asserted to be tonic, diuretic, and alterative, and are given in *syphilitic*, *scrofulous*, and *cutaneous affections*, in the dose of from ten to thirty grains (0.65-2.0 Gm.). They are also used in the form of tincture and decoction. *Corydalin* or *corydalia*, of the eclectics, is an impure resinous mixture. Fischer and

Svell have found that the *Dicentra Cucularia* Torr., a plant closely resembling *B. canadensis*, but producing no tubers, contains three alkaloids, one of which is *protopine*. (*Ph. Archiv*, No. 7, 1903.)

Makoshi has found in *Corydalis ambigua*, which is employed as a medicine in China, a number of the same alkaloids as occur in the above species, and others closely allied to them. (*A. Pharm.*, 1908, ccxvii, p. 387.) According to Heyl (*P. J.*, 1910, lxxxv, p. 325) the alkaloid *protopine* occurs in several species of *corydalis*, although it is not found in *C. cappa*.

Cosciniium. *Br. Add.*—The dried stem of *Cosciniiumfenestratum* Colebr. The stem of this menispermaceous plant has long been used in Ceylon and Southern India as a yellow dye and bitter tonic, and has found its way into Europe under the names of *false columba* and *tree turmeric*. It almost certainly contains berberine and is an efficient stomachic. The *Br. Add.* recognized an *infusion* (*Infusum Coscinii*, *Br. Add.*), *dose*, one-half to one fluidounce (15-30 mls); a *concentrated solution* (*Liquor Coscinii Concentratus*, *Br. Add.*), *dose*, one-half to one fluidrachm (1.8-3.75 mls); and a *tincture* (*Tinctura Coscinii*, *Br. Add.*), *dose*, one-half to one fluidrachm (1.8-3.75 mls).

Coto Bark.—In the years 1873 and 1874 a bark bearing this name appeared in the London drug market, coming from Bolivia. Its botanical origin still remains unknown. Under the name of *coto-coto*, the bark of a rubiaceous plant (*Palicourea densiflora*) is employed in Brazil in *rheumatism*. Whether this be the Bolivian plant or not is uncertain. (See also *Paracoto*)

Coto bark occurs in pieces 3 dm. or more long, from 3 to 6 cm. wide, and from 5 to 15 mm. thick. The outer surface is irregular, often looking as though it had been shaved or split off, and in other parts covered with a fine adherent corky layer free from lichens; the inner surface also is irregular, with numerous rather closely placed, longitudinal projecting bark bundles.

The general color approaches cinnamon-brown; upon fresh cross-section the bark is seen to be filled with yellowish spots, except in the outer portions. The odor is aromatic, and much more apparent if bruised; the taste hot, and somewhat aromatic; the powder is very pungent to the nostrils. The microscope shows the outer bark to be composed of thin-walled, colorless, parenchymatous cells, containing starch granules, with numerous yellowish sclerenchymatous cells joined into groups. The inner bark contains numerous yellow bark cells, mostly joined into bundles of from twenty to fifty. For microscopic structure, see *P. J.*, vi, 301, also *Ph. Era*, May, 1888. The *coto bark* which we have seen in the American market conforms with the original description, but other barks are said to pass under the name. The most important of these is the so-called *Paracoto* bark, which is stated to differ from the true *coto bark* chiefly in its having a less pungent but more agreeably spicy taste, and being marked with deep whitish furrows upon its surface. Wittstein found in *coto bark* a volatile alkaloid, a pungent aromatic volatile oil, yellowish-brown soft resin, brown hard resin, starch, gum, sugar, calcium oxalate, tannin, and formic, butyric, and acetic acids. (*A. Pharm.*, iii, 4, 219.) Jobst and Hesse obtained a crystallizable body, *cotoin*, from true

coto bark, by making an ethereal extract from the powdered bark, treating this with warm petroleum benzin, and allowing the mixture to stand until clear. The clear liquid yields cotoin in crystals on spontaneous evaporation. The oily resinous residue contains considerable cotoin, which may be obtained by boiling with milk of lime and adding to the solution hydrochloric acid. After twenty-four hours the clear liquid will be found studded with large, glistening, laminated crystals of cotoin, of a pale yellow color. Cotoin (methyl-trioxy-benzophenone), $C_{14}H_{12}O_4$, is sparingly soluble in cold water, more soluble in hot water, insoluble in petroleum benzin, very soluble in alcohol, chloroform, benzol, acetone, and carbon disulphide. Nitric acid becomes blood-red in contact with cotoin, sulphuric acid is colored brownish-yellow, and ferric chloride blackens a dilute solution of cotoin. O. Hesse described a coto bark which did not contain cotoin but *cotellin*, $C_{20}H_{20}O_6$. (*Ph. Ztg.*, 1905, 845.)

Paracotoin, $C_{12}H_8O_4$, is extracted from paracoto bark, in which it exists associated with *hydrocotoin*, $C_{15}H_{14}O_4$, *protocotoin*, $C_{16}H_{14}O_6$, *methyl-hydrocotoin*, $C_{16}H_{16}O_4$, and *methylprotocotoin*, $C^{16}H_{16}O_6$. Paracotoin may be distinguished from cotoin by giving no reaction with ferric chloride. Piperonylic acid (methyleneprotocatechuic acid), $C_8H_6O_4$, is present in both barks.

Coto bark is decidedly irritating: its powder, rubbed upon the skin, is said to produce heat and redness, and, according to Burkart, fifteen grains (1.0 Gm.) taken into the stomach produce persistent burning pain, followed by repeated vomiting. The remedy was first introduced as serviceable in diarrhea, and seems to have established its reputation. Although observers are not explicit upon this point, it is evident that when there is a tendency to acute inflammation it must be used with great caution. Inpens (*D. M. W.*, 1913, 1827) from his physiological studies concludes that it acts by lessening intestinal peristalsis. The paracoto bark is said to resemble it in its action, but to be much less powerful. The fluidextract and tincture are very eligible preparations, the former made with alcohol in the usual way, and the tincture 1 part in 10 of alcohol, which may be given in from five-to fifteen-minim (0.3-0.9 mil) *doses* every two or three hours.

The active principle, cotoin, is given by Dr. Burkart in *doses* of three-quarters of a grain (0.048 Gm.) every two or three hours. He states that he could detect it in the urine from four to six hours after the ingestion of the dose. Balz (Tokio, Japan) is said to have treated cholera successfully by hypodermic injections of three grains (0.2 Gm.) of paracotoin. The value of cotoin in the treatment of *diarrhea* has been confirmed by various clinicians. It has been used in *catarrhal diarrheas* and the *diarrheas of tubercularulceration*, of *typhoid fever*, and of other conditions. (See B. G. T., vol. xi, 167.) It does appear to have some special effect upon the alimentary canal, as, according to Pribram (*Prager Med. Wochens.*, 1880) and Albertoni (*A. E. P. P.*, xvii, 293), it markedly lessens the excretion of indican. Albertoni also believes that it actively dilates the abdominal vessels and thereby hastens absorption, and Bibrana, that it is an antiseptic. It is not probable that cotoin has any general action upon the system, and Jobst found that even fifteen grains (1.0 Gm.) injected hypodermically into the rabbit produced no other than local symptoms. *Dose*, of cotoin, from one to three grains (0.065-0.2 Gm.); of fluidextract of coto, from five to twenty minims (0.3-

1.3 mls), four to six times a day.

Cotula. *U. S.* 1870. *Mayweed. Wild Chamomile. Dog Chamomile. Camomille puante, Maroute, Herbe de camomille puante, Herbel de maroute, Fr. Hunds-Kamille, Hunds-Kamillen-kraut, Stinkende Kamille, G. Camomilla fetida, Cotula, It. Manzanilla loca, Sp. Herba Chamomillae Foetidae. Anthemis Cotula* L.—Mayweed is an annual composite plant, which grows abundantly both in the United States and in Europe. In this country it is found in the vicinity of inhabited places, growing among rubbish, along the sides of roads, and in waste grounds. W. H. Warner found in the flowers volatile oil, oxalic, valeric, and tannic acids, coloring matter, acrid fatty matter, bitter extractive, and salts of potassium, calcium, magnesium, and iron. (*A. J. P.*, 1858, 390.) Pattone (1859) claimed to have found an alkaloid, *anthemidine*, and a crystallizable bitter acid, *anthemidic acid*, but his results have not been confirmed. The whole plant has a strong, disagreeable odor, and a warm, bitter taste, and imparts these properties to water.

The medicinal properties of this species of *Anthemis* are essentially the same as those of chamomile, for which it may be substituted, but its disagreeable odor is an obstacle to its general use. On the continent of Europe it has been given in hysteria as an antispasmodic. It has also been thought to be emmenagogue. It is said to have the property of vesicating, if applied to the surface fresh and bruised. The whole plant is active, but the flowers, being less disagreeable than the leaves, are preferred for internal use. The remedy is best administered in the state of infusion.

Cotyledon Umbilicus L. *Navelwort. Pennywort. Cotylet, Nombril de Venus, Fr. Nabelkraut, G.*—This is a perennial, herbaceous, succulent plant, of the fam. *Crassulaceae*. The plant is a native of England, where it grows upon old walls and rocks, and dry sandy banks.

According to Fletet, it contains trimethylamine, combined with an unknown acid. When the powder of the plant is exposed to the air, it attracts moisture, and exhales a disagreeable odor strikingly analogous to that of fish, and an extract treated with a fixed alkali disengages, even in the cold, an odor which, at first ammoniacal, soon acquires the fishy character referred to. The plant contains cellulose, starch, glucose, mucilage, chlorophyll, yellow coloring matter, a volatile oil of a sandarac-like odor, tannin, iron, and salts of potassium, sodium, calcium, and iron, with 0.9 per cent. of nitre, and 95 per cent. of water. (*Ann. Ther.*, 1865, 125.) It has been highly lauded in epilepsy (for references, see 16th edition *U. S. D.*), but it has very feeble and uncertain therapeutic properties. *Dose*, of fresh juice, from one-half to one fluidounce (15-30 mls), two or three times a day; of fluidextract, one fluidrachm (3.75 mls) ; of dry extract, five grains (0.32 Gm.); to be increased and given steadily for months.

Cow Tree. *Palo de Vaca. Palo de Leche.*—The milky juice of the *Brosimum Galactodendron*, D. Don (fam. *Urticaceae*) is much used in South America instead of cream in tea and coffee, etc. It is obtained by making incisions in the tree, is white and viscous, turns sour on exposure to the air, and deposits a caseous substance. According to the analysis of Boussingault, its composition varies very much, but it

always contains a large percentage of fatty matters (32.2 per cent.), and much less casein, albumen, sugar, and phosphates. (*P. J.*, ix, 67-9.)

Cranberries. Fruit of *Vaccinium macrocarpon* Aiton. (Fam. *Ericaceae*.)—These familiar berries, so well known as an article of diet, have come into notice as a source of citric acid. For method, see *J. P. C.*, 4e ser., xviii, 439. The leaves of the *Vaccinium Vitis-idaea* (L.) have been studied by Edo Claassen (*A. J. P.*, 1886) and A. M. Karger (*P. J.*, vol. lxx). They contain *arbutin*, *hydroquinone*, and *tannin*. *Benzoic acid* has also been recognized as normally present in small amounts. In the *cranberry*, Edo Claassen found an uncrystal-lizable glucoside, *oxycoccin*.

Crescentia. *Crescentia Cujete* L.—The fruit of this West Indian and South American plant (fam. *Bignoniaceae*) has been found by Gustav Peckoldt to contain *crescentinic acid* and a blue coloring matter allied to indigo. (*Ph. Rund.*, Aug., 1884.)

Crocus. *N. F. IV. Saffron. Stigmata, Croci. Spanish Saffron, Safran*, Fr. Cod. *Crocus*, P. G. *Safran*, G. *Zafferano*, It. *Azafran*, Sp.—"The stigmas of *Crocus sativus*, Linne (Fam. *Iridaceae*), without the presence of more than 10 per cent. of the yellow styles or other foreign matter." *N. F. IV.* "The dried stigmas and tops of the styles of *Crocus sativus*, Linn." *Br.*, 1898. *Crocus* was dropped at the 1914 revision of the British Pharmacopoeia and the ninth U. S. P. revision. It has been recognized by the National Formulary IV.

Crocus sativus is a perennial plant, with a rounded and depressed bulb or corm, from which the flower rises a little above the ground, upon a long, slender, white, and succulent stem. The flower is large, of a beautiful lilac or bluish-purple color, and appears in September or October. The leaves are radical, linear, slightly revolute, dark green upon their upper surface, with a white longitudinal furrow in the center, paler underneath, with a prominent flattened midrib, and enclosed at their base, together with the tube of the corolla, in a membranous sheath, from which they emerge soon after the appearance of the flower. The style hangs out on one side between the two segments of the corolla, and terminates in three long convoluted stigmas, which are of a rich orange color, highly odorous, rolled in at the edges, and notched at the summit. The stigmas of the *Crocus orientalis* are used in the East.

C. sativus, or *autumnal crocus*, is believed to be a native of Greece and Asia Minor, where it has been cultivated from the earliest ages. There are three main varieties of it, the French, the Grecian, and the Chinese. The first of these is superior in color and flavor, the second in the amount of yield, while the third is said to unite these qualities. Saffron is also cultivated for medicinal use in Sicily, Spain, France, England, and other temperate countries of Europe. Large quantities of saffron are raised in Egypt, Persia. We cultivate the plant in this country chiefly as a garden flower, although some of the drug of very fine quality has been produced in Pennsylvania; the high cost of labor in America will probably prevent the possibility of its coming into commerce. Wild saffron is found growing in uncultivated fields in Southern Russia; Tichomirow believes that these are varieties of *C. sativus* and *C. speciosus* Marsh. Biebr., var. *β-Pallassii* (*C. Palassii* Marsh. Biebr.). He further states that wild saffron from these

sources is in no way inferior to the cultivated. (*A. Pharm.*, 1903, 656.)

In England the flowers appear in October, and the leaves continue green through the winter; but the plant does not ripen its seed, and is propagated by offsets from the bulb. The flowers are gathered soon after they show themselves, as the period of flowering is very short. The stigmas, or summits of the pistils, together with a portion of the style, are separated from the remainder of the flower, and carefully dried by artificial heat, or in the sun. During this process they are sometimes made to assume the form of a cake by pressure; but the finest saffron is that which has been dried loosely. The two forms are distinguished by the names of *cake saffron* and *hay saffron*. Five pounds of the fresh stigmas are said to yield one pound of the dried. The English saffron, formerly most highly esteemed in this country, has disappeared from our market; what may be sold under the name is probably derived from other sources. For an account of the cultivation in England, see *P. J.*, June, 1887. The Spanish saffron is generally considered the best in the United States, although most European writers on *Materia Medica* give the preference to the French saffron. The better grades of Spanish saffron are known as *Valencia* saffron, while *Alicante* saffron was said by Maisch to contain scarcely more than 50 per cent. of genuine saffron. According to Landerer, the stigmas of several other species besides those of *C. sativus* are gathered and sold as saffron in Greece and Turkey.

Properties.—Saffron has a peculiar, sweetish, aromatic odor, a warm, pungent, bitter taste, and a rich deep orange color, which it imparts to the saliva when chewed. It is described in the *N. F.* as follows: " Stigmas 3, united or separate, attached to the summit of the style; usually about 25 mm. in length, cornucopia-shaped, of a dark, rich red color, the margin dentate or fimbriate; styles about 10 mm. in length, more or less cylindrical, solid, yellowish. Odor strong, peculiarly aromatic; taste bitterish, aromatic. When chewed it colors the saliva orange-yellow. Under the microscope, the upper end of the stigma shows numerous cylindrical papillae about 0.15 mm. in length, among which occur a few spherical pollen grains, the latter being nearly smooth, and from 0.04 to 0.07 mm. in diameter; occasionally some of the pollen grains have germinated and show pollen tubes. When placed in sulphuric acid, the stigmas are immediately colored blue, gradually changing to violet, and finally become a deep wine-red color. Add 0.01 Gm. of finely powdered *Crocus* to 100 mils of cold water, allow it to macerate for several hours and filter; on adding 10 mils of this filtrate to 100 mils of water, it gives a distinctly yellow-colored solution. Macerate 0.01 Gm. of *Crocus* in 5 mils of methyl alcohol; a deep orange color is imparted to the liquid. Macerate 0.01 Gm. of *Crocus* in 5 mils of acetone, alcohol, or dehydrated alcohol; a distinct lemon-yellow color is produced. With corresponding quantities of *Crocus* and ether a very light lemon-yellow color is produced. With corresponding quantities of *Crocus* and chloroform a very slight, yellow tinge is imparted; and with corresponding portions of *Crocus* and xylene, benzene, carbon disulphide, or carbon tetrachloride, the solvents remain colorless. When *Crocus* is pressed between filter paper, the paper does not display transparent spots due to the absorption of oil. It loses not more than 14 per cent. of its weight when dried at 100° C. (212° F.). *Crocus* yields not more than 7.5 per cent. of ash and the ash is not fusible." *N, F.* The following tests were given in the *Br.*, 1898: " Incinerated with free access of air, dried Saffron does not deflagrate (absence of nitrates), and yields about 7 per cent. of ash. It should not lose more than 12.5 per

cent. of moisture when dried at 212° F. (100° C.)."

Analyzed by Vogel and Bouillon-Lagrange, saffron afforded 65 per cent. of a peculiar extractive matter, which they named *polychroite*, but later researches have shown that it is a mixture of the glucoside crocin, sugar, and essential oil. (Planchon, *Drogues Simples*, vol. i, 210.) Kayser obtained (*Ber. d. Chem. Ges.*, 1884, 2228) pure *crocin*, having the formula $C_{44}H_{70}O_{28}$) as a yellow powder, easily soluble in water and diluted alcohol, only slightly soluble in absolute alcohol, and giving with concentrated sulphuric acid a deep blue color, which turns violet, then cherry-red, and finally brown. It is easily decomposed by lime or baryta water into *crocetin*, and a dextro-rotatory sugar which Kayser calls *crocese*. The crocetin is a red powder, not soluble in water, but easily soluble in alcohol and ether. Its solution in alkalies shows an orange-yellow color, from which solution acids separate it again in orange-colored flecks. Its formula is $C_{34}H_{46}O_9$, or, according to Schmuck and Marchlewski, $C_{15}H_{20}O_4$; Kayser also found a colorless bitter principle, to which he gave the name *picro-crocin* or *saffron bitter*, and the formula $C_{38}H_{66}O_{17}$) which is also of glucoside character. Saffron contains, according to Henry, about 10 per cent. of essential oil. This has the formula $C_{10}H_{14}O$, boils at 208° to 210° O. (406.4°-410° F.), is yellow, of a hot, acrid, bitterish taste, and heavier than water.

The high price of this medicine gives rise to frequent adulterations. Water is said to be very often added in order to increase its weight. Oil or glycerin is also added for the same purpose, or to improve the appearance. In some specimens the dyed corolla of the crocus with the attached stamens is abundant. Sometimes the flowers of other plants, particularly *Carthamus tinctorius*, or safflower, *Calendula officinalis*, or marigold, and arnica are fraudulently mixed with the genuine stigmas. They may be known by their shape, which is rendered obvious by throwing a portion of the suspected mass into hot water, to expand them. (See *Carthamus*.) A specimen of this adulteration was at one time introduced into the American market, by the name of *African Saffron*. (Maisch, A. J. P., March, 1872, p. 110.) Other adulterations are the fibers of dried beef, the stamens of the crocus, distinguishable by their yellow color, the stigmas previously exhausted in the preparation of the infusion or tincture, and various mineral substances, easily detected upon close examination. The flowers of a Brazilian plant named *Feminella*, or *Feminelle*, have, according to M. J. L. Soubeiran, been employed for the adulteration of saffron. They may be detected by shaking, gently but repeatedly, a large pinch of the suspected saffron over a piece of paper. The flowers of *Feminella*, being smaller and heavier, separate and fall, and may be seen to consist of very short fragments, with a color like that of saffron, but a rusty tint which the latter does not possess. (See *Ph. Rev.*, 1898, 258.) The name *Feminelle* is also applied in commerce to the dyed styles of crocus or ligulate flowers of *Calendula*. J. Muller recommends concentrated sulphuric acid as the most certain test of saffron. It instantly changes the color of pure saffron to indigo blue. (*Chem. Gaz.*, May, 1845.) An adulteration which has been largely practised appears to consist of yellow-colored chalk or barium sulphate, made into a thin paste, probably with honey, and attached to the stigmas, sometimes isolated, sometimes in groups of five or six, enveloping them almost completely. If this saffron be kept in a dry place, and often handled, the paste becomes partly broken up, and the colored powder

spreads itself in the mass and the envelope. The chalk can at once be detected by shaking the suspected saffron with water, and treating the precipitated powder with hydrochloric acid, when effervescence will occur. A less than the ordinary brightness of color in the saffron should lead to suspicion of this adulteration. Much can be told as to the purity of saffron by agitating the suspected flowers in distilled water; if the drug be pure the liquid will remain clear, slowly assuming a fine pure yellow tint; the saffron also will retain its red color for hours. Another excellent plan is to scatter a pinch of the flowers upon the surface of warm water, when the stigmas should spread out and display their proper form. Minute fragments of red saunders, which are often added to saffron, may be separated by agitating with water. For an elaborate discussion of adulteration, see article by Kraemer, *A. J. P.*, 1898, p. 386. Adulterations of crocus may sometimes be detected by remembering that the pollen grains are spheroidal, nearly smooth, and from 0.040 to 0.075 mm. in diameter. In various European markets there has been offered a saffron largely adulterated with borates, chlorides, and other salts of sodium and potassium, and yet retaining the physical properties of saffron of high character. These and other adulterations with inorganic salts can be detected by the amount of ash left on burning, genuine saffron leaving from five to seven per cent. This saffron also yielded immediately to water an orange-yellow color. Further, some of it at least was hygroscopic, so that when rubbed up between the fingers into a ball it retained that form instead of being elastic as is true saffron.

Attention has been called to a product of the Cape of Good Hope, named *Cape saffron*, which has a remarkable resemblance to genuine saffron, having a similar odor, and yielding a similar color to water, though the flowers themselves are differently colored. It is the flower of a small plant very abundant at the Cape, belonging to the family of *Scrophulariaceae*, and is said by Pappe of Cape Town, to possess medicinal virtues closely resembling those of true saffron. The flowers have been used successfully in the convulsions of children. (*P.J.*,vi, 462, 1865.)

Choice of Saffron.—Saffron should not be very moist, nor very dry, nor easily pulverized; nor should it emit an offensive odor when heated upon a porcelain dish. The freshest is the best, and that which is less than a year old should, if possible, be selected. It should possess in a high degree the characteristic properties of color, taste, and odor. When agitated with water it should color it bright yellow, and it should not effervesce in the presence of a diluted acid. If it does not color the fingers when rubbed between them, or if it has an oily feel, or a musty flavor, or a black, yellow, or whitish color, it should be rejected. In the purchase of this drug in cakes, those should be selected which are close, tough, and firm in tearing; and care should be taken to avoid *cakes made up of safflower*.

As its activity depends, partly at least, on a volatile ingredient, saffron should be kept in well-stoppered vessels. Some recommend that it should be enclosed in a bladder and introduced into a tin case.

Saffron was extensively used by the ancients and by medieval physicians, as a highly stimulant antispasmodic and even narcotic emmenagogue, and is still employed to some extent upon the Continent; but in Great Britain and the United States it has

fallen into well deserved and almost complete desuetude. In domestic practice saffron tea is occasionally used in *exanthematous diseases*, to promote the eruption. At present it is chiefly used to impart color and flavor. Saffron should be preserved in tightly-closed containers protected from light.

A tincture of saffron is recognized in the N. F. and it is also an ingredient of several compound pills and tinctures.

Dose, from ten to thirty grains (0.65 to 2.0 Gm.).

Cryptocarya. *Cryptocarya australis* Benth. (Fam. *Lauraceae*.) —From the bark of this Queensland tree, T. L. Bancroft (*Austral. Journ. Pharm.*, March, 1887) has separated an alkaloid which is said to be a powerful respiratory poison.

CUBEBA. U. S. (Br.)

CUBEBA Cubeb. [Cubeb.]

"The dried, full-grown, unripe fruits of *Piper Cubeba* Linne filius (Fam. *Piperaceae*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter." *U. S.* "Cubeb is the dried full-grown unripe fruits of *Piper Cubeba*, Linn. fil." *Br.*

Cubebae Fructus, *Br.*; Fructus (s. *Baceae*) *Cubebae*, *Piper Caudatum*; *Cubeba*, Tailed Pepper; *Cubebe*, *Cubebe* ou *Poivre a Queue*, *Fr. Cod.*; *Cubebae*, *P. G.*; *Kubeben*, *G.*; *Pepe Cubebe*, *Cubebe*, *It.*; *Cubeba*, *Sp.*; *Kebabeh*, *Ar.*

Piper Cubeba is a climbing perennial plant, with a smooth, flexuous, jointed stem, and entire, petiolate, oblong or ovate-oblong, acuminate leaves, rounded or obliquely cordate at the base, strongly nerved, coriaceous, and very smooth. The flowers are dioecious and in spikes, with peduncle's about as long as the petioles. The fruit is a globose, pedicelled drupe. This species of *Piper* is a native of Java, Penang, and probably other parts of the East Indies. It is extensively grown in the coffee plantations, supported by the trees which are used for shade, and has been introduced into Ceylon. The dried unripe fruit is the official portion. Our knowledge of the false cubeb of commerce up to 1894 was epitomized in the 17th edition of the *U. S. D.*, p. 457. To this account the reader is referred for historical details. (See also *U. S. D.*, 19th ed., p. 410.)

Properties.—Cubeb is officially described as follows: "Upper portion globular, from 3 to 6 mm. in diameter, with a straight, slender stem-like

portion, from 5 to 7 mm. in length; pericarp externally grayish, brownish, or bluish-black; coarsely reticulate; about 0.3 mm. in thickness, easily cut, 1-locular, 1-seeded; the immature seed attached at the base of the pericarp ; odor aromatic, characteristic; taste strongly aromatic and pungent. Under the microscope, sections of Cubeb show an epidermal layer of tabular cells with thickened, undulate outer walls, the contents being olive-green; 1 or 2 rows of parenchyma cells, the contents resembling those of the epidermal cells; a continuous layer of radiately elongated, thick-walled stone cells having numerous pores; a few layers of collapsed cells near which may occur an occasional small group of bast-fibers; a middle layer of 10 rows of cells composed chiefly of parenchyma, scattered among which are numerous secretion cells containing a volatile oil and occasionally crystals in the form of short rods, the contents of the secretion cells being colored a deep crimson upon the addition of sulphuric acid; an endocarp of small, somewhat isodiametric or polygonal stone cells with very thick porous walls; seed-coat of several rows of reddish-brown, tangentially elongated, more or less collapsed cells; perisperm of numerous thin-walled parenchyma, the cells being more or less polygonal in shape and containing either small compound starch grains, or globules of a fixed oil or occasionally a crystal of calcium oxalate. The powder is light brown to blackish-brown, consisting of a more or less even distribution of starch-bearing cells of the perisperm and fragments of the pericarp with stone cells; starch grains numerous, single or compound, from 0.002 to 0.012 mm. in diameter; stone cells numerous in palisade-like groups, in surface view rounded or polygonal with rather prominent dark lumina and yellowish porous walls; secretion cells with a yellowish, oily content, becoming reddish on the addition of sulphuric acid; fragments of stalk few, with spiral trachea and groups of sclerenchymatous fibers from 0.05 to 1 mm. in length with blunt, rounded, or very much attenuated ends, the walls strongly lignified and with numerous oblique pores. Cubeb yields not less than 10 per cent. of volatile extractive, soluble in ether (see Part III, Test No. 12). Cubeb yields not more than 8 per cent. of ash." *U. S.*

"Nearly globular, about four millimetres in diameter, greyish-brown or nearly black. Pericarp reticulately wrinkled, thin, brittle, and abruptly prolonged at the base into a slender, rounded stalk about one and a half times as long as the globular portion. Seed almost spherical, sometimes much shrivelled, attached by the base. In the' transverse section of the pericarp two layers of sclerenchymatous cells, one near the outer, the other near the inner surface, those of the latter being radially elongated

and usually arranged in a single row. Strong, aromatic, and characteristic odor; taste warm, aromatic, and somewhat bitter. When 2 grammes of powdered Cubebs are macerated with 20 millilitre's of *ether* for twenty-four hours, and shaken occasionally, 10 millilitres of the clear ethereal solution, allowed to evaporate in a flat-bottomed dish, yield a residue which, dried for one hour in a desiccator over *sulphuric acid*, weighs not less than 0.200 gramme." Crushed Cubebs impart a crimson color to *sulphuric acid*. Ash not more than 8 per cent." *Br.*

Commercial cubebs are not infrequently admixed with and entirely substituted by other fruits, some of which contain volatile oils which possess very different properties from the genuine oil of cubeb, being in some instances highly toxic. Hartwich (*Arch. d. Pharm.*, 1898, Heft 3; also p. 172) gives the following classification for the identification of spurious fruits:

I. *Fruits of the Piperaceae having slender stalks.*

A. STONE CELLS IN EPICARP, ENDOCARP AND
DISTRIBUTED IN THE MESOCARP :

Piper ribesoides Wallich (identical with *Padang Cubeb*). Fruits not colored red with sulphuric acid.

B. STONE CELLS ONLY PRESENT IN THE EPICARP AND
ENDOCARP :

(a) Stone cells of the endocarp radially elongated.

Piper Cubeba L.f. Seed attached only at the base of the pericarp. a *Rinoe Katoentjor*, the official variety, which is colored red with sulphuric acid.

β Rinoe badak, distinguished by not being colored red with sulphuric acid.

(b) Stone cells of the endocarp of iso-diametric form.

Piper crassipes Korthals. Sections not colored red with sulphuric acid.

(c) Stone cells of the endocarp thickened like a horseshoe.

Piper a court pedicelle. Origin unknown.

C. STONE CELLS PRESENT ONLY IN THE EPICARP :

(a) Fruit with stem 3 cm. in length, the stem-like portion being alone 17 mm. long.

Piper mollissimum Blume (*Keboe Cubeb. Karbauw berries*) sections

- not colored red with sulphuric acid.
(b) The fruits and stems much smaller, but distinguished by having radially elongated stone cells.

Piper venosum DC. colored red with sulphuric acid.

D. STONE CELLS ABSENT IN THE PERICARP :

(a) African varieties:

1. Fruit without stem 5 to 6 mm. long, stem-like portion equally long.

a Piper clussi DC., sections colored red with sulphuric acid.

β Piper guineense Schum. sections not colored red with sulphuric acid.

2. Fruits 4 mm. long, 2 to 3 mm. thick and stems 6 mm. long.

Piper borbonense DC. (Cubebe du pays) sections not colored red with sulphuric acid.

(b) Indian varieties: None of which are colored red with sulphuric acid.

a. Stems flattened.

Piper Lowong Blume. Secretion cells colored bluish-green with sulphuric acid.

Ceylon pepper. Secretion cells colored yellow with sulphuric acid.

β Stem-like portion cylindrical.

Piper canium Blume and *P. phyllostitum* DC.

II. Fruits of the Piperacece without stalks.

A. STONE CELLS PRESENT IN EPICARP AND ENDOCARP:

1. *Piper nigrum* L. Stone cells of epicarp radially elongated and sections colored red with sulphuric acid.

2. *Cubebe de Jaba sauvage*. Stone cells of the epicarp not radially elongated.

B. STONE CELLS ONLY IN THE EPICARP :

Dangdang boeroeng. A fruit obtained from Java, the origin of which is unknown.

C. STONE CELLS ABSENT IN PERICARP.

Cubeb from Bangil, origin unknown. Sections at first colored red with sulphuric acid, then becoming brown.

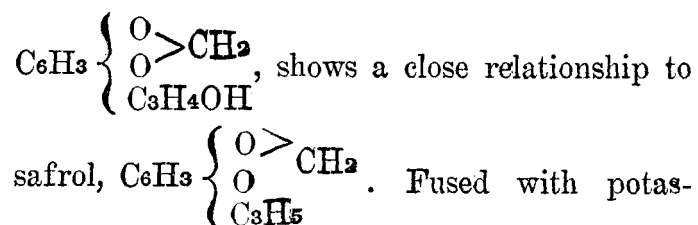
III. Fruits obtained from plants belonging to other families than the

Piperaceae.

1. *Xanthoxylum Budrunga* Wall. (*Fagara Budrunga* Roxb.)
(*Rutaceae*).
2. *Bridelia tomentosa* Bl. (*Euphorbiaceae*).
3. *Tetranthera citrata* N. v. Esenbeck (*Litsea citrata* Bl.)
(*Lauraceae*).
4. *Daphnidium Cubeba* Nees. (*Lauraceae*).
5. *Pericampylus incanus* Miers. (*Menispermaceae*).
6. *Xylopia frutescens* Graertner. (*Anonaceae*).
7. *Helicteres hirsuta* Bl. (*Sterculiaceae*).
8. *Grewia tomentosa* Juss. (*Tiliaceae*).

Constituents.—The most obvious constituent of cubeb is the volatile oil, the proportion of which yielded by the drug varies from 4 to 13 per cent. It is, as shown by Ogialoro, a mixture of a terpene, $C_{10}H_{16}$, boiling at 158° to 163° C. (316.4° - 325.4° F.), which is present in very small amount, and is probably pinene or camphene, some dipentene, and two oils of the formula $C_{15}H_{24}$, boiling at 262° to 265° C. (503.6° - 509° F.). One of these, known as cadmene, is strongly laevogyrate, and yields a crystallized compound having the formula, $C_{15}H_{24}2HCl$, and melting at 118° C. (244.4° F.), while the other is less laevogyrate, and does not combine with HCl.

The oil distilled from old cubeb on cooling at length deposits large transparent inodorous octahedra of *camphor of cubeb*, $C_{15}H_{25}O$. E. Schmidt found that this camphor melts at 66.5° C. (152° F.); simply by standing over sulphuric acid, more rapidly on heating, it gave up water and passed into that fraction of cubeb oil which boils at 260° C. (500° F.), of which it is, therefore, simply the hydroxide. Another constituent of cubeb is *cubebin*. This is an inodorous substance, crystallizing in small needles or scales, melting at 125° C. (257° F.), having a bitter taste in alcoholic solution, it dissolves freely in boiling alcohol, but deposits on cooling, and is abundantly soluble in chloroform. Its composition, according to Weidel (1877), is $C_{10}H_{10}O_3$, and its structural formula,



sium hydroxide it yields proto-catechuic acid. The resin extracted from cubeb consists of an indifferent portion, nearly 3 per cent., and of cubebic acid, $\text{C}_{13}\text{H}_{14}\text{O}_7$, amounting to about 1 per cent. (*Pharmacographia*, 2d ed., p. 587.)

The formula of cubebic acid as just given is that of .Schmidt. Schultze (*Jahresbericht*, 1873, p. 863), on the other hand, gives to it the formula $\text{C}_{28}\text{H}_{30}\text{O}_7 + \text{H}_2\text{O}$. According to Capitaine and Soubeiran, *cubebin* is best obtained by expressing cubeb from which the oil has been distilled, preparing from the marc an alcoholic extract, treating this with a solution of potassium hydroxide, washing the residue with water, and purifying it by repeated crystallizations in alcohol. In the official oleoresin of cubeb a deposit takes place consisting chiefly of cubebin, which may be obtained by washing the deposit with a small quantity of cold alcohol to remove adhering resin and oil, and then dissolving repeatedly in boiling alcohol, and crystallizing until the product is white. E. Schaer calls attention to the similarity in reaction between cubebin and veratrine, aconitine, morphine, and digitalin. (*A. Pharm.*, 1887, p. 531.) The volatile oil is official. (See *Oleum Cubebae*.) By practical trial Bernatzik has satisfied himself that the peculiar virtues of cubeb as a remedy in *gonorrhoea* depend not on the cubebin or the volatile oil, but on the cubebic acid. When the ethereal extract of cubeb is deprived of its volatile oil by evaporation on a water bath, and of cubebin and wax by deposition, a soft resin is left, the *cubebic acid* of Bernatzik, in which, according to F. V. Heydenreich, who experimented with it as a physiological agent, the diuretic properties reside, the cubebin being without apparent effect, and the volatile oil, though stimulant and carminative, having no diuretic action. The soft resin, which was of the consistence of honey, of a dark olive-green color, and some remaining odor of cubeb, when taken in the dose of ten grains every two hours for six hours, acted as a laxative, and gave the urine a peculiar odor, without increasing its quantity; but in the dose of a drachm, once repeated at an interval of three hours, while it produced the same effects as the smaller dose, it considerably augmented the urine. In still larger doses it produced decided irritation of the urinary passages. (*A. J.*

P., Jan., 1868.) Heydenreich's experiments are confirmatory of Bernatzik's conclusion as to the peculiar active principles of cubeb. Cubeb gradually deteriorates by age, and in powder becomes rapidly weaker, in consequence of the escape of its volatile oil. It should be kept whole, and pulverized when dispensed. The powder is said to be sometimes adulterated with that of pimenta.

Uses.—Cubeb is generally stimulant, with a special direction to the urinary organs. In considerable quantities it excites the circulation, increases the heat of the body, and sometimes occasions headache and giddiness. At the same time it frequently produces an augmented flow of the urine, to which it imparts a peculiar odor. Among its effects are also occasionally nausea and moderate purging, and it is said to cause a sense of coolness in the rectum during the passage of the feces. We have no evidence that it was known to the ancients. It was probably first brought into Europe by the Arabians, and was formerly employed for similar purposes as black pepper, but it was found much less powerful and fell into disuse. In India it has long been used in *gonorrhoea* and *gleet*, and as a grateful stomachic and carminative in disorders of the digestive organs, and it is at present very frequently given both in this country and in Europe in *gonorrhoea*, after the subsidence of the first active inflammatory symptoms. It has been given also in *leucorrhoea*, *cystorrhoea*, the *urethritis* of women and female children, *abscess of the prostate gland*, *piles*, and *chronic bronchitis*. In connection with copaiba it has been especially recommended in affections of the neck of the bladder and the prostatic portion of the urethra.

It is best administered in powder, of which the dose in *gonorrhoea* is from one to three drachms (3.9-11.6 Gm.) three or four times a day. The volatile oil may be substituted, in the dose of ten or twelve minims (0.6-0.7 mil), suspended in water by means of sugar, although the oleo-resin is generally preferred. (See *Oleoresina Cubebae*.) An infusion, made in the proportion of an ounce of cubeb to a pint of water, has been employed as an injection in discharges from the vagina.

Dose, of powdered cubeb, ten grains to one drachm (0.65-3.9 Gm.).

Off. Prep.—Fluidextractum Cubebas, *N. F.*; Oleoresina Cubebae, *U. S.*; Tinctura Cubebas, *Br.*; Trochisci Cubebas (from Oleoresin), *U. S.*; Elixir Buchu Compositum (from Compound Fluidextract of Buchu), *N. F.*; Fluidextractum Buchu Compositum, *N. F.*; Pilulae Antiperiodicae, *N. F.*;

Pilulas Antiperiodicse sine Aloes, N. F. ; Tinctura Antiperiodica, N. F.;
Tinctura Antiperiodica sine Aloes, N. F.; Tinctura Cubebaa, N. F.

Cucurbita. *Citrullus vulgaris* Schrad. *Watermelon*.—The seeds of the watermelon are employed, to a considerable extent, as a domestic remedy in strangury and other affections of the urinary passages. Power and Salway(-P. J', Ixxxiv, 760) found in watermelon seeds a fixed oil very similar to that which is found in pumpkin seeds. The Russian peasants are said to employ watermelon in the treatment of *dropsy*, *urino-genitalaffections*, *chronichepaticcongestion*, and *chronicintestinalcatarrh*. Manassein (*Vratch*, Nov., 1881), found that the melon honey acts upon the lower animals as a very powerful diuretic, and causes, when in sufficient dose, fall of the arterial pressure, rapid pulse, and death from cardiac paralysis. A resin, extracted in the amount of 0.3 per cent. from the press cake of watermelon seed, when administered to a dog in doses of 1 gramme exhibited no physiological activity. A chemical examination of this resin led, however, to some results of interest, inasmuch as it yielded, besides a little phytosterol, a new crystalline alcohol, C₂₄H₄₀O₄, which has been designated *cucurbitol*.

The pulp of the root of *Legendaria vulgaris*, or *gourd*, is said by Chapin to be a powerful and even drastic purgative, and to be used by the natives of the Sandwich Islands successfully in the treatment of *dropsy*. (See *N. Y. Journal of Med.*, 1855, 203.)

Cudbear. *N.F. IV. Persia. Orseille de terre, Fr.*—"A purplish-red powder prepared from species of *Roccella* De Candolle, *Lecanora* Acharius, or other lichens." *N. F. IV.* Cudbear is described in *N. F. IV* as follows: "An aqueous or alcoholic preparation of Cudbear is of a deep red color which is rendered lighter in tint by the addition of acids and changed to purplish-red on the addition of alkalies. Agitate 2 Gm. of Cudbear occasionally with 200 mils of water during thirty minutes and then filter; the deep red-colored filtrate conforms to the following tests: Add to 5 mils of the filtrate 5 drops of glacial acetic acid and boil for one minute; then add 5 drops of stannous chloride T.S., and boil again for one minute; the liquid is only faintly pink (*brazilwood* or *logwood* which produce solutions of a deep red color) ; add 25 Gm. of kaolin to 100 mils of the filtrate in an Erlenmeyer flask, shake frequently during one hour and then filter; the filtrate is almost entirely decolorized in comparison with some of the original filtrate (*a number of coal tar colors*). Cudbear yields not more than 35 per cent. of ash, consisting mainly of sodium chloride." *N. F. IV.*

Cudbear was introduced into the National Formulary solely for coloring liquids. Two preparations were made official, *Tinctura Persionis*, *N. F. IV* (*Tincture of Cudbear*) and *Tinctura Persionis Composita* (*Compound Tincture of Cudbear*). Both tinctures are used to give a deep red color to syrups, tinctures, solutions, and elixirs of the National Formulary. George M. Beringer has given much attention to cudbear with a view of securing a uniform product. (See *Proc. New Jersey Pharm. Assoc.*, 1912, 56.) He declares that all of the ordinary methods, as color charts, colored yarns, threads, glass, etc., are unsatisfactory and inapplicable to pharmacy. He advocates the preliminary purification of cudbear by washing it with water to remove the sodium

chloride so largely used as a diluent and the ammonium salts with their empyreumatic odor. He states that if the washing is properly done the cudbear loses scarcely any of its tinctorial power. He gives a table showing comparative values of eight tinctures prepared with various menstrua. He believes that the best results, however, would follow the preparation and use of a standard extract. Alexander Gardner gives the name *persionin* to an acetone extract of cudbear made as follows: The process consists in percolating commercial cudbear with purified benzoin until free from wax, then drying the drug, repacking it in a percolator and percolating it with acetone to exhaustion—about 2500 mils being required for 1000 Gm. of cudbear. The acetone is recovered by distillation, the residual extract heated for thirty minutes to 98.8° C. (210° F.) in a porcelain capsule, then pulverized and placed in a sulphuric acid desiccator for three days, during which it loses about 25 per cent. of its weight. So obtained, "persionin" is a black, lustrous powder with an aromatic odor, soluble in alcohol, glycerin, chloroform, ether, and hydro-alcoholic liquids, but is only sparingly soluble in water. Five different lots of cudbear yielded, respectively, 6.5, 7, 6, 5, and 5.5 per cent. of persionin. Each sample of "persionin" was tested by dissolving 1 part in 100 parts of alcohol and 3 parts of glycerin. One mil -of this was added to 99 mils of distilled water, and in each particular the color was the same. (*J. A. Ph. A.*, 1913, 51-52.) H. V. Army (*J. A. Ph. A.*, 1913, 47) proposes to remove a brown pigment present in cudbear (which interferes with the tinctorial power) by macerating an alcoholic extract with chloroform and extracting the residue with acetone. The final product is then "scaled."

Because of the difficulty of completely extracting cudbear the liquid preparations are rarely uniform in color value. For this reason the N. F. uses powdered cudbear in several preparations, allowing it to macerate until all color is extracted. This plan results in more uniform coloring than if the tincture was directed.

Culilawan. *Cortex Culilaban.*—An aromatic bark, produced by *Cinnamomum Culilawan*, Blume (*Laurus Culilawan*, L.), (Fam. *Lauraceae*), a tree of considerable size, growing in the Molucca Islands, Cochin-China, and other parts of the East. It is usually in flat or slightly quilled pieces, 5 to 10 cm. long, 2.5 to 3.5 cm. wide, and 2 to 4 mm. thick. Sometimes the bark is thinner and more quilled, bearing considerable resemblance to cinnamon. The periderm is for the most part removed, but when present is of a light brownish-gray color, soft to the touch, and somewhat spongy. The color of the bark itself is a dull, dark, cinnamon brown, the odor highly fragrant, the taste agreeable, aromatic, and not unlike that of cloves. The active constituent is a volatile oil, smelling like a mixture of the oils of cajuput and cloves. Culilawan has the medicinal properties of the aromatics, but is rarely used. (See *Cortex Caryophyllata*.)

Cumin. *Cuminum* Lond. *Cuminum* Ed. *Cumin*, Fr. *Kreuzkummel*, *Mutterkummel*, *Römischer (langer, scharfer) Kummel*, G.—The so-called *cumin seeds* are the fruit of the *Cuminum Cuminum* L., an annual umbelliferous plant, which is a native of Egypt, but is cultivated for its fruit in Sicily, Malta, and other parts of Europe.

The cumin fruits (*seeds*) are elliptical, flat on one side, convex, furrowed, and rough on

the other, from 5 to 6 mm. in length and about 1.5 mm. in thickness, and of a light brown color. Each has seven longitudinal ridges. Two mericarps are sometimes seen united. Their odor is peculiar, strong, and heavy; their taste warm, bitterish, aromatic, and disagreeable. They contain about 2.5 per cent. of an essential oil, which is lighter than water, yellowish, and has the sensible properties of the fruits. It consists of three distinct oils, one a hydrocarbon, *cymene*, $C_{10}H_{14}$, recognized now as *isopropyl-p-methyl-benzene*, another *cuminol*, $C_{10}H_{12}O$, which may be regarded as *cuminic aldehyde*, $C_{10}H_{11}OH$, and the third a terpene, $C_{10}H_{16}$. Dumas, a long time since, obtained a cymene identical with that of oil of cumin seeds, by dehydrating camphor, and Paterno prepared it in a similar way from oil of turpentine. (*J. P. C.*, 4e ser., xx, 409.) In his discovery Paterno seems, however, to have been preceded by seven chemists, O. R. A. Wright apparently having the priority. (*A. J. P.*, xlvi, 117; see especially *A. J. P.*, xlv, 452.) Cumin aldehyde has also, together with cymene, been obtained from the fruits of *Cicuta virosa* L. (Trapp, *Ann. Ch. Ph.*, cviii, 386; see also *Schim. Rept.*, 1909, 49.) In medicinal properties cumin fruits resemble the other aromatic umbelliferous fruits. Dose, fifteen to thirty grains (1-2 Gm.).

Cunila. *Cunila origanoides* (L.) Britt. (*C. Mariana* L.) (Fam. *Labiatae*), *American or Common Dittany. Sweet Horsemint. Stonemint.*—A small indigenous perennial herb, growing on dry, shady hills, from New York to Georgia, and Illinois and Arkansas westward, and flowering in June and July. The whole herb has a warm, pungent taste and a fragrant odor, dependent on an essential oil. This, according to Philip Milleman, of Chicago, is of reddish-amber color, becoming light yellow by exposure to light, of a delicate, fragrant odor, very similar to that of oil of monarda, of a warm pungent taste, and of the sp. gr. 0.920. It is readily soluble in alcohol, ether, and chloroform. On spontaneous evaporation, it leaves a small crystalline residue. Iodine decomposes it, producing white vapors; by sulphuric acid it is reddened and decomposed, by nitric acid resinified, and by hydrochloric acid decolorized, though its color returns on exposure. It is slightly rubefacient; in the dose of five or ten minims (0.3-0.6 mil) it is carminative, and of from fifteen to twenty minims (0.9-1.3 mils) diaphoretic. The same author found in the dried herb tannic acid, a trace of glucose, gum, bitter extractive, resin, and salts of potassium, calcium, magnesium, and iron. (*A. J. P.*, Nov., 1866, 495.) American dittany is a gently stimulant aromatic, analogous to the mints.

Curare. *Woorari. Woorara. Woorali. Urari.* —This powerful South American arrow poison was first brought to Europe by the celebrated traveller Waterton; it was in the form of a thick syrup, but as it now occurs in commerce it is a blackish extract, brittle, somewhat resinoid in appearance, encrusting the sides of gourds or little rude earthenware jars, into which it has been poured in a liquid state. The drug varies much in strength. It has been variously described. According to the researches of Planchon (*P. J.*, xi, 491), there are really four distinct varieties of curare.

(1) That from the Upper Amazon, obtained from the *Strychnos Castelnaii* Wedd., and possibly from *S. Yapurensis* G. Planch.

(2) That from the Upper Orinoco, extending towards the Rio Negro, yielded by *S.*

Gubleri G. Planch.; this is the variety spoken of by Humboldt.

(3) That of British Guiana, obtained from *S. toxifera* Schomb., associated with *S. pedunculata* Benth. and *S. cogens* Benth.

(4) That of French Guiana, made out of *S. Crevaiuxiana* Baill. (*S. Crevauxii* G. Planch.).

These varieties are, however, commercially indistinguishable. The preparation of woorari has been witnessed by various travellers and variously described. (See *P. J.*, xvi, 502; *B. F. M. R.*, Oct., 1865; *P. J.*, x, 1881.)

The method followed in the Upper Amazon region is to make a decoction of the bark of *Strychnoscastelnaei*, to which one-tenth of the stem of another liane is added. This is then concentrated by evaporation. To this concentrated juice then is added the leaves of *Petiveria alliacea*, the stems of *Dieffenbachia Seguine*, the root barks of two plants of the *Piperaceae* and a species of *Marcgravia*. The fluid extract is then evaporated until it is in the condition of an extract, and poured into small vessels. Joubert asserts that the Tecuma Indians use, besides *S. Castelnaeana* Weddell, *Cocculustoxiferus* and an arum (*Taya*), which he found to be very poisonous. According to Kobert (*Ph. Ztg.*, June, 1885), *Malouetia nitida* Spruce (fam. Apocynaceae), or Guachamaca, a plant which is abundant in the Orinoco and Rio Negro districts, enters largely into the composition of curare. The alkaloid, guachamacine, isolated by T. Schiffer in 1883, is very closely allied to, if it be not identical with, curarine, in both its chemical and its physiological activity. It is entirely possible that the varieties of woorari vary in their alkaloid and their physiological properties.

Allied, it may be, to the third variety of woorari are the arrow poisons brought by W. S. W. Ruschenberger from Colombia, and studied by W. A. Hammond and S. Weir Mitchell. (*Am. J. M. S.*, July, 1859.) *Corroval* was in dark brown lumps, having the appearance of a vegetable extract, and of an intensely bitter and persistent taste. They found its activity to depend upon the presence of a peculiar alkaloid, *corrovaline*. It resembles curare in that it produces general paralysis without previous spasm, but differs, in paralyzing also the heart. *Vao* or *Bao* appears to be a dilute and adulterated form of carroval. It would seem, therefore, that there is a variety of "woorari" used in South America which is more closely allied to strophanthus than to the true curares.

The term "curare" has no specific meaning, but according to Whiteford is simply the Indian word for poison, and it is evident that there are a considerable variety of arrow poisons used in South America under the same name.

In 1898 Boehm classified the curares of the markets as *Tubocurare*, originating from the Amazon, preserved in hollow bamboo canes, and said to contain about 9 to 11 per cent. of *tubocurarine* as its poisonous constituent; *Gourd curare*, derived from *Strychnos toxifera*, very rarely met with, and having *curarine* and a second alkaloid soluble in ether for its active principle; *Jor curare*, obtained from *Strychnoscastelnoei*, also exceedingly rare in the European markets, containing three alkaloids—*protocurine*, having a feeble curare action; the non-poisonous *proto-*

curidine; and *protocurarine*, which is more actively poisonous than is curarine. (*Ph. Ztg.*, xlii, 41.)

R. Boehm has isolated the two bases, *curarine* (also called *tubocurarine* from its source in the curare packed in bamboo tubes), $C_{19}H_{19}O_3N$, and curine, $C_{19}H_{19}O_3N$. The free tubocurarine forms an amorphous brown-red mass. Boehm (*Ber. d. Chem. Ges.*, xx, 143) states that curine exists in many specimens of curare; it may also be obtained from the aqueous extract of curare. It is much less poisonous than the accompanying curarine. Curine is a crystalline powder fusing at $161^{\circ} C$. ($321.8^{\circ} F$.), slightly soluble in cold water, freely soluble in alcohol, chloroform, and dilute acids. It forms a voluminous white precipitate with meta-phosphoric acid.

Woorari is one of those poisons whose active principle passes through animal membranes with difficulty, and hence when given by the stomach or rectum it acts very slowly, and in some cases elimination may proceed so rapidly that no marked influence is exerted, because not enough of the alkaloid is in the blood at any one time. There is also reason for believing that the alkaloid is destroyed in the liver. When injected into a vein, or introduced by the hypodermic needle or the poisoned arrow into the cellular tissue, it acts with great promptness. The symptoms caused are progressive loss of muscular power, the animal growing weaker and weaker, the respirations becoming more and more feeble, until death by asphyxia results.

The action of curare is to paralyze the peripheral ends of the motor nerves, the muscles, when directly stimulated, retaining their irritability. In mammals, as a result of the paralysis of the phrenic nerves, there is failure of respiration, and consequent death from asphyxia. The heart usually continues beating after cessation of the breathing, only very large doses affecting the arterial pressure directly. If, however, the dose be sufficient, the drug paralyzes the peripheral ganglia, thereby causing a dilation of the blood vessels with consequent fall of pressure, increased rate of the pulse through lack of inhibitory control, loss of irritability in the secretory nerves, and other modifications of functions of less importance. Tillie (*A. E. P. P.*, xxvi) has brought forward evidence to show that there is a primary excitation of the spinal cord which, however, in ordinary poisoning, is masked by paralysis of the motor nerves. The sensory apparatus does not seem to be affected, unless by enormous doses. Glycosuria has been frequently noticed in animals as the result of curare poisoning. According to Morishima (*A. E. P. P.*, 1889, xlii), this is apparently independent of the amount of glycogen in the liver or muscles.

Voisin and Lionville describe two types of poisoning in human beings. In the milder type the pulse is increased in force and frequency, respirations somewhat rapid, the temperature a little elevated, and the urine contains sugar. After larger quantities symptoms begin with severe chill, tremors, small pulse, and early loss of power in the lower extremities, later the cold skin becomes hot, the pulse rapid and full, there is marked reduction of the body temperature, with redness of the skin, and frequently profuse sweating. In non-fatal cases, the paralysis of the extremities rarely lasts for an hour, but the fever may continue for several days.

In cases of poisoning from the injection of woorari, a ligature around the limb between the place of injection and the heart, the free exhibition of diluents and evacuants, and artificial respiration when required, are the measures recommended. (*Ed. M. J.*, 1867, 667.)

According to the experiments of Joseph Tillie, *curine* has no influence upon the motor nerves, but acts both in the frog and in the mammal upon the heart, belonging physiologically to the digitalis group. Boehm states that the presence of curine in curare can be recognized by the white precipitate made by metaphosphoric acid.

Although curare has in the past been used as an anti-convulsant in *tetanus* and *hydrophobia*, it is a remedy of no practical value, because the phrenic nerve is no less susceptible than the other motor nerves of the body, and if given in sufficient doses to control the spasm, will likely lead to fatal asphyxia. According to the elaborate experiments of Du Cazal (*A. G. M.*, Sept., 1869), from one-fourteenth to one-seventh of a grain (0.005-0.01 Gm.) daily were borne by a dog without inconvenience; at the dose of ten milligrammes the characteristic phenomena began to show themselves, but disappeared in a few hours; with fourteen milligrammes the animal perished. For man the *doses* administered by subcutaneous injection were from one-twelfth to one-third of a grain (0.005-0.02 Gm.) of the crude curare. According to Bernard, curarine is at least twenty times as strong as curare.

Curcuma. U. S. 1870. *Turmeric. Curcuma longa* L. (Fam. *Zingiberaceae*.)—The rhizome of this plant is perennial, ovate or pear-shaped, and internally of a deep yellow or orange color. The plant is a native of Southern Asia, and is cultivated particularly in China, Bengal and Java, whence the root is exported to London, about 2,400,000 Kg. being shipped annually. The best is said to come from China.

The dried rhizome [*Safran des Indes, Souchet des Indes*, Fr.; *Kurkuma, Gelbwurzel*, G.; *Curcuma*, It., Sp.; *Zirsood*, Arab.; *Huldie*, Hindoo) is in cylindrical or oblong pieces (*Curcuma longa*), from 0.5 to 1.5 cm. in thickness, distinctly annulate, tuberculated, somewhat contorted, externally yellowish-brown or greenish-yellow, internally deep orange-yellow, hard, compact, breaking with a fracture like that of wax, and yielding a yellow or orange-yellow powder. Another variety, *Curcuma rotunda*, or *roundturmeric* is ovate or pear-shaped, about the size of a pigeon's egg, and marked externally with numerous annular wrinkles. Sometimes it comes cut into two transverse segments. The two varieties have a close resemblance in sensible properties, and are derived from the same plant, though formerly ascribed to different species. The odor of turmeric is peculiar; the taste warm, bitterish, and feebly aromatic. It tinges the saliva yellow. Analyzed by Pelletier and Vogel, it was found to contain lignin, starch, a peculiar yellow coloring matter called *curcumin*, a brown coloring matter, gum, an odorous and very acrid volatile oil, and a small quantity of calcium chloride. Curcumin was obtained, mixed with a little volatile oil (about 1 per cent.), by digesting the alcoholic extract of turmeric in ether, and evaporating the ethereal tincture. It has been obtained by F. A. Daube, in deep yellow crystals, of a high luster, by a process which may be found in the *A. J. P.* (1871, 308). C. L. Jackson and Menke have submitted turmeric root to a thorough examination, and give the following results:

The turmeric oil was first removed from the ground root by treatment with ligroine, then the curcumin mixed with a large quantity of resin is extracted with ether, and finally purified by crystallization from alcohol. The oil extracted by ligroine was dark yellow, and amounted to 11 per cent. of the root. The purified curcumin amounted to 0.3 per cent., and melted at 178° C. (352.4° F.). Analyses of the pure curcumin, of several of its salts, and of derivatives, show its formula to be C₁₀H₁₀O₃. It is brown in mass, but yellow in the state of powder, without odor or taste, insoluble in benzine, scarcely soluble in water, but very soluble in alcohol, ether, and the oils. It is a diatomic monobasic acid. When treated with weak oxidizing agents it yields vanillin. The alkalies rapidly change its color to a reddish-brown, and paper tinged with tincture of turmeric is employed as a test of their presence. The paper is rendered brown also by boric acid, which it thus serves to detect. When treated with a mixture of sulphuric and boric acids it yields a product called rosocyanin, because it dissolves in alcohol with a fine red color, and is turned blue by alkalies. Its alcoholic solution produces colored precipitates with lead acetate, silver nitrate, and other salts. Turmeric is used for dyeing yellow, but the color is not permanent. James Cook has found in turmeric an alkaloid, which forms crystallizable salts with sulphuric and nitric acids, and, separated from these acids by ammonia, yields a semi-crystalline precipitate. He observed also indications of a second base. (*P. J.*, Nov., 1870.) Ivanow Gajewaky also states that there is an alkaloid in the root. (*Pharmacographia*, 641.)

This root is a stimulant aromatic, bearing some resemblance to ginger in its operation, and is much used in India as a condiment, the so-called *curry powder*. It is a constant ingredient in the curries so generally employed in the East. In former times it had some reputation in Europe as a remedy in *jaundice*, but its medicinal action was purely imaginary, based on the old doctrine of signatures, and at present it is employed only to impart color to ointments and other preparations.

Turmeric, when used as an adulterant, may be detected by means of a mixture of boric and sulphuric acids, but according to A. E. Bell, a much better test is afforded by the use of the reagent made by dissolving 1 gramme of diphenylamine in 20 mls of 90 per cent. alcohol, carefully adding 25 mls of pure sulphuric acid. To a little of the suspected powder, placed on a slide, a drop of the reagent is added with a glass rod. Spots of a fine purple color immediately develop, which may be readily recognized with the microscope.

Turmeric paper, used as a test, is prepared by the method described in the appendix of the U. S. P.

Curry Leaves. *Currie*.—The leaves of the *Murraya Koenigii* Spreng. (fam. Rubaceae), a tree of India, are very largely used in that country as an aromatic, stomachic stimulant; when powdered and mixed with spices and other substances it forms *curry powder*, which is much used for seasoning food, rice, cooked dishes, etc.; it is also employed in *dyspepsia*, *diarrhea*, and even *dysentery*. According to J. Gr. Prebble (*Pharmacographia Indica*, vol. i), curry leaves yield to distillation a small quantity of volatile oil, and also contain a greenish-black resin, and a glucoside, koenigin. The clear oil extracted from the seeds is known as *sima-boleo oil*.

Cusparia Bark. *Cuspariae Cortex.* Br. 1898. *Angostura*, U. S. 1870. *Angostura (Angostura) Bark.* Carony Bark. *Cortex Angosturae.* *Angusture vraie*, Fr. Cod. *Angusture*, Fr. *Angusturarinde*, G. *Corteccia dell' Angostura*, It. *Corteza de Angostura*, Sp.—" The dried bark of *Cusparia febrifuga*, DC." Br., 1898. This bark was dropped from the U. S. Pharmacopoeia at the revision of 1880 and from the British in 1914. The subject of Angostura bark in its botanical relations has been involved in some confusion. Humboldt and Bonpland were the first to throw light upon its true source. Unable to attach it to any known genus, they erected it into a new one with the title of *Cusparia*, a name of Indian origin, to which they added the specific appellation of *febrifuga*. On their authority, *Cusparia febrifuga* was generally believed to be the true source of the medicine, and was recognized as such by the London College. But it appears from the researches of Hancock, who resided for several months in the country of the Angostura bark tree, that it is doubtful whether the plant described by Humboldt and Monpland is that which yields the drug, and not another species of the same genus. Hancock proposed for the plant of the Orinoco the title of *Galipea officinalis*, which was adopted in the U. S. P., 1870. This name was afterward changed by Hancock to *Cusparia officinalis*, which is now generally accepted as the correct origin for true Angostura bark.

Cusparia febrifuga is a small tree, irregularly branched, with an erect stem from three to five inches in diameter, and covered with a smooth gray bark. The leaves are alternate, petiolate, and composed of three leaflets, which are oblong and pointed at each extremity. They are very smooth and glossy, of a vivid green color, marked occasionally with small whitish round spots, and, when fresh, of a strong odor resembling that of tobacco. The flowers are numerous, white, arranged in axillary and terminal peduncled racemes, and of a peculiar unpleasant odor. The fruit consists of five two-valved capsules, of which two or three are commonly abortive. The seeds, two of which are contained in each capsule, one often abortive, are round, black, and of the size of a pea. The tree grows abundantly on the mountains of Carony, between the 7th and 8th degrees of N. latitude, at the height of from six hundred to one thousand feet above the level of the sea.

The bark is generally brought from the West Indies packed in casks; but, according to Brande, the original package as it comes from Angostura consists of the leaves of a species of palm, surrounded by a net-work of sticks.

Cusparia bark "occurs in flattened or curved pieces, or in quills, generally about 10 to 12 Cm. long, 2.5 Cm. wide, and 2 mm. thick. The outer layer usually consists of a gray or yellowish cork which is often soft and easily removed, disclosing a hard, dark brown inner layer; the inner surface is light brown and frequently laminated. The fracture is short and resinous; on the fractured surface many white points are visible. A transverse section exhibits numerous cells filled with acicular crystals of calcium oxalate and small oil glands, but seldom any sclerenchymatous tissue other than small isolated groups of bast fibers. Odor musty;

taste bitter." Br., 1898. Calcium oxalate raphides are abundant in the bark, but the

most characteristic peculiarity is the presence of numerous cells a little larger than the other parenchymatous cells and completely filled with oil or a yellowish resin. The odor of Angustura bark is peculiar and disagreeable when fresh, becoming fainter with age; the taste is bitter and slightly aromatic, leaving a sense of pungency at the end of the tongue. According to Fischer, it contains volatile oil, bitter extractive, a hard and bitter resin, a soft resin, a substance analogous to caoutchouc, gum, lignin, and various salts. Oberlin and Schlagdenhauffen (1878) found in the bitter extractive an alkaloid, *angosturine*, $C_{10}H_{40}O_{14}N$, which melts at $85^{\circ} C.$ ($185^{\circ} F.$), is crystallizable, and is turned red by pure sulphuric acid, and green by sulphuric acid with admixture of nitric acid. The volatile oil, which may be obtained by distillation with water, is of a pale yellowish color, lighter than water, of an acrid taste, and with the odor of the bark. Beckurts and Froeger (Gildemeister and Hoffman, *Aetherische Oele*, p. 601) found as its essential ingredient a sesquiterpene alcohol, $C_{15}H_{26}O$, to which they give the name *galipol*. It $H_{17}O_3N$. Korner), melting at $89^{\circ} C.$ ($192.2^{\circ} F.$) and is optically inactive. *Cadinene*, $C_{15}H_{24}$, is also present and gives left rotatory character to the oil. A small quantity of an inactive sesquiterpene, *galipene*, is also present, as well as traces of a terpene which is probably *pinene*. The *cusparine* of Saladin has not been found by other investigators. Beckurts and Nehring (*A. J. P.*, 1892, 410) announced the discovery of four alkaloids in Angustura bark—viz., *galipine*, $C_{20}H_{21}O_3N$, melting at $115.5^{\circ} C.$ ($240^{\circ} F.$) and crystallizing in slender lustrous needles of white

color; *galipidine*, $C_{19}H_{19}O_3N$, melting at $111^{\circ} C.$ ($231.8^{\circ} F.$) and crystallizing in silky lustrous plates of white color; *cusparine*, $C_{20}H_{19}O_3N$ ($C_{19}H_{17}O_3N$, Korner), melting at $90^{\circ} C.$ ($192.2^{\circ} F.$) and readily soluble in alcohol, ether, chloroform, acetone, and benzene, more sparingly in light petroleum; and *cuspardine*, $C_{19}H_{17}O_3N$, melting at $78^{\circ} C.$ ($172.4^{\circ} F.$) and crystallizing in minute slender white needles. Its salts are less soluble than those of galipine and galipidine, but more readily than those of cusparine. The four alkaloids are tertiary bases. (See also *A. Pharm.*, 233 (1895, No. 6), 410.) Beckurts and Nehring also extracted the essential oil, amounting to 1.5 per cent. It had a sp. gr. at $15^{\circ} C.$ ($59^{\circ} F.$) of 0.956. Distilled under a pressure of 35 mm. it commenced to boil at $153^{\circ} C.$ ($307.4^{\circ} F.$) and the greater part distilled between 200° and $220^{\circ} C.$ (392° - $428^{\circ} F.$) the last portions becoming solid when artificially chilled. (See also *A. Pharm.*, 1897, 518.) They found the bitter principle angosturine, which when purified was white and melted at $58^{\circ} C.$ ($136.4^{\circ} F.$). A glucoside was also found, the solution of which fluoresced; but it was not investigated. Troeger and Beck assert that angostura bark contains *cusparine*, $C_{19}H_{17}ON_3$ (thus confirming Korner's formula) *galapoidine*, $C_{19}H_{15}ON_4$, and a new alkaloid of the formula $C_{16}H_{13}O_2N$. (*A. Pharm.*, 1913, cli, 246.) For a description of false Angustura barks, see *U. S. D.*, 19th ed., p. 417.

Angustura bark has long been used by the natives of South America and the West Indies as a stimulant tonic. In large doses it also evacuates the stomach and bowels, and is often employed for this purpose in South America. It is said to be peculiarly efficacious in bilious *diarrheas* and *dysenteries*, and has been recommended in dyspepsia and other diseases requiring a tonic treatment. The testimony, however, of practitioners in Europe and the United States, is not strongly in its favor.

The Br., 1898, *Infusion, of Cusparia* was prepared as follows: "Cusparia Bark, in No. 20 powder, 1 ounce (Imperial) or 5.0 grammes; Distilled Water, boiling, 1 pint (Imp. meas.) or 1000 mils. Infuse in a covered vessel for fifteen minutes; strain." Br., 1898. Under the name of *Infusum Angusturae* this preparation was official in the U. S. Pharm., 1870, made in the proportion of half a troyounce of Angustura bark in a pint of water. Dose, two fluidounces (60 mils), repeated every two, three, or four hours.

It may be given in powder, infusion, tincture, fluidextract, or extract. *Dose*, of the extract, five to fifteen grains (0.32 to 1 Gm.), which, however, according to Hancock, is inferior to the powder or infusion. To obviate nausea, it is frequently combined with aromatics. *Dose*, in substance, ten to thirty grains (0.65 to 2.0 Gm.). In larger quantities it is apt to produce nausea. It is known best in the proprietary preparation called "Angustura Bitters."

CUSSO. Br.

KOUSSO [Brayera]

"Koussou consists of the dried panicles of pistillate flowers of *Brayera anthelmintica*, Kunth." Br. "The dried panicles of the pistillate flowers of *Hagenia abyssinica* (Bruce) Gmelin (Fam. *Rosaceae*), without the presence of more than 10 per cent. of the staminate flowers, other parts of the tree, or other foreign matter. Reject any portions of the stems over 3 mm. in diameter and any binding material, before the drug is powdered or used." N. F.

Brayera, N. F.; Kooso; Kusso; Cousso, Fr. *Cod.*; Koussou, Fr.; Flores Koso, P. G.; Kosobluthen, Koso, Kusso, Cusso, G.; Koussou, Cosso, It.; Couso, Sp.

Koussou was dropped from the U. S. P. IX but has been introduced into the N. F. IV and is retained in the Br. Pharm., 1914.

Hagenia abyssinica Willd. (Syn. *Brayera anthelmintica* Kunth) is a beautiful tree about twenty feet high, growing on the table-land of Abyssinia, at an elevation of from three thousand to eight thousand feet. The branches exhibit circular cicatrices, left by the fallen leaves. The latter are crowded near the ends of the branches, are large, pinnate, sheathing at the base, with opposite, lanceolate, serrate, leaflets, villose at the margin, and nerved beneath. The unisexual flowers are tinged with purple, pedicelled, with an involucre of four roundish, oblong, obtuse, membranous bracts, and are arranged in fours, upon hairy, flexuous, bracteate peduncles, with alternate

branches. They are small and of a greenish color, becoming purple. These and the unripe fruit are the parts of the plant employed. The petals are apt to be wanting in the dried flowers. They are brought from Abyssinia packed in boxes, reaching Europe chiefly by way of Aden and Bombay. The Abyssinian name of the medicine has been variously spelled by European writers kosso, koosso, cusso, cosso, etc. The fruit of the tree is said to be used as an anthelmintic in Abyssinia, but Dragendorff failed to detect any active principle in it. It is stated that in Abyssinia, honey gathered directly after the flowering season from beehives in gardens planted with kouso plants, is used in doses of a teaspoonful as a very effective tenicide.

Properties.—The dried flowers are in unbroken though compressed clusters. The male flowers are usually collected, so that ordinarily the general color of the mass is greenish-yellow or light brown; sometimes the female flowers constitute the bulk of the drug, which then has a distinct reddish tint, and is often known in commerce as *red kouso*. In accordance with our Pharmacopoeia, this commercial variety should alone be used. The male flowers are often found mixed with the female flowers, when loose (not in bundles), as high as 12 per cent. of this adulteration having been noticed by Meyer and Sandlund. (*Ph. Ztg.*, 1893, No. 99.) The description in the Br. Pharm. is as follows: "Usually in more or less cylindrical rolls from three to six decimetres long, composed of reddish panicles of pistillate flowers. Panicles much branched, the branches arising from the axils of large sheathing bracts; more or less covered with hairs and glands. Flowers numerous, small, shortly stalked, mostly unisexual, with two roundish, membranous, veined bracts at the base of each. Calyx with reddish veins, hairy externally, and consisting of two alternating whorls each of five segments, the inner whorl being curved inwards over the young fruit and shrivelled. No marked odor; taste bitter and acrid." *Br.*

The N. F. describes the drug as "usually in rolls or flattened bundles from 25 to 50 cm. in length, reddish-brown, or occurring more or less loose and stripped from the larger portions of the panicles. Panicle branches cylindrical, somewhat flattened, longitudinally furrowed or wrinkled, externally light brown to yellowish, tomentose, glandular; internally, cork brownish, bast- and wood-fibers yellow, fibro-vascular bundles in wedges, pith large and yellowish-brown; nodes distinct, each with a scar or branch and subtended by a sheathing bract; internodes mostly from 1 to 2 cm. in length; flowers subtended by two ovate,

reddish, pubescent and glandular bracts; pedicel short; calyx turbinate, pubescent below, subtended by four or five rigid, spreading, obovate, purple-veined bractlets which are persistent and elongated in fruit, alternating with and larger than the five usually shriveled, reflexed calyx lobes; petals five, caducous, and usually absent in the drug; carpels two; styles exserted, stigmas broad and hairy with prominent papillae; fruit an ovoid akene about 2 mm. in diameter, enclosed by the remains of the calyx. The staminate flowers are greenish-yellow, with about twenty fertile? stamens. Odor slight; taste bitter. The powdered drug is light brown or reddish-brown and, when examined under the microscope, exhibits numerous simple, non-glandular, straight or curved hairs, up to about 1 mm. in length, with thick, strongly lignified walls, usually enlarged at the base; glandular hairs with one- to three-celled stalks, the glandular head unicellular or consisting of one or two pairs of cells; tracheae spiral, annular, scalariform, or with bordered pores, up to 0.05 mm. in width; sclerenchymatous fibers long, thick-walled, strongly lignified and with numerous, simple, oblique pores; parenchyma of pith more or less lignified and with large simple pores; fragments of epidermal tissue from the bracts and calyx with elliptical stomata up to 0.03 mm. in length; groups of thin-walled, somewhat branching parenchyma cells with large intercellular spaces; tissue from the inner surface of the pericarp consisting of numerous, elongated, porous, strongly lignified cells; calcium oxalate in rosette aggregates up to 0.04 mm. in diameter; occasionally fragments of tissue containing prisms of calcium oxalate, the latter about 0.014 mm. in length; pollen grains few, nearly spherical, from 0.025 to 0.04 mm. in diameter, with three pores. The larger branches of the panicles exhibit simple, non-glandular hairs up to about 5 mm. in length; tracheae up to 0.125 mm. in width and rosette aggregates of calcium oxalate up to about 0.075 mm. in diameter. *Brayera* yields not more than 9 per cent. of ash." *N. F.*

As the medicine, from its high price, is apt to be adulterated, it should be procured in the unpowdered state, in which the botanical characters of the flower will sufficiently test its genuineness. It has a fragrant balsamic odor, and the taste, slightly perceptible at first, becomes in a short time somewhat acrid and disagreeable. Analyzed by Wittstein, it was found to contain, in 100 parts, 1.44 of fatty matter and chlorophyll, 2.02 of wax, 6.25 of bitter acrid resin, 0.77 of tasteless resin, 1.08 of sugar, 7.22 of gum, 24.40 of tannic acid, < ? > of lignin, 15.71 of ashes, with 0.14 part of loss. It has also been studied by Clemens Willing (*Ch. Cb.*, 1855, 224), and by Pavesi (*Viertelj. f. Prak. Pharm.*, 1858, viii, 505)

but we are chiefly indebted to Bedall, of Munich, for determining that the bitter acrid resin of Wittstein is equivalent to the *taeniin* of Pavesi, and for the name of *kosin*. This may be obtained by treating kousso repeatedly with alcohol to which calcium hydroxide has been added; the residue is boiled with water, the liquids are mixed, filtered, and distilled, and the residue treated with acetic acid, which precipitates the kosin in a white flocculent form, soon becoming denser and resin-like, and, on drying', yellowish, or, at a higher temperature, brown. The product is 3 per cent. In bulk, kosin has an odor like that of Russian leather, a persistent bitter and acrid taste, a yellowish or yellowish-white color, and an indistinct crystalline appearance under the microscope. It is very sparingly soluble in water, but freely so in alcohol, ether, and alkaline solutions. (*A. J. P.*, 1872, 394.) Its formula, according to Fluckiger, is $C_{31}H_{38}O_{10}$. It fuses at $142^{\circ} C.$ ($287.6^{\circ} F.$), and remains after cooling an amorphous yellow mass, but if touched with alcohol it immediately assumes the form of stellate tufts of crystals. This may be repeated at pleasure, kosin not being altered by cautious fusion. (*Pharmacog.* 2d ed., 258.) Leichsenring (*A. Pharm.*, 1894, 50) has reexamined kousso, and finds an inactive crystalline principle to which he gives the name *protokosine*, and an amorphous substance, *kossotoxine*, which he considers the active principle of the drug; the latter is a yellowish powder, fusing at $80^{\circ} C.$ ($176^{\circ} F.$), and not obtainable in a crystalline state. It is easily soluble in alcohol, ether, benzene, carbon disulphide, and insoluble in water.

Sodium kosinate has been recommended by Pavesi as a very eligible preparation for obtaining the virtues of kosin; a process is given in *Am. Drug.*, 1884, 96; *A. J. P.*, 1885.

Uses.—Kousso is highly valued in Abyssinia as a vermifuge. Bruce speaks of it in his travels, and gives a figure of the plant. Brayer, a French physician practising in Constantinople, published a treatise on it at Paris in 1823. It was in his honor that Kunth adopted the generic title of the plant. Much attention has been attracted to this valuable medicine, and trials made with it have proved its efficacy in the destruction and expulsion of the *tape-worm*. Its effects when taken internally are not very striking. In the ordinary dose it sometimes produces heat of stomach, nausea, and even vomiting, and shows a tendency to act on the bowels, though this effect is not always produced. It appears to act exclusively as a poison to the worms, and has been found equally effectual in both kinds of tape-worm. The medicine is

taken in the morning upon an empty stomach, a light meal having been made the preceding evening. A previous evacuation of the bowels is also recommended. The flowers are given in the form of powder, mixed with half a pint of warm water, the mixture being allowed to stand for fifteen minutes, then stirred up, and taken in two or three draughts at short intervals. The medicine may be preceded and followed by lemonade. The medium dose for an adult is half an ounce (15.5 Gm.), which may be diminished one-third for a child of twelve years, one-half for one of six years, and two-thirds for one of three years. Should the medicine not act on the bowels in three or four hours, a brisk cathartic should be administered. One dose is said to be sufficient to destroy the worm. Should the quantity mentioned not prove effectual, it may be increased to an ounce (31 Gm.).

Pure kosin has been considerably used in Germany in doses of thirty grains (2 Gm.), taken in two or four powders; but Buchheim found *pure* kosin less powerful as an anthelmintic than that which was not pure, while Arena (*Ph. Z. R.*, 1879, 655) believes that kosin is not the active principle at all, but that the activity of kousso resides exclusively in the green, slightly bitter resin, which is soluble in alcohol and ether. If this view be correct, it explains the greater efficacy of freshly powdered kousso, for the green resin turns yellow by age and loses its power, and Arena's investigations further indicate that the amorphous kosin of commerce is preferable to the pure principle. It is a yellowish-brown mass, which may be given in doses of from seven to fifteen grains (0.45-1.0 Gm.), repeated every half hour until four doses are taken, to be followed in an hour by a full dose of castor oil. So far as we know, no cases of poisoning by kousso or its active principle are on record, but it has been found by Rochebrune to be capable of causing centric convulsions in the lower animals.

Dose, of kousso, half an ounce (15.5 Gm.); of kosin, seven to fifteen grains (0.45-1.0 Gm.).

Cyclamen. *Cyclamen europoeum* L. *Pain de Porceau*, *Arthanite*, Fr. *Erdscheibe*, *Erdbrod*, *Schweinbrod*, G. *Sowbread*.—This is an herbaceous, perennial, stemless plant, of the subalpine mountainous regions of Europe. Some of the species of *Cyclamen* are among the most popular of winter plants on account of their beautiful foliage and exquisite flowers. The corm is globular, with many branched rootlets, almost black without, and white within, inodorous, and, when fresh, of a bitter, acrid, burning taste. By drying it loses much of its acridity, and is said to be rendered edible by roasting. Hogs are said to root it up from the ground and to eat it with impunity,

and hence the common name "Sow Bread." The corm is a drastic cathartic, and is used to cause abortion, but has in such cases produced fatal gastro-enteritis. Its active principle appears to be *arthanitin* of Saladin, the *cyclamin* of S. De Luca. This is a poisonous glucoside, which, when boiled with diluted acids, splits into cyclamiretin, $C_{15}H_{22}O_2$, and glucose. It is white, amorphous, inodorous, and, when held a short time in the mouth, intensely acrid, extending its action even to the throat. With cold water it swells and becomes gelatinous, but is readily dissolved, and form a solution which froths like soap and water, and is coagulated by a heat of about $65.5^{\circ} C.$ ($150^{\circ} F.$). Alcohol dissolves it with difficulty when cold, but freely when hot; it is soluble in glycerin with the aid of heat; and is insoluble in ether, chloroform, carbon disulphide, and the essential oils. Its formula, according to an analysis by Klinger, is $C_{20}H_{34}O_{10}$, although Robert (*Chem. Ob.*, 1893, i, 32) makes it one of the class of saponins, and gives it the formula $C_{20}H_{32}O_{10}$, which is the same as that of sarsaparilsaponin and smilacin. T. W. C. Martius recommends the following method of preparing it. The tubers, collected in the autumn, dried and powdered, are mixed with animal charcoal, and exhausted at a boiling heat by alcohol of 0.825; the tincture is filtered, concentrated, and set aside for six or eight weeks, when the cyclamin is deposited. This should be washed on a filter with alcohol till it passes colorless, and if the filtrate be concentrated, and set aside, it will deposit a further quantity in a few weeks. The whole is then mixed with animal charcoal and treated with boiling alcohol, which will slowly deposit the pure cyclamin on cooling. *Dose*, of powdered root, is said to be from twenty to forty grains (1.3-2.6 Gm.).

Cydonium. *U. S.* 1880. *Quince Seed. Semen Cydonus. Semeneces (Pepins) de Coing.* Fr. *Quittenkerne, Quittensamen*, Gr. *Semi di Cotogno*, It. *Simiente de Membrillo*, Sp.—*Cydonia vulgaris*, Pers. (Fam. *Rosaceae*), or common quince tree, has been under cultivation since very remote times. It is supposed to be a native of Crete, but grows wild in Austria, on the banks of the Danube, and in Northern Africa, is extensively cultivated for its fruit. The fruit is yellow, downy, of an agreeable odor, and a rough, astringent, acidulous taste, and in each of its five cells contains from eight to fourteen seeds. Though not eaten raw, it forms a very pleasant confection, and a syrup prepared from it may be used as a grateful addition to drinks in sickness, especially in looseness of the bowels, which it is supposed to restrain by its astringency. The seeds, which were formerly official, are ovate, angled, reddish-brown externally, white within, inodorous, and nearly insipid, being slightly bitter when long chewed. Their coriaceous envelope abounds in mucilage, which is extracted by boiling water. They were officially described as follows: "About 6 mm. in length, oval, or oblong, triangularly compressed, brown, covered with a whitish, mucilaginous epithelium, causing the seeds of each cell to adhere. With water the seeds swell up, and form a mucilaginous mass. The unbroken seeds have an insipid taste." *U. S.*, 1880. The seeds which are still extensively imported and used in the preparation of *Bandoline* and cosmetic lotions are frequently adulterated with fragments of bark or other vegetable tissue of the same size and color as the seeds and only detected by a close examination of the drug. Two drachms of the seeds will render a pint of water thick and ropy. (*A. J. P.*, 1876, 35.) It has been proposed to evaporate the decoction to dryness, and powder the residue. Three grains of this powder form a sufficiently consistent mucilage with an ounce of water. According to Garot, one part communicates to a thousand parts of

water a semi-syrupy consistence. (*J. P. C.*; 3e ser., iii, 298.) Pereira considers the mucilage as peculiar, and proposes to call it *cydonin*. It differs from arabin in not yielding a precipitate with potassium silicate, and from bassorin and cerasin in being soluble in water both hot and cold. Tollens and Kirchner (*Ann. Ch. Phys.*, clxxv, 205-226) assign to it the formula $C_{18}H_{28}O_{14}$, regarding it as a compound of gum, $C_{12}H_{20}O_{10}$ and cellulose, $C_6H_{10}O_5$, less one molecule of water. Quince mucilage (*Mucilago Cydonii*, U. S., 1880) may be used for the same purposes as other mucilaginous liquids. The U. S. P., 1880, gave the following formula for its preparation. "Cydonium, two parts [or thirty-six grains]; Distilled Water, one hundred parts [or four fluidounces]. Macerate the Cydonium for half an hour, in a covered vessel, with Distilled Water, frequently agitating. Then drain the liquid through muslin, without pressure. This preparation should be freshly made, when required for use." U. S., 1880.

Cynara. *Cynara. Scolymus* L, (*Artichoke*).— This is a composite plant, indigenous in the south of Europe, and cultivated as a culinary vegetable. The receptacle and the lower portion of the fleshy leaflets of the flower-heads are eaten. When young, the heads are cut up raw and eaten as salad; when older, they are boiled, and dressed variously. The flowers are said to curdle milk, and the plant to yield a good yellow dye. The leaves and their expressed juice are very bitter, and have been thought to be actively diuretic. *Cynara Cardunculus*, the cardoon of the garden, very much resembles the artichoke. The stalks of the leaves are used as a vegetable in France. Artichoke leaves have been used in *dropsies* and *rheumatic affections*.

Cynoglossum. *Cynoglossum officinale* L. *Hound's-tongue. Langue de Chien*, Fr. *Hundszunge*, G.—A biennial plant of the fam. *Boraginaceae*, common both in Europe and in this country. The leaves and root have been employed, but the latter has been generally preferred. The fresh plant has a disagreeable narcotic odor, resembling that of mice, which is dissipated by drying. The taste is nauseous, bitterish, and mucilaginous. Although hound's-tongue has been believed by some to be nearly inert, there can be little doubt that it is a dangerous poison. The experiments of Diediilin (*M. S. Rep.*, 1868) many years ago demonstrated that the extract paralyzes motor nerves in vertebrate animals, and K. Greimer has found in it a poisonous alkaloid, *cynoglossine*, which acts upon the animal organism similarly to curare; also a toxic glucoside, *consolidin*, and a notable amount of *choline*. (*P. J.*, vol. Ixv.) *Consolicin*, a derivative of *consolidin*, like *consolidin*, paralyzes the central nervous system. *Cynoglossum* has been used as a demulcent and sedative in *coughs, catarrh, spitting of blood, dysentery, and diarrhea*. The *pilulae de cynoglosso* owe their properties chiefly to opium.

Cypress Oil. *N. N. R.* 1917. *Oleum Cupressi*. —A volatile oil distilled from the leaves and young branches of *Cupressus sempervirens*. It has a specific gravity of 0.88 to 0.89 at 15° C. (59° F.) and an optical rotation of + 4° to + 18°. It contains furfural, d-pinene, d-camphene, cymene, d-sylvestrene, d-terpineol, and esters of the same, l-cadinene and cypress camphor. It is used as an inhalant in whooping cough by sprinkling on the pillow and coverlet of the patient.

Cypripedium. *N. F. IV (U. S. VIII). Lady Slipper. Rhizoma Cypripedii. Yellow Lady Slipper Root. Yellow Indian Shoe. Yellow Moccasin Flower. Yellow Noah's Ark. Venus' Shoe. Male Nervine. American Valerian. Racine de Cypripede jaune, Valeriane americaine, Fr. Gelbfrauenschuhwurzel, G.—*" The dried rhizome and roots of *Cypripedium hirsutum* Miller, *Cypripedium pubescens* Willdenow, or of *Cypripedium parviflorum* Salisbury (Fam. *Orchidaceae*), without the presence of more than 5 per cent. of other parts of the same plants or other foreign matter." *N. F. IV.*

Under the common name of *lady's slipper*, or *moccasin plant*, several species of *Cypripedium* inhabit the woods in different parts of the United States. They are small plants, with large, many-nerved, plaited leaves, sheathing at the base, and large, often beautiful flowers, of a shape not unlike the Indian moccasin, whence they derive one of their common names. Several of them have been used by American physicians, the root being the part employed. R. P. Stevens of Ceres, Pennsylvania, says of them that he has found the *C. reginae* Walt. (*C. spectabile* Salisb.), and *C. acaule* Ait., especially when growing in dark swamps, to be possessed of narcotic properties, and to be less safe than the *C. parviflorum* Salisb., which is gently stimulant with a tendency to the nervous system, and is quite equal to valerian. He has employed it advantageously in hysteria, and in the pains of the joints, following scarlet fever. (*N. Y. Journ. Mod.*, iv, 359.) E. Ives considers *C. hirsutum* Mill. and *C. reginae* Walt. identical in their effects, but *C. reginae* more powerful. (*Trans. Am. Med. Assoc.*, iii, 312.) The roots of the two species, *C. hirsutum* and *C. parviflorum* are indiscriminately found in commerce and sold under the same name.

Cypripedium parviflorum var. *pubescens* or large *yellow lady's slipper*, has a simple, often flexuous, pubescent, leafy stem, from one to two feet high. The leaves are pubescent, ovate-lanceolate, acuminate, narrowing at the base, about four or five inches long by two in breadth, alternate, sessile, and sheathing. The flower is usually solitary and terminal, with four divisions of the perianth, the two outer cohering nearly to the apex, the inner longer, narrower, undulatory or twisted, and the lip an inch or two in length, swelling sac-like, and of a yellow color. The fruit is an oblong capsule, tapering at each end, recurved, pubescent, and peduncled. The plant is indigenous, growing abundantly in rich, moist woods throughout the United States.

Cypripedium parviflorum. Small-flowered Yellow Lady's Slipper, is a perennial plant with a leafy stem, a foot or two in height, and comparatively small yellowish-green flowers, appearing in May. The specific character of the flower, which is that also of the plant, is that the lobe of the style is triangular and acute; the outer petals are oblong-ovate and acuminate; the inner linear and contorted; the lips shorter than the petals, and compressed. This species grows extensively through the United States, south of the Potomac, east and west of the Alleghanies, and in several of the Northern States, particularly New York, Michigan, Connecticut and Vermont.

It is described by the *N. F. IV* as a " rhizome of horizontal growth, curved, from 3 to 10 cm. in length, and from 2 to 6 mm. in thickness, orange-brown to dark-brown, the upper side showing numerous circular, cup-shaped scars, closely covered below with simple, wiry roots, varying from 3 to 15 cm. in length; fracture of rhizome short, white, that of roots somewhat fibrous. Odor distinct, heavy; taste sweetish, bitter,

and somewhat pungent. The powdered drug is yellowish-brown and, when examined under the microscope, exhibits numerous rounded or somewhat angular, simple and compound starch grains up to 0.014 mm. in diameter; calcium oxalate in raphides up to 0.065 mm. in length and occurring isolated or in bundles, occasionally imbedded in a mucilage-like plasma; tracheae spiral, scalariform, or with simple or bordered pores; a few tracheids; sclerenchyma fibers, long, thin-walled and lignified; a few non-lignified, thick-walled fibers; fragments of epidermal tissue composed of elongated cells with reddish-brown walls; groups of thick-walled parenchyma cells with numerous simple pores. *Cypripedium* yields not more than 12 per cent. of ash." *N. F. Maisch* gave a distinctive description of the roots of the two species. (*A. J. P.*, 1872, 297.) Poisonous properties have been attributed to *C. reginae* Salisb. and *C. parviflorum* var. *pubescens* (see *Geol. Nat. Hist. Survey, Minnesota, Bull.*, 9, part i), but it has been shown that the secretion from the glandular hairs simply exerts an irritant action.

Senega and hydrastis roots are sometimes found accidentally mixed with those of *cypripedium*, probably from the plants having a common habitat.

Cypripedium has a somewhat aromatic odor, which diminishes by time, and a bitter, sweetish, peculiar, and in the end somewhat pungent taste. Henry C. Blair found it to contain a volatile oil, a volatile acid, tannic and gallic acids, two resins, gum, glucose, starch, and lignin. (*A. J. P.*, 1866, p. 494.) The eclectic preparation *cypripedin* is said to be a resinoid, obtained by precipitating with water a concentrated tincture of the rhizome. The substance thus obtained is complex, and has no claim to the name given it, which ought to be reserved for the active principle when discovered. It is probable that the virtues of the rhizome reside in a volatile oil and a bitter principle.

Cypripedium appears to be a gentle nervous stimulant or antispasmodic, and has been used for the same purposes as valerian, though less powerful. E. Ives of New Haven, Conn., commends the remedy in *hypochondriasis* and *neuralgia*. It may be used in powder, infusion, or tincture.

Dose, of the powder, fifteen grains (1.0 Gm.), three times a day. The resinoid, obtained by precipitating the tincture, has been given in doses varying from half a grain to three grains (0.032 to 0.20 Gm.).

Cytisus. *Cytisus Laburnum*, L. (Fam. *Leguminosae*.)—*Laburnum* is a small hardy tree, indigenous in the higher mountains of Europe and cultivated throughout the civilized world for its flowers, which appear early in the spring in rich pendant yellow clusters. All parts of the plants are probably poisonous. In fifty-eight boys poisoned simultaneously by the roots, the symptoms were intense sleepiness, vomiting, convulsive movements, coma, slight frothing at the mouth, and unequally dilated pupils. (*M. T. G.*, vol. ii, 875.) In some cases the diarrhea has been severe. The convulsions have at times been markedly tetanic; wide-spread anesthesia has been noted, and also excessive mydriasis, with loss of the pupillary reflex, elevation of temperature, delirium, and cyanosis. After death there have been found erosion of the colonic mucous membrane, extreme hyperemia of the brain, and nephritis. (*D. M. W.*, xxi, 1895.) For cases, see also previous editions of the *U. S. D.*; *Le Mouvement*

Med., 1875, No. 28; *Dublin Q. J.*, 1863, 248; *M. T. G.*, Sept., 1862; *L. L.*, Aug., 1870.

Husemann and Marme isolated in 1864 an alkaloid, *cytisine*, a white, crystalline solid, of a bitter, somewhat caustic taste, soluble in water and alcohol, but scarcely at all soluble in ether, chloroform, benzene, or carbon disulphide. The same alkaloid has been isolated from the seeds of several plants of the *Papilionaceous* group. A second alkaloid, *laburnine*, was also announced by them. (*Chem. News*, July 16, 1869, 36.) Partheil (*A. Pharm.*, 1892, 448) has since studied cytisine, and gives it the formula $C_{11}H_{14}ON_2$, which has been adopted by other authorities. Ferric chloride colors cytisine and its salts blood-red, which color, however, disappears on diluting with water or on addition of hydrogen dioxide. If after the addition of this latter reagent the mixture is heated gently in the water bath an intense blue color is developed. When cytisine is distilled with soda lime, pyrrol is obtained, besides a base, $C_9H_{13}N$, which is possibly a hydroquinoline. A. Kannerda purified crude cytisine, obtained from the seeds of *Cytisus Laburnum* L., by the well known shaking out process with chloroform, by distilling it in a partial vacuum. Under a pressure of 2 mm. and a temperature of $228^{\circ} C.$ ($442.4^{\circ} F.$), the alkaloid distils over as a colorless liquid and congeals in the receiver in the form of fine crystalline needles. It separates from absolute alcohol in the form of small transparent rhombic crystals, which have the sp. gr. 1.0046. (*Ap. Ztg.*, July, 1900, 486.)

According to the researches of P. C. Plugge (*A. Pharm.*, 1895), cytisine is a very widely distributed alkaloid. He has found it in eight species of the genus *Cytisus*, two of the genus *Genista*, two of the genus *Sophora*, two of the genus *Baptisia*, and in other plants. He asserts that *ulexine* of Gerrard, from *Ulex europaeus* L., *sophorine* of H. C. Wood, from *Sophora secundiflora* (Gav.) DC. (*S. speciosa* Benth.), and *baptitoxine* of von Schroeder, from *Baptisia tinctoria* K. Br., are identical with cytisine. Plugge also believes that the alkaloid of *Euchestra Horsfieldii* Benn. (fam. *Leguminosae*), a Javanese pea, whose seeds are used as a contra-poison by the natives, is identical with cytisine. Kobert and Kadziwillowicz (*Arb. d. Pharm. Inst. Dorpat.*, 1888, ii) found that cytisine caused in lower animals, spinal convulsions, followed, if the dose were large enough, by paralysis, vomiting of central origin, primary stimulation, and secondary paralysis of respiration and a marked reduction in the ozonizing powers of the red corpuscles. The blood pressure was at first elevated and later depressed and there was a paralysis of the motor nerves similar to that produced by curare. Dale and Laidlaw (*J. P. Ex. T.*, 1912, hi) find that the rise and secondary fall of the blood pressure is due to effects upon the sympathetic ganglia and that cytisine closely resembles nicotine in its physiological action. Gray (*J. P. C.*, 1862) found laburnum to produce in man narcotic effects, and commends it in *vomiting, bronchitis, whooping cough*, and *asthma*.

Of late years several salts of cytisine have made their appearance. The hydrochloride, hydro-bromate and nitrate have all been used as diuretics and nervines in one-twentieth to one-tenth grain doses (0.003-0.006 Gm.).

The Dispensatory of the United States of America Twentieth Edition (1918)

Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Damiana. *N. F. IV. Turnera.*—"The leaves of *Turnera diffusa* Willdenow or of *Turnera aphrodisiaca* Ward (Fam. *Turneraceae*), without the presence of more than 10 per cent. of stems and other parts of the same plants or other foreign matter." *N. F.* There are 57 species of *Turnera* which are mostly indigenous to tropical America. The 2 species which yield damiana are small shrubs indigenous to Southern California, Mexico and the Antilles. These leaves are "obovate to lanceolate, from 10 to 25 mm. in length and from 4 to 10 mm. in width, shortly petiolate, obtuse or acute at the apex, and with a short, cuneate base; sharply two- to ten-toothed on each side; the veins ascending, generally strong, straight and simple, and running to the sinuses of the teeth, but sometimes branched and sending the branches into the teeth; the upper surface smooth and pale green, the lower glabrous or with a few hairs on the ribs (*Turnera aphrodisiaca*) or densely tomentose over the entire surface (*Turnera diffusa*). Intermixed with the leaves are frequently found some reddish twigs, the young tips and buds of which are grayish with appressed pubescence (*Turnera aphrodisiaca*) or white floccose (*Turnera diffusa*), also flower buds, yellowish flowers, and globose pods. Odor aromatic; taste characteristic, aromatic and resinous. The powdered drug is light yellowish-green and, when examined under the microscope, exhibits numerous rough simple hairs, up to 0.8 mm. in length and 0.03 mm. in width at the base, with a narrow lumen usually distinct at the base only and with heavy, mostly non-lignified walls, often curved near the base so that the major portion of the hair lies nearly parallel to the surface of the stem or leaf; fragments of the epidermis from the stems composed of somewhat rectangular cells up to about 0.07 mm. in length and about one-half as broad, with square or somewhat pointed ends, with few broadly elliptical stomata about 0.03 mm. in length; sub-epidermal cells from the stem resembling those of the epidermis in shape but with lignified walls; tracheae, spiral, up to 0.02 mm. in width, with bordered pores up to about 0.035 mm. in width; tracheids from stem few; strongly lignified, thick-walled sclerenchyma cells or fibers few; lignified pith-parenchyma with large simple pores; fragments of epidermal cells and mesophyll of leaf; the former with somewhat wavy, vertical walls and associated with stomata up to 0.024 mm. in length; numerous crystals of calcium oxalate in rosette aggregates up to 0.03 mm. in diameter and occasionally in prisms; starch grains few, simple, up to 0.005 mm. in diameter. Damiana yields not more than 10 per cent. of ash." *N. F.*

Parsons (Arch. d. Pharm., 1881, p. 133) obtained 0.2 per cent. of a volatile oil; 8.06 of

a soft resin, fixed oil and chlorophyll; 3.46 per cent. of tannin; 7.08 per cent. of a bitter principle; 6.39 per cent. of a hard brown resin; 10 per cent. of extractive; 13.5 per cent. of a gum; 6.15 per cent. of starch, etc.

The leaves of the composite plant *Aplopappus discoideus* DC. (*Bigelovia Veneta* Gray) were, formerly, also sold under the name of damiana.

Although damiana has achieved some repute in the treatment of sexual impotence, it is worthy of note that it is always given in conjunction with strychnine, phosphorus or some other stimulant; it is probably nothing more than a feeble tonic. Dose, one-half to one drachm (2-4 Gm.) of the leaves, either in the form of infusion or fluid-extract.

Danais. *Danais fragrans*, Commerc. (Fam. *Rubiaceae*.)—In this Madagascar plant, the root of which is said to be tonic and antiperiodic, Heckel and Schlagdenhauffen found a glucoside, *danain*. (A. J. P., 1886.)

Daphnandra.—The bark of *Daphnandramicrantha* (Tul.) Benth., an Australian tree (fam. *Monimiaceae*), is asserted to be rich in poisonous alkaloid. (*P. J.*, Oct., 1887.) Bancroft states that the active alkaloid is soluble in water, and to some extent is antagonistic to strychnine.

DATURAE FOLIA. Br.

DATURA LEAVES

"Datura Leaves are the dried leaves of *Datura fastuosa*, Linn., var. *alba*, Nees and also of *Datura Metel*, Linn." *Br.*

DATURAE SEMINA. Br.

DATURA SEEDS

"Datura Seeds are the dried seeds of *Datura fastuosa*, Linn. var. *alba*, Nees." *Br.*

The genus *Datura* consists of fifteen species, which are distributed throughout the warmer portions of the whole world, the greatest number being found in Central America. Nearly all of them are used locally in medicine. The plants vary from herbs to shrubs and even trees. The leaves of *Datura Stramonium* are official in the U. S. Pharmacopoeia. (See *Stramonium*.) The leaves and seeds of *Datura fastuosa alba* are used in India and the Eastern and West Indian Colonies as an equivalent of Belladonna and *Stramonium* leaves. A

tincture of *Datura seeds* is used in India as an equivalent of Stramonium seeds.

Datura fastuosa is a small shrub, indigenous to tropical India. There is said to be several varieties of this species and it is very generally conceded to be the most toxic of the Indian Daturas. The leaves are ovate and more or less angular, the flowers being white or purplish. *Datura Metel* is also an Indian plant and resembles *D. fastuosa*. It differs in that the leaves are cordate, almost entire, and pubescent. The flowers being white. Pyman and Reynolds (*P. J.*, 1908, lxxxix) have found in the *D. meteloides* a new alkaloid, which they call *meteloidine*.

Of the varieties of *D. fastuosa*, the British Pharmacopoeia recognizes that known as *alba*. From it the Thugs prepared the poison Dhat (whence is derived the generic name), which they used to stupefy their victims. The leaves and seeds are recognized by the Br. Pharm. 1914, and the leaves are described as "Brownish or yellowish-green, attaining twenty centimetres in length and thirteen centimetres in breadth; ovate, acuminate, with sinuate-dentate margins and long petioles; often unequal at the base; bearing scattered glandular or simple hairs. Characteristic odor; taste bitter." *Br.*

The trumpet-shaped corolla, together with the stamens, is sometimes found mixed with the leaves. The drug has a slight unpleasant odor, and a bitter taste.

The seeds are "yellowish-brown, somewhat wedge-shaped, flattened, with rounded, thickened, furrowed, wavy margins; from four to five millimetres broad and about one millimetre thick. Hilum large, extending from about the middle to the acute end of the seed. Surface finely pitted and reticulated. Endosperm narrow and translucent, enclosing a curved embryo. No odor; taste slightly bitter." *Br.*

They contain the alkaloid hyoscine, a resin, a fixed oil and traces of hyoscyamine and atropine.

Uses.—While this drug produces effects more or less similar to those of belladonna its precise action has not been clearly determined. It is used in India to a considerable extent as a criminal poison. Banerja (*Indian Med. Gaz.*, 1885, xx, p. 209) has reported 32 cases. The symptoms are not given in sufficient detail to allow of definite statement but seem to

differ somewhat from those of either atropine or scopolamine. Gimlette (*B. M. J.*, 1903, i, p. 1137) also records several cases of poisoning and states that the nature of the active principle of the drug has not been determined. In India the *Datura fastuosa* leaves have been used for the same purposes as the stramonium leaves.

Off. Prep.—Tinctura Daturae Se'minum, *Br.*

DECOCTA. U. S.

DECOCTIONS

Tisanes par decocion, Decoctions, *Fr.*; Abkochungen, *G.*; Decotti, *It.*; Cocimiento, *Sp.*

Decoctions are solutions of vegetable principles, obtained by boiling the substances containing these principles in water. Vegetable tissues generally yield their soluble ingredients more readily, and in larger proportion, to water maintained at the point of ebullition, than to the same liquid at a lower temperature. Hence decoction is occasionally preferred to infusion as a mode of extracting the virtues of plants, when the call for the remedy is urgent, and the greatest possible activity in the preparation is desirable. The process should be conducted in a covered vessel, so as to confine the vapor over the surface of the liquid, and thus prevent the access of atmospheric air, which sometimes exerts an injurious agency upon the active principle. The boiling, moreover, should not, as a rule, be long continued, as the ingredients are apt to react on one another, and thus lose, to a greater or less extent, their original character. The substance submitted to decoction should if dry be either powdered or well bruised, if fresh should be sliced, so that it may present an extensive surface to the action of the solvent; and previous maceration for some time in water is occasionally useful by overcoming the cohesion of the vegetable fiber. Should the physician not happen to prescribe this preliminary comminution, the pharmacist should not omit it.

All vegetable substances are not proper objects for decoction. In many the active principle is volatile at a boiling heat, in others it undergoes some change unfavorable to its activity, and in a third set is associated with inefficient or nauseous principles, which, though insoluble or but slightly soluble in cold water, are abundantly extracted by that liquid at the boiling temperature, and thus encumber, if they do not positively

injure, the preparation. In all these instances, infusion is preferable to decoction. Besides, by the latter process more matter is often dissolved than the water can retain, so that upon cooling a precipitation takes place and the liquid is rendered turbid, and this constitutes the greatest objection to this class of preparations. When the active principle is thus dissolved in excess, the decoction should always be strained while hot, so that the matter which separates on cooling may be mixed again with the fluid by agitation at the time of administering the remedy. In compound decoctions, the ingredients may be advantageously added at different periods of the process, according to the length of boiling requisite for extracting their virtues; and, should one of them owe its activity to a volatile principle, the proper plan is, at the close of the process, to pour upon it the boiling decoction, and allow the liquor to cool in a covered vessel.

As a rule, glass or earthenware vessels should be preferred, as those made of metal are sometimes corroded by the ingredients of the decoction, which thus become contaminated. Vessels of clean cast-iron or common tin, or of block tin, are preferable to those made of copper, brass, or zinc; but iron pots should not be used where astringent vegetable substances are concerned.

Decoctions, from the mutual reaction of their constituents, as well as from the influence of the air, are apt to spoil in a short time. Hence they should be prepared only when wanted for use, and should not be kept, when the "weather is warm, for a longer period than forty-eight hours.

The tendency of modern medicine and pharmacy has been decidedly against the employment of decoctions; their nauseous taste, bulky dose, repulsive appearance, and non-permanent character have been powerful reasons for causing their retirement, while the use of tinctures and fluidextracts has largely increased. In the 1880 revision of the U. S. Pharmacopoeia the number of official decoctions was reduced to two, and a general formula was appended for the guidance of the pharmacist. The U. S. P., 1890, reduced the strength of the general formula for decoctions from 10 per cent. to 5 per cent., and this strength was retained in the U. S. P. VIII and IX, as will be seen from the following: "Decoctions must be *freshly made from the drugs*, and, when the strength of decoctions is not otherwise directed, they are to be prepared by the following general formula:

"The Drug, coarsely comminuted, fifty grammes [or 1 ounce av., 334 grains]; Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Introduce the drug into a suitable vessel provided with a cover, pour upon it one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of cold water, cover it well, and boil for fifteen minutes. Then allow it to cool to about 40° C. (104° F.), express, strain the expressed liquid, and pass enough cold water through the strainer to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms"].

"*Caution.*—The strength of decoctions of energetic or powerful substances should be specially directed by the physician." *U. S.*

The two decoctions of the U. S. P., 1890, *Decoction Cetrariae* and *Decoction Sarsaparillae Compositum*, were both dismissed in the Eighth Revision and only the general formula for decoctions retained. See Decoction of Cetraria and Zittman's Decoction.

DECOCTION OF ACACIA BARK

DECOCTION OF ACACIA BARK

"Acacia Bark, bruised, 60 grammes; Distilled Water sufficient to produce 1000 milli-litres. Boil the Acacia Bark with twelve hundred millilitres of Distilled Water, in a suitable vessel, for ten minutes; strain; if necessary pour sufficient Distilled Water over the contents of the strainer to produce the required volume." *Br.*

This decoction was transferred from the British Addendum (1900) to the British Pharm. (1914). It is used in India as an astringent gargle, lotion, or injection. The *dose* is from four fluidrachms to two fluidounces (15-60 mils).

DECOCTION OF COUCH GRASS

DECOCTION OF COUCH GRASS [Decoction of Triticum]

"Couch Grass, cut small, 50 grammes; Distilled Water sufficient to produce 1000 millilitres. Boil the Couch Grass with twelve hundred millilitres of Distilled Water, in a suitable vessel, for ten minutes; strain;

if necessary pour sufficient Distilled Water over the contents of the strainer to produce the required volume." *Br.*

This decoction was transferred from the British Addendum (1900) to the British Pharm. (1914). It is used in *cystitis* and *urinary diseases*. Dose, four fluidrachms to two fluidounces (15-60 mls).

DECOCTUM GOSSYPII RADICIS CORTICIS. Br.

DECOCTION OF COTTON ROOT BARK

"Cotton Root Bark, bruised, 200 grammes; Distilled Water sufficient to produce 1000 millilitres. Boil the Cotton Root Bark with two thousand millilitres of the Distilled Water, in a suitable vessel, until the volume is reduced to one thousand millilitres; strain; if necessary pour sufficient Distilled Water over the contents of the strainer to produce the required volume." *Br.*

This decoction was transferred from the British Addendum (1800) to the British Pharm. (1914). It is used as an *emmenagogue* and in *uterine hemorrhage*. Dose, from four fluidrachms to two fluidounces (15-60 mls).

DECOCTUM ALOES COMPOSITUM. Br.

COMPOUND DECOCTION OF ALOES

Tisane (Decocte) d'Aloes composee, *Fr.*: Zusammenge-setates Aloedecoct. *G.*

"Extract of Aloes, 10 grammes; Myrrh, Potassium Carbonate, of each, 5 grammes; Extract of Liquorice, 40 grammes; Compound Tincture of Cardamoms, 300 millilitres; Distilled Water sufficient to produce 1000 millilitres. Reduce the Extract of Aloes and the Myrrh to coarse powder, and boil them and the Potassium Carbonate and the Extract of Liquorice with four hundred millilitres of Distilled Water in a covered vessel for five minutes; cool; add the Tincture of Cardamoms; set aside for two hours; strain through flannel; pass sufficient Distilled Water through the strainer to produce the required volume." *Br.*

This is essentially the former process of the British Colleges. The effect of the alkaline carbonate is, by combining with the resin of the myrrh

and the insoluble portion of the aloes, to render them more soluble in water, while the licorice assists in the suspension of the portion not actually dissolved. The tincture of cardamom is useful not only by its cordial property, but also by preventing spontaneous decomposition. This decoction is said not to filter clear when first made, but, if kept for some time, to deposit insoluble matter, and then to become bright and clear on filtering. (*P. J.*, xiv, 491.) J. F. Brown proposes to prepare a concentrated decoction which keeps for a long time unchanged. (*C. D.*, 1896, 425.)

Long boiling impairs the purgative property of aloes, and the same effect is thought to be produced, to a certain extent, by the alkalis, which certainly qualify its operation and render it less apt to irritate the rectum. This decoction, therefore, is milder as a cathartic than aloes itself; it is also more tonic and cordial, from the presence of the myrrh, saffron, and cardamom, and derives antacid properties from the potassium carbonate. It is given as a gentle cathartic, tonic, and emmenagogue, and is especially useful in *dyspepsia*, *habitual constipation*, and *atonic amenorrhoea*. The decoction should not be combined in prescription with acids, acidulous salts, or other bodies incompatible with the alkaline carbonate.

Dose, from one-half to two fluid ounces (15-60 mls).

DECOCTUM HAEMATOXYLI Br.

DECOCTION OF LOGWOOD

Tisane (Decocte) de Bois de Campeche, *Fr.*; Blauholz-Abkochung, *G.*

“Logwood, in chips, 50 grammes; Cinnamon Bark, bruised, 10 grammes; Distilled Water, sufficient to produce 1000 millilitres. Boil the Logwood with twelve hundred millilitres of Distilled Water in a suitable vessel for ten minutes, adding the Cinnamon Bark towards the end of the time; strain; if necessary pour sufficient Distilled Water over the contents of the strainer to produce the required volume.” *Br.*

We prefer the old U. S. formula, which ordered an ounce of the logwood to be boiled with two pints down to a pint, and doubt much whether the wood is exhausted by a boiling of ten or fifteen minutes. The cinnamon of the *Br.* formula is in general a very suitable addition, but there might

be circumstances under which it would be better omitted, and in this case, as in others, any addition to the simple decoction might be left to the judgment of the prescriber.

This is an excellent astringent in *diarrheas* of relaxation.

Dose, for an adult, two fluidounces (60 mils); for a child about two years old, two or three fluidrachms (7.5-11.25 mils).

DECOCTUM ISPAGHULAE. Br.

DECOCTION OF ISPAGHULA

"Ispaghula, bruised, 15 grammes; Distilled Water, sufficient to produce 1000 millilitres. Boil the Ispaghula with twelve hundred millilitres of Distilled Water, in a suitable vessel, for ten minutes; strain; if necessary pour sufficient Distilled Water over the contents of the strainer to produce the required volume." *Br.*

This decoction was transferred from the British Addendum (1900) to the British Pharm. (1914). It is used as a'demulcent drink in India for *diarrhea*. Dose, four fluidrachms to two fluidounces (15-60 mils).

DECOCTUM SAPPAN. Br.

DECOCTION OF SAPPAN

"Sappan, in chips, 50 grammes; Cinnamon Bark, bruised, 10 grammes; Distilled Water, sufficient to produce 1000 millilitres. Boil the Sappan with twelve hundred millilitres of Distilled Water, in a suitable vessel, for ten minutes, adding the Cinnamon Bark towards the end of the time; strain; if necessary pour sufficient Distilled Water over the contents of the strainer to produce the required volume." *Br.*

This decoction was transferred from the British Addendum (1900) to the British Pharm. (1914). It is used like logwood decoction in India as an astringent in *diarrhea* in *doses* of four fluidrachms to two fluidounces (15-60 mils).

Dianthus. *Dianthus Caryophyllus* L. Clove Pink. (Fam. *Caryophyllaceae*).—Of the ordinary garden pink those specimens should be selected for medicinal use which have the deepest red color and the most aromatic odor. The petals should not be collected

until the flower is fully blown, and should be employed in the recent state. They have a fragrant odor, said to resemble that of the clove. Their taste is sweetish, slightly bitter, and somewhat astringent. Both water and alcohol extract their sensible properties, and they yield a fragrant essential oil by distillation. In Europe they are employed to impart color and flavor to a syrup, used as a vehicle. The Edinburgh Pharmacopoeia directed this to be made by macerating one part of the flowers, without their claws, in four parts of boiling water for twelve hours, then filtering, and adding seven parts of sugar.

Dicentra.—The *Dicentra pusilla* Sieb. et Zucc. is a Japanese plant belonging to the *Fumariaceae* which is used in that country as a folk remedy in dysentery. Asahina (*A. Pharm.*, 1909, ccxivii) has found it in an alkaloid, $C_{20}H_{21}NO_4$, which is isomeric with papaverine. It has been studied physiologically by K. Iwakawa (*A. E. P. P.*, 1911, Ixiv), who finds that it produces in both cold and warm blooded animals a light narcosis, followed, if the dose be large, by convulsions. It also caused a fall in the blood pressure with slowing of the heart and depression of the respiratory center.

Dichondra Brevifolia.—An extract of this plant dissolved in glycerin is used as an application in the treatment of diphtheritic ulcers. It is applied direct to the mucous membrane and is claimed to possess specific action on the diphtheritic bacilli.

Diervilla. *Diervilla Lonicera* Mill. (*D. trifida* Moench.) *Bush Honeysuckle.*—A low, erect, indigenous shrub, growing in dry woods and rocky places throughout the Eastern Northern States and Canada. L. E. Dawson (*Chem. News*, 1912) examined the fruit of *D. Florida*, the dark-red berries contain fructose, fixed oil, tartaric and citric acids and an alkaloid which he believes to be *narceine*. Charvaux found a glucoside identical with *fraxin* in *D. lutea*. (*J. P. C.*, 1911, -2,4:8.) The whole plant is supposed to be possessed of diuretic and astringent properties, and is given in infusion by the eclectics in diseases of the urinary passages.

Dioscorea. *N. F. IV- Wild Yam Root. Colic-root. Rheumatism-root.*—"The dried rhizome of *Dioscorea villosa* Linne (Fam. Dioscoreaceae)." *N. F. IV.* An indigenous, perennial, twining plant, with long, knotty, matted, contorted, ligneous root stocks. It grows from Ontario to Wisconsin, and south to Florida and Texas. The rhizome is used by the eclectics, who consider the drugs efficacious in *bilious colic*, and by the Southern negroes in *rheumatism*. The rhizome is described by the *N. F.* as "knotted and woody, elongated, from 6 to 12 mm. in thickness, often compressed, bent and branched, bearing scattered nodular projections at the sides, slender, tough roots underneath and stem-scars on their upper surface; externally pale brown, surface more or less scaly from the partly detached, thin outer layer; fracture short but tough, the fractured surface whitish or pale-brown, with numerous small, scattered, yellowish wood bundles. Odorless; taste starchy, insipid, afterwards acrid. *Dioscorea* yields not more than 7 per cent. of ash." *N. F.*

W. C. Kalteyer found abundant saponin in the roots. (*A. J. P.*, 1888; see also M. R., 1913, 311.) A substance, improperly called *dioscorein*, obtained by precipitating the tincture with water, is used in the dose of from one to four grains (0.0065-0.26 Gm.).

Dose, one-half to one drachm (1.9-3.75 mils), which may be given either in the form of a decoction or a fluidextract.

Dioscorea hirsuta, Bl. grows in the island of Java, where it is known as *Gadoeng*. In 1894 W. G. Boorsma (*Mededeelingen wuit's Lands Planten-tuin*, xiii) separated from it an alkaloid to which he gave the name of *dioscorine*. This alkaloid has been studied by Plugge and Schutte (*A. J. P.*, iv, 1897) who assigned to it the formula $C_{13}H_{19}NO_2$, and found it to be a convulsant poison, resembling closely in its action picrotoxin, but much more feeble. *Dioscorea bulbifera* L. grows in the Gaboon country of tropical Africa. Heckel and Schlagden-hauffen found in the tuber a glucoside, together with wax, chlorophyll, saccharose, and resin.

The root of *Dioscorea rhipogonoides* (?) Oliver, under the names of *Cunao*, *Shu-lang*, *faux gambier*, is exported in enormous quantities from Indo-China to Southern China for use as a dye-stuff.

Diospyros. *Persimmon. Date-plum. Fruits de Plaqueminier de Virginie*, Fr. *Persimmon-fruchte, Dattelpflaumen*, G.—The *Diospyros virginiana* L., or persimmon (fam. *Ebenaceae*), is a small indigenous tree, occurring in woods and old fields from Connecticut, southward. The flowers appear in May or June, but the fruit is not ripe until the middle of autumn. The fruit is a globular berry, dark yellow when ripe, and containing numerous seeds in a soft yellow pulp. The seeds, dried, roasted, and ground, are used in some parts of Georgia as a substitute for coffee. (*M. S. Rep.*, 1873, 437.)

While green, the fruit is excessively astringent, and in this form was formerly included in the U. S. Secondary List; but, when perfectly mature, and after being touched by the frost, it is sweet and palatable. The unripe fruit, according to B. "R. Smith of Philadelphia, contains tannic acid, pectin, sugar, malic acid, coloring matter, and lignin. (*A. J. P.*, xviii, .167.) The persimmon has been used by Mettauer in *diarrhea*, *chronic dysentery*, and *uterine hemorrhage*. The *dose* of the vinous tincture (an ounce of the fresh green fruit to two fluidounces of dilute alcohol) is half a fluidrachm (1.9 mils) or more for infants, and half a fluidounce (15 mils) or more for adults. The bark is astringent and very bitter. For further information concerning this drug, see *U. S. D.*; 19th ed., p. 1474.

Dirca. *Dirca palustris* L. *Leather Wood*. (Fam. *Thymelceaceae*.) —A shrub growing widely in the Northeastern United States. The berries, which are small, ovoid, and of an orange or reddish color, are said to be narcotic and poisonous. The tough bark, in the fresh state, has a peculiar, rather nauseous odor, and an unpleasant acrid taste, and when chewed excites a flow of saliva. It yields its acidity completely to alcohol, but imperfectly to water even by decoction. Six or eight grains of the fresh bark produce violent vomiting, preceded by a sense of heat in the stomach, and often followed by purging. Applied to the skin it slowly excites redness and ultimately vesicates. It is analogous to mezereon in its medicinal as well as botanical characters.

Doundake. *Dundaki. Quinquina Africaine. Kina du Rio Nunez*.—*Sarcocephalus*

esculentus Afzel (fam. *Rubiaceae*) of Africa yields & bark which is said to be an astringent and tonic febrifuge. For a description of the bark and its chemical characteristics, see *P. J.*, vol. xvi, 49. Heckel and Schlagdenhauffen do not believe that *doundake* contains an alkaloid, but attribute its power to three distinct principles of a resinous nature, the first of which is of an orange-yellow color and very bitter, soluble in water, alcohol, and potassium hydroxide ; the second light yellow in color, soluble in potassium hydroxide but not in water; the third soluble in potassium hydroxide, insoluble in water and in alcohol. (*J. Soc. Chem. Ind.*, 1886, 435.) The wood of the *Sarcocephalus Diderrichii* (?) (fam. *Rubiaceae*), which is used for making shuttles, has been found by Gibson to contain an alkaloid, which is a cumulative cardiac poison. Workers in the wood frequently suffer and even die from cardiac disturbances. [*Bio-Chem, J.*, 1906, i, p. 39).

Dracontium. *Symplocarpus Foetidus* (L.) Nutt. (*Spathyema fctida* (L.) Raf. *Dracontium foetidum* L. *Ictodes foetidus* Bigelow.) *Skunk Cabbage. Skunk Weed. Polecat Weed. Racine de Pothos fetide, Fr. Stinkende Drachenwurssel, G* —The plant of the Fam. *Araceae* is abundant in wet places throughout the Northern and Middle United States. All parts of it have a fetid odor, dependent upon an extremely volatile principle, which is rapidly dissipated by heat. The rhizome should be collected in the autumn, or in the early spring.

The rhizome occurs either whole or in transverse slices. When entire, it is cylindrical or in the shape of a truncated cone, 5 to 10 cm. long and 2 to 4 cm. thick, externally dark brown and very rough from the insertion of the radicles, internally white and amylaceous. The rootlets are of various lengths, 2 to 4 mm. thick, coarse, simple, and very strong, very much flattened and wrinkled, white within, and covered by a yellowish or reddish-brown epidermis, considerably lighter colored than the body of the rhizome. The odor is fetid, the taste acrid; both are lessened by drying and progressively diminish with time, so that the dried rhizome should not be kept longer than a single season. This acidity is entirely absent in the decoction. The seeds are very acrid, and, though inodorous when whole, give out, when bruised, the peculiar odor of the plant.

The rhizome is affirmed to be antispasmodic and narcotic; occasioning nausea and vomiting, with headache, vertigo, and dimness of vision. It has been used with alleged success in *asthma, chroniccatarrh, chronicrheumatism, chorea, hysteria, and dropsy.* Dose, of powder, from ten to twenty grains (0.65-1.3 Gm.), increased *pro re nato*.

Dragon's Blood. *Sanguis Draconis. Sang-dragon, Fr. Drachenblut, G. Sangre de drago, Sp.*—*Dragon's blood*, of which there are several commercial varieties, is a resinous exudation obtained from the fruits of a number of palms. East Indian dragon's blood is obtained from a number of species of *Daemonorops*, a genus which was previously ascribed to *Calamus*. Malay dragon's blood is obtained from *Daemonorops didynophyllos, D. micranthus* and *D. propinquus*; Sumatra dragon's blood from *Daemonorops Draco* Blume (*Calamus Draco* Willd.). In Borneo a dragon's blood is obtained from *Daemonoropsdraconcellus* and other species of *Daemonorops*. On the surface of the fruit, when ripe, is an exudation, which is separated by rubbing,

or shaking in a bag, or by exposure to the vapor of boiling water, or finally by decoction. The finest resin is procured by the two former methods. It comes in two forms: sometimes in small oval masses [*tear dragon's blood*] of a size varying from that of a hazelnut to that of a walnut, covered with the leaves of the plant, and connected in a row like beads in a necklace; sometimes in cylindrical sticks, eighteen inches long and from a quarter to half an inch in diameter, thickly covered with palm leaves, and bound round with slender strips of cane. See paper by E. M. Holmes in *P. J.*, 1905, 933.

Dragon's blood is inodorous and tasteless, insoluble in water, but soluble in alcohol, ether, and the volatile and fixed oils, with which it forms red solutions. According to Herberger, it consists of 90.7 parts of a red resin, which he calls *draconin*, 2.0 of fixed oil, 3.0 of benzoic acid, 1.6 of calcium oxalate, and 3.7 of calcium phosphate. Tschirch (*Harze und Hambehalter*, 1900, p. 189) has made an elaborate study of dragon's blood, and finds 2.5 per cent. of *draco-alban*, $C_{20}H_4O_4$, a white substance melting with decomposition at about 200° C. (392° F.) ; 13.58 per cent. of *draco resen*, a yellow resinous substance of the formula $C_{26}H_4O_4$, and 56.86 per cent. of *dracoresin*, a resin ester or mixture of esters, *benzoic dracoresinotannol ester* and *benzoylactic dracoresinotannol ester*, and 18.4 per cent. of insoluble substances. It was formerly employed in medicine as an astringent, but is nearly or quite inert, and is now never given internally. It is sometimes used to impart color to plasters. For further information concerning this drug, see *U. S. D.*, 19th ed., p. 1475.

Drosera. *Sundew.* *N. F. IV. Herba Rorellce. Rosollis. Rosee du Soleil, Fr. Sonnentheu,* G. —It is described by the *N. F.* as "the air-dried flowering plant of *Drosera rotundifolia* Linne (Fam. *Droseraceae*), frequently mixed with the closely allied species *Drosera intermedia*- Hayne and *Drosera longifolia* Linne, or at times wholly replaced by these. A delicate plant of a reddish color throughout, with few fibrous, blackish rootlets; leaves all in a basal rosette, blade orbicular, about 15 mm. in diameter, abruptly contracted into a slender, pubescent petiole, upper surface covered with prominent glandular hairs; scape filiform, smooth, from 10 to 20 cm. in length, bearing a few, five-parted, small, white fugacious, flowers in a curved, one-sided raceme. *Drosera intermedia* is identified by its spatulate leaves with blades two or three times as long as they are wide and glabrous petioles. *Drosera longifolia* is identified by its elongated spatulate obovate leaves with blades six to eight times as long as they are wide, and its slender smooth petioles and scape, declinate at base. Odorless; taste faintly bitter and acidulous. *Drosera* yields not more than 30 per cent. of ash." *N. F.* *Drosera* has been employed in *phthisis*, but is probably of no value. (See *Proc. A. Ph. A.*, xxvii, 225.) Under the name of *droserin* an extract of various plants of this species has been recommended in *whooping cough*. It is marketed in the form of tablets of which there are two strengths; number one being intended for children, number two for adults. The *dose* of the crude drug is one drachm (4 Gm.).

Duboisia.—*D. myoporoides* R. Br. (fam. *Solanaceae*) is a tall, glabrous shrub or small tree, which is a native of Australia, New South Wales, New Caledonia, and Queensland. The medicinal properties of this plant were made known by Baron von Mueller, who received the leaves from J. Bancroft. The alkaloid *duboisine* was

discovered in the leaves by A. W. Gerrard. (*P. J.*, viii, 787). For his method, see 16th ed., *U. S. D.*; also, for an account of the chemical and medicinal properties of this alkaloid, and its relations to atropine, see Belladonna.

According to the researches of Jos. Lanterer (L. L., 1896), the old leaves and twigs of *Duboisia myoporoides*, contain hyoscyamine, the fresh young leaves scopolamine, the dried leaves being stronger than are belladonna leaves, and yielding 0.97 per cent. of alkaloid. *Duboisia Leichhardtii* F. v. Muell. is said to be still richer in alkaloid, which is chiefly amorphous scopolamine; while the leaves of *Datura arborea* L. (*Brugmansia arborea* Steud.) and of *D. cornigera* Hooker (*Brugmansia Knightii* Hort.), natives of South America, acclimatized in Queensland, contain a mixture of hyoscyamine and atropine.

D. Hopwoodii F. v. Muell., *pitury plant*, is the source of *pituri*, a narcotic stimulant largely used by the natives of Central Australia. The drug itself is a fine powder, composed of the leaves and twigs which are gathered during the month of August, while the flower is in bloom, and are put up in various forms of circular mats about 7.5 cm. in diameter. The natives smoke and chew pituri, and it is alleged to have a powerfully stimulating effect, assuaging hunger, and enabling those who are its devotees to perform much labor and go long journeys with but little food. Pituri yielded to A. W. Gerrard minute quantities of an alkaloid which he believed to be identical with nicotine, but Liver-sidge has shown that the liquid, acrid alkaloid, piturine, $C_{12}H_{16}N_2$, is distinct from nicotine. (*Proc. Roy. Soc. N. S. W.*, 1880.) Pituri contains from 1 to 2 $\frac{1}{2}$ per cent. of the alkaloid.

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[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. Michael Moore]

Echinacea. *N. F. IV. Nigger-head. Sampson-root. Pale Purple Cone-flower.*—"The dried rhizome and roots of *Brauneria pallida* (Nuttall) Britton (*Echinacea angustifolia* De Candolle) (Fam. *Compositae*)." *N. F. IV.* This composite plant, a native of the prairie region of America west of Ohio, has been introduced by the so-called eclectic physicians as a remedy in divers dissimilar diseases. The root is described by the *N. F.* as "nearly entire, cylindrical, very slightly tapering and sometimes slightly spirally twisted, from 10 to 20 cm. in length and from 4 to 13 mm. in diameter, externally grayish-brown, light brown or purplish-brown, slightly annulate in the upper portion, with occasional V-shaped stem scars, somewhat longitudinally wrinkled, or furrowed; fracture short, fibrous, bark less than 1 mm. in thickness, wood thick and composed of alternate light yellowish and black wedges; the rhizome with a circular pith. Odor faint, aromatic; taste sweetish, followed by a tingling sensation suggesting aconite, but lacking the persistent and benumbing effect produced by that drug. Under the microscope, sections show the presence of intercellular (schizogenous) oil and resin cavities or reservoirs in both the wood and bark, numerous stone cells distinguished by the presence of a blackish, resinous substance in the intercellular spaces between them and some of the adjoining parenchyma, the latter containing masses or aggregates of inulin. The walls of the tracheae or vessels are marked with simple slit-like pores or annular and reticulate thickenings; bast fibers occur in the stem, and in some specimens true libriform or wood fibers are found. Echinacea yields not more than 6 per cent. of ash." *N. F.* Kraemer and Sollenberger (*A. J. P.*, 1911, p. 315) have described the physical characteristics of the drug. Lloyd (*Eclectic Med. Journ.*, 1897) obtained minute quantities of an inert alkaloid and believed that the active substance was a resin. Heyl and Hart (*J. Am. C. S.*, 1915, xxxvii, p. 1769) found the drug to contain inulin, 5.9 per cent.; inuloid, 6; sucrose, 7; vulose, 4; betaine, 0.1, and resins, 1.9 per cents.; the latter consisting of two isomeric phytosterols, phytosterolin, and the following fatty acids, oleic, linolic, cerotic and palmitic, but could find no physiologically active substance. Echinacea has been attributed with the property of increasing the resistance of the body to infection and is consequently used in *boils, septicemia, cancer*, and other infective conditions. It is also attributed with aphrodisiac and analgesic powers, but is probably without therapeutic value. The recommended dose of the fluidextract is from ten to thirty minims (0.6-1.8 mls). Hale (*Lancet Clinic*, March, 1901) injects an extract into the rectum in the treatment of *hemorrhoids*.

Brauneria purpurea D.G. Britton (*Rudbeckia purpurea* L., *Echinacea purpurea* Moench), *Black Sampson*, *Purple Cone-flower* (Virginia to Illinois and southward to Louisiana), has similar properties to *B. pallida*, and is similarly used.

Elaterium. Br. 1898. *Extractum Elaterii. Elaterium, Elaterion*, Fr. *Elaterium*, G. *Elaterio*, It., Sp.—"A sediment from the juice of the fruit of *Ecballium Elaterium*, A. Richard." Br., 1898. *Ecballium Elaterium* (L.) A. Eich., commonly known as the *wild* or *squirting cucumber*, is a perennial plant, with a large fleshy root, from which rise several round, thick, rough stems, branching and trailing like the common cucumber, but without tendrils. The leaves are petiolate, large, rough, irregularly cordate, and of a grayish-green color. The flowers are yellow and axillary. The fruit has the shape of a small oval cucumber, about an inch and a half long, an inch thick, of a greenish or grayish color, and covered with stiff hairs or prickles. When fully ripe, it separates from the peduncle, and throws out its juice and seeds with considerable force through an opening at the base, where it was attached to the footstalk. The name of squirting cucumber was derived from this circumstance, and the scientific and official title is supposed to have had a similar origin, though some authors maintain that the term elaterium was applied to the drug rather from the mode of its operation upon the bowels than from the projectile property of the fruit. The word elaterium was used by Hippocrates to signify any active purge. Dioscorides applied it to the medicine of which we are treating. It is a native of the south of Europe, and is cultivated in Great Britain, where, however, it perishes in the winter. (For description of the culture in England, see *U. S. D.*, 19th ed., p. 432.)

Elaterium is the substance spontaneously deposited by the juice of the fruit, when separated and allowed to stand. Strong expression of the juice injures the product. When the fruit is sliced and placed upon a sieve, a perfectly limpid and colorless juice flows out, which soon becomes turbid, and in the course of a few hours begins to deposit a sediment. This, when collected and carefully dried, is very light and pulverulent, of a yellowish-white color, slightly tinged with green. It is the genuine elaterium, and was found by Clutterbuck to purge violently in the dose of one-eighth of a grain. But the quantity contained in the fruit is very small. Clutterbuck obtained only six grains from forty cucumbers. Commercial elaterium is often a weaker medicine, owing in part, perhaps, to adulteration, but much more to the fact that in order to increase the product, the juice of the fruit is often expressed with great force, and there is reason to believe that it is sometimes evaporated so as to form an extract, instead of being allowed to deposit the active matter. The French elaterium is prepared by expressing the juice, clarifying it by rest and nitration, and then evaporating to a suitable consistence. As the liquid remaining after the deposition of the sediment is comparatively inert, it will be perceived that the preparation of the French Codex must be relatively feeble. The following are the directions of the British Pharm. (1885): "Cut the fruit lengthwise, and lightly press out the juice. Strain it through a hair sieve, and set aside to deposit. Carefully pour off the supernatant liquor; pour the sediment on a linen filter, and dry it on porous tiles, in a warm place. The decanted fluid may deposit a second portion of sediment, which can be dried in the same way." The slight pressure directed is necessary for the separation of the juice

from the somewhat immature fruit employed. The perfectly ripe fruit is not used, as, in consequence of its disposition to part with its contents, it cannot be carried to market.

The best elaterium is in thin flat or slightly curled cakes or fragments, often bearing the impression of the muslin upon which it was dried, of a greenish-gray color becoming yellowish by exposure, of a feeble odor, and a bitter, somewhat acrid taste. It is pulverulent and inflammable, and so light that it floats when thrown upon water. When of inferior quality, it is sometimes dark-colored, much curled, and rather hard, breaking with difficulty, or presenting a resinous fracture. "In light, friable, flat or slightly curved, opaque cakes, about one-tenth of an inch (two and a half millimetres) thick; pale green, grayish-green, or yellowish-gray in color; fracture finely granular; odor faint, tea-like; taste bitter and acrid. It should not give the characteristic reactions with the tests for carbonates or for starch, and should yield half its weight to boiling alcohol (90 per cent.). When exhausted with chloroform, the solution evaporated, the residue washed with ether, and the process of solution, evaporation, and washing repeated, Elaterium should yield 25 per cent., or not less than 20 per cent., of Elaterin." Br. For an assay of elaterium by Jones and Ransom, see *U. S. Dispensatory*, 19th ed., p. 432. The *Maltese elaterium* is in larger pieces, of a pale color, sometimes without the least tinge of green, destitute of odor, soft, and friable, and not infrequently gives evidence of having been mixed with chalk or starch. It sinks in water, and usually contains so little elaterin that it should be employed only as a source of that principle. In the analyses of T. A. Elwood, the average yield of English elaterium was 21.5 per cent., of Maltese elaterium 15.3 per cent. (*P. J.*, Nov., 1891.)

Clutterbuck first observed that elaterium resided in the portion of it soluble in alcohol and not in water. The subsequent experiments of Hennell, of London, and Morries, of Edinburgh, which were nearly simultaneous, demonstrated the existence of a crystallizable matter in elaterium which is the active principle, and has been named elaterin. (See Elaterinum.) According to Hennell, 100 parts of elaterium contain 44 of elaterin, 17 of a green resin (chlorophyll) ; 6 of starch, 27 of lignin, and 6 of saline matters.

Uses.—Elaterium is a powerful hydragogue cathartic, and in a large dose generally excites nausea and vomiting. If too freely administered, it operates with great violence upon both the stomach and bowels, producing inflammation of these organs, which has in some instances eventuated fatally. It also increases the flow of urine. The fruit was employed by the ancients, and is recommended in the writings of Dioscorides as a remedy in *mania* and *melancholy*. It is at present employed only for its purgative effects. It is one of the most efficient hydragogue cathartics in the treatment of dropsy, especially valued when edema is due to disease of the kidney. It should be used with the greatest caution, or not at all, in the old or feeble or those prostrated by disease. Two-fifths of a grain (0.025 Gm.) of elaterium proved fatal by purging in an ill and feeble lady of 70 years. (*A. J. P.*, 1868, p. 373.) Because of its variability elaterium should never be employed, preference always being given to the official elaterin.

Elder Flowers. *Sambucus*, N. F. IV. *Elder. Sambuci Flores*, Br. 1898. *Sweet Elder, Black Elderberry. Sureau*, Fr. Cod. *Fleurs de Sureau, Hollunder, Fliederblumen*, G. *Sambuco*, It. *Sauco* (Flor de), Sp.—"The air-dried flowers of *Sambucus canadensis* Linne or of *Sambucus nigra* Linne (Far., Caprifoliaceae), separated from the peduncles and pedicels." N. F. The common elder, *Sambucus nigra*, of Europe, differs from the American most obviously in its size, the former approaching in height that of a small tree. The stem is much branched towards the top, and has a rough whitish bark. The leaves are narrower. The flowers are small, whitish and in five-parted cymes. The ovary consists of but three carpels, there being five cells in *S. canadensis* L. The berries are larger in the European elder, globular, and blackish-purple when ripe. A fungus growing on this plant, called *fungus sambuci*, has been used as a local application in *conjunctivitis*. According to Steckel, it is capable of taking up from 9 to 12 times its weight of water. (N. R. Pharm., xiii, 476, 1864.) G. De Sanctis (*Gazz. Chim. Ital.*, 1895, xxv, 1, vol. xlix) obtained coniine from the leaves and stems of *Sambucus nigra*.

The indigenous *common elder, Sambucus canadensis*, is a shrub from six to ten feet high, with a branching stem, covered with a rough gray bark, and containing a large spongy pith. The small branches and leaf-stalks are very smooth. The leaves are opposite, pinnate, sometimes bipinnate, and composed usually of five to nine oblong-oval, acuminate, smooth, shining, deep-green leaflets; the veins of the under surface are somewhat pubescent. The flowers are small, white, and disposed in loose cymes; the cream-colored corolla is wheel-shaped, with five stamens on the tube. The berries are small, globular, and deep purple when ripe. The shrubs grow in low, moist grounds, along fences, and on the borders of small streams, throughout the United States, from Canada to the Carolinas, and westward as far as Arizona and Texas. It flowers from May to July, and ripens its fruit early in autumn. The flowers were official in the U. S. P., 1890, and Br. Pharm., 1898, and are now recognized by the N. F. IV. They have an aromatic though rather heavy odor. The berries as well as other parts of the plant are employed, in domestic practice, for the same purposes as the corresponding parts of the European elder, to which this species bears a close affinity.

They are described by the N. F. as follows:

"Small, from 2 to 3 mm. in breadth, shrivelled; calyx superior, five-lobed; corolla cream-colored to brownish-yellow, rotate, flat or slightly campanulate, regularly five-lobed; stamens five inserted at the base of the corolla, and alternating with its lobes, filaments slender, anthers oblong, yellow; pollen ellipsoidal or tetrahedral and rounded, covered with finely punctate markings and having three pores. Odor faintly sweet and aromatic; taste slightly bitter. *Sambucus* yields not more than 8 per cent. of ash." N. F.

The flowers yield their active properties to water by infusion, and when distilled give over a small proportion of volatile oil, which on cooling assumes a butyraceous consistence and contains an appreciable portion of ammonia. The berries are nearly inodorous, but have a sweetish, acidulous taste, dependent on the presence of saccharine matter and malic acid. Their expressed juice is susceptible of fermentation, and forms a vinous liquor used in Northern Europe. It is colored violet

by alkalies, and bright red by acids, and the coloring matter is precipitated blue by lead acetate. The *inner bark* is without odor. Its taste is at first sweetish, afterwards slightly bitter, acrid, and nauseous. Both water and alcohol extract its virtues, which are said to reside especially in the green layer between the liber and the epidermis. According to Simon, the active principle of the inner bark of the root is a soft resin, which may be obtained by exhausting the powdered bark with alcohol, filtering the tincture, evaporating to the consistence of syrup, then adding ether, which dissolves the active matter, and finally evaporating to the consistence of a thick extract. Of this, twenty grains produce brisk vomiting and purging. (*Ann. Ph. Ch.*, xxxi, 262.) The bark, analyzed by Kramer, yielded an acid called by him *viburnic acid* (which has proved to be identical with *valeric acid*), traces of volatile oil, albumen, resin, fat, wax, chlorophyll, tannic acid, grape sugar, gum, extractive, starch, pectin, and various alkaline and earthy salts. (*Chem. Gas.*, May, 1846; from *A. Pharm.*) C. G. Traub found in the bark valeric acid, volatile oil, fat, resin, tannin, sugar, and coloring matter. (*A. J. P.*, 1881, p. 392.) J. B. Metzgar made a partial examination of the fruit and found sugar, gum, tannin, fat, and a resinous body. (*A. J. P.*, 1881, p. 553.) It was also examined by F. F. Lyons (*A. J. P.*, 1892, p. 1), who found 0.5 per cent. of a volatile oil, an amorphous yellow compound of a glucosidal character, and a tannin. The volatile oil of elder flowers was examined by W. J. Bush & Co. (*C. D.*, 1897, 53.) It has the sp. gr. 0.827, and is solid at ordinary temperatures like oil of rose. The liquid portion possesses the fragrance of fresh elder blossoms.

The flowers are gently excitant and sudorific, but are seldom used. The berries are diaphoretic and aperient, and their inspissated juice has been used as an alterative in *rheumatism* and *syphilis* in doses of from one to two drachms (3.9-7.7 Gm.) ; also as a laxative in doses of half an ounce (15.5 Gm.) or more. The inner bark is a hydragogue cathartic, and in large doses emetic. It has been employed in *dropsy*, *epilepsy*, and as an alterative in various *chronic diseases*. An ounce may be boiled with two pints of water to a pint, and four fluidounces (118 mls) given for a dose. It is also used in vinous infusion. The leaves are not without activity, and the young leaf-buds are said to be a violent and even unsafe purgative. The juice of the root has been highly recommended in *dropsy* as a hydragogue cathartic, sometimes acting as an emetic, in the dose of a tablespoonful, repeated *pro re nata*. The fruits of the California species *S. glauca* and *S. racemosa* are said to be used as food by the Indians. According to Combemale, confirmed by Lemoine, the aqueous solution of the European elder, *S. nigra*, is a very active diuretic, also causing in the lower animals, when given in sufficient amount, a pronounced fall of temperature, pulse, and respiration. It was found very useful in cardiac and *renal dropsies*. The drug itself sometimes caused vomiting and purging, but this effect never followed the use of the decoction. *Elder-flower water* was official in the Br., 1898, and was made by distilling one-fifth of the volume from a mixture of 10 pounds (Imperial) or 500.0 Gm. of fresh elder flowers, and 5 gallons (Imp. meas.) or 25 liters of water. In the N. F. they are an ingredient in compound fluidextract of stillingia and laxative species. *Dose*, from one to two drachms (3.9-7.7 Gm.) ; as a laxative, half an ounce (15.5 Gm.) or more.

Elemi. *Gum Elemi. Elemi*, Fr.—This concrete resinous exudation is official in several of the European Pharmacopoeias. The variety which is mostly used is known as

Manila or σ and is derived from *Canarium commune* L. and probably also from *C. luzonicum* Gray (Fam. *Burseraceae*). The name elemi is applied commercially to a large number of resins. The true elemi varieties contain from 20 to 25 per cent. of amyryn. These are further distinguished as "hard" or "soft" elemi, which are differentiated by the fact that the "soft" elemi contains from 20 to 25 per cent. of volatile oil. There are a number of other commercial varieties of elemi. The so-called carana-elemi is obtained from *Protium Carana* (Humb.) L. March., a tree growing in Venezuela and Northern Brazil. Brazilian Almesseyia-elemi is obtained from *Protium heptaphyllum* March., var. *Brasiliense* Engl. East African elemi is probably obtained from *Boswellia Frereana* Birdwood. Yucatan elemi is derived from *Amyris Plumieri* DC. All these plants belong to the *Burseraceae*. The elemi is obtained by incisions into the trees, through which the juice flows and concretes upon the bark.

Carana-elemi occurs in masses of a greenish-yellow color, externally hard, internally soft, with a peculiar fennel-like aromatic odor. It is insoluble in water, soluble in sulphuric ether, chloroform, and benzene. According to Tschirch and Saal, carana-elemi contains 20 per cent. of exceedingly acrid resin. (*A. Pharm.*, Bd. 241, 1903.)

Elemi is in masses of various consistence, sometimes solid and heavy like wax, sometimes light and porous; unctuous to the touch; diaphanous; of diversified colors, generally greenish with intermingled points of white or yellow, sometimes greenish-white with brown stains, sometimes yellow like sulphur; fragile and friable when cold; softening by the heat of the hand; of a terebinthinate somewhat aromatic odor, diminishing with age, and resembling to some extent that of lemon and fennel; of a warm, slightly bitter, disagreeable taste; entirely soluble, with the exception of impurities, in boiling alcohol; and affording a volatile oil by distillation. "Moistened with rectified spirit, it breaks up into small particles, which, when examined by the microscope, are seen partly to consist of acicular crystals." Br., 1885. Elemi is sometimes adulterated with rosin and turpentine.

According to Bacon (*Philippine Journal of Science*, 1909, iv, p. 93), the Manila elemi is derived from the *Canarium luzonicum* Miq. When first collected it is soft, but later becomes hard on exposure to the air and light, which has given rise to the belief that there were two varieties of the Manila gum. It is collected by incising the tree at the time when it is developing new leaves, the juice exuding through the bark and collecting in lumps at the point of the incision.

The two varieties of elemi that have been investigated chemically are the Manila, or soft elemi, and the Brazilian, or hard elemi. The Manila elemi contains 10 per cent. of an ethereal oil (made up of phellandrene and dipentene), *amyryn*, $C_{30}H_{50}O$, of which, according to Vesterberg, the isomeric varieties *a*- and *b*-*amyryn* are present, an amorphous resin, small amounts of *a*-*manelemic acid*, $C_{37}H_{56}O_4$, *β -manelemic acid*, $C_{44}H_{80}O_4$, *bryoidin*, $C_{20}H_{38}O_4$, and a bitter principle. The Brazilian elemi (*protium elemi*) contained *protomyryn*, 30 per cent.; *protolaminic acid*, 25 per cent.; and *protolaresine*, 37.5 per cent. The *protomyryn* has the same melting point and formula as the amyryn from Manila elemi.

Elemi has properties analogous to those of the turpentines, but is exclusively applied to external use. In the United States it is rarely employed even in this way, except as a constituent of plasters prepared upon the large scale. In the pharmacy of Europe it enters into the composition of numerous plasters and ointments. *Unguentum Elemi* (Br. Ph., 1885) was of the strength of about 20 per cent.

ELIXIR AROMATICUM. U. S.

AROMATIC ELIXIR Elix. Arom. [Simple Elixir]

Elixir aromatique, *Fr.*; Aromatisches Elixir, *G.*

“Compound Spirit of Orange, twelve mils [or 195 minims] ; Syrup, three hundred and seventy-five mils [or 12 fluidounces, 326 minims]; Purified Talc, thirty grammes [or 1 ounce av., 25 grains]; Alcohol, Distilled Water, each, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6% fluidrachms]. To the Compound Spirit of Orange add enough Alcohol to make two hundred and fifty mils [or 8 fluidounces, 218 minims]. To this solution, add the Syrup in several portions, agitating after each addition, and afterwards add, in the same manner, three hundred and seventy-five mils [or 12 fluidounces, 326 minims] of Distilled Water. Mix the Purified Talc intimately with the liquid, and then filter through a wetted filter, returning the first portions of the filtrate until a transparent liquid is obtained. Lastly, wash the filter with a mixture of one volume of Alcohol and three volumes of Distilled Water, until the product measures one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms].” U. S.

This is justly one of the most popular vehicles of the Pharmacopoeia. The flavor which is agreeable to nearly all palates is enhanced by its sweetness. If desired it can be colored with cochineal or caramel.

Off. Prep.—Elixir Aromaticum Rubrum, *N. F.*

ELIXIR GLYCYRRHIZAE. U. S.

ELIXIR OF GLYCYRRHIZA Elix. Glycyrrh. [Elixir Adjuvans. U. S. VIII Elixir of Licorice]

Adjuvant Elixir, Elixir adjuvant, *Fr.*; Gewurahftes Lakritzenelixir, *G.*

“Fluidextract of Glycyrrhiza, one hundred and twenty-five mils [or 4

fluidounces, 109 minims]; Aromatic Elixir, eight, hundred and seventy-five millilitres [or 29 fluidounces, 282 minims], to make one thousand mls [or 33 fluid-ounces, 6¹/₂ fluidraehms]. Mix and filter." *U. S.*

Uses.—This elixir is used as a vehicle for the administration of various medicinal preparations; it was introduced into the U. S. Pharmacopoeia (8th Rev.) mainly to furnish an alternative elixir to aromatic elixir which is similarly used. The presence of the glycyrrhiza aids in disguising or obtunding the taste of bitter or disagreeable substances and the proportion might advantageously be increased.

ELIXIRIA

ELIXIRS

Cordials; Elixirs, *Fr.*; Elixire, *G.*

Elixirs as they are known in modern American pharmacy are aromatic, sweetened, spirituous preparations, containing small quantities of active medicinal substances. They differ greatly from the liquids formerly termed elixirs, from the fact that the first object sought for in the modern elixir is an agreeable taste, and usually this is attained only by such sacrifices as to render the effect of the medicine almost nil, while the principal activity is due to the alcohol, which has proved in many cases very injurious. These considerations have prevented an extensive official recognition of elixirs, and the U. S. Pharm., 1890, recognized but two, one of which, the Aromatic Elixir, has been introduced merely as a vehicle. In the U. S. P. (8th Rev.) two elixirs were introduced, Adjuvant Elixir and Elixir of Iron, Quinine and Strychnine Phosphates. In the U. S. P. IX Elixir of Iron, Quinine and Strychnine Phosphates was dropped and Aromatic Elixir and Elixir of Glycyrrhiza (formerly named Adjuvant Elixir) were alone retained.

A number are, however, included in the N. F. IV. Elixir of Orange, official in the U. S. Pharm., 1880, may be made by the formula on page 435, *U. S. Dispensatory*, 19th edition.

EMBELIA. Br.

EMBELIA

"*Embelia* is the dried fruit of *Embelia Ribes*, Burm. fil., and also of *Embelia robusta*, Roxb." *Br.*

Embelia was introduced into the Br. Pharm. (1914) from the British Addendum (1900). It is officially described as "globular, about four millimetres in diameter, varying in color from dull red to nearly black; warty or striated longitudinally; superior, minutely beaked and often attached to a 5-partite calyx and slender pedicel. Pericarp brittle, enclosing a single seed surrounded by a delicate membrane. Seed reddish, marked with lighter spots. Endosperm horny and slightly ruminated. Taste slightly astringent and aromatic." *Br.*

The genus *Embelia* (Fam. *Myrsinaceae*) includes a large number of creeping or almost climbing tropical shrubs. They possess petiolate leaves, small white flowers and are especially abundant in tropical Asia, *Embelia Eibes* extending as far as southern China. The fruits of this plant somewhat resemble pepper and have been used as an adulterant of it.

Embelia contains 2.5 per cent. of *embelic acid*, $C_9H_{14}O_2$, which occurs in golden yellow crystals, which are insoluble in water and soluble in alcohol, ether, chloroform and benzene.

Uses.—*Embelia*, under the names of *viranga*, *vayvirang* or *birang-i-kabuli*, has long been employed in India as an anthelmintic and has found its way into European commerce. It has but slight laxative properties, so that it is better to follow it by a purgative. It is especially tenicidal, the tape worm being expelled dead. The powdered drug may be given in milk early in the morning. Warden has found that *ammonium embelate* is an effective tenicide in dose of three grains (0.2 Gm.) for children and six grains (0.4 Gm.) or more for adults. As it is nearly tasteless and soluble it may be readily administered in syrup.

Dose, of *embelia*, one to four drachms (3.9-15.5 Gm.).

EMPLASTRA

PLASTERS

Emplatres, *Fr.*; Pflaster, *G.*; Empiastri, *It.*; Emplastos, *Sp.*

Plasters are solid compounds intended for external application, adhesive at the temperature of the human body, and of such a consistence as to render the aid of heat necessary in spreading them. Spread plasters having rubber in their composition are most largely used; they are usually perforated. Some plasters have as their basis a compound of olive oil and litharge, constituting the Emplastrum Plumbi of the Pharmacopoeias. Others owe their consistence and adhesiveness to resinous substances, or to a mixture of these with wax and fats.

In the preparation of the plasters, care is requisite that the heat employed be not sufficiently elevated to produce decomposition, nor so long continued as to drive off any volatile ingredient upon which the virtues of the preparation may in any degree depend. After having been prepared, they are usually shaped into cylindrical rolls, and wrapped in paper to exclude the air. Plasters should be firm at ordinary temperatures, should spread easily when heated, and, after being spread, should remain soft, pliable, and adhesive, without melting, at the heat of the human body. When long kept, they are apt to change color and to become hard and brittle, and, as this alteration is most observable upon their surface, it must depend chiefly upon the action of the air, which should therefore be excluded as much as possible. The defect may usually be remedied by melting the plaster with a moderate heat and adding a sufficient quantity of oil to give it the due consistence.

Plasters are prepared for use by spreading them upon leather, linen, or muslin, according to the particular purposes they are intended to answer. Leather is most convenient when the application is made to the sound skin, linen or muslin when the plaster is used as a dressing to ulcerated or abraded surfaces, or with the view of bringing and retaining together the sides of wounds. The leather usually preferred is white sheepskin, or the kind known commercially as "hemlock splits." A margin about one-fourth or half an inch broad should usually be left uncovered, in order to facilitate the removal of the plaster, and to prevent the clothing in contact with its edges from being soiled. An accurate outline may be obtained by pasting upon the leather a piece of paper so cut as to leave in the center a vacant space of the required dimensions, and removing the paper when no longer needed. The spreading of the plaster is most conveniently accomplished by the use of a spatula or plaster iron. This may be heated by means of a spirit lamp or gas jet. Care must be taken that the instrument be not so hot as to

discolor or decompose the plaster, and special care is requisite in the case of those plasters which contain a volatile ingredient. A sufficient portion of the plaster should first be melted by the heated instrument, and, having been received on a piece of coarse stiff paper, or in a shallow tin tray open on one side, should, when nearly cool, be transferred to the leather, and applied quickly and evenly over its surface. By this plan the melted plaster is prevented from penetrating the leather, as it is apt to do when applied too hot. Before removing the paper from the edge of the plaster, if this has become so hard as to crack, the iron should be drawn over the line of junction.

The spreading of plasters has become to a great extent a lost art to the pharmacists of this country, owing to the introduction of machine-spread plasters, which contain India-rubber in the adhesive composition. These are reasonably permanent, and do not require the application of heat. When made by reliable manufacturers they are in many cases to be preferred, but the introduction of immense quantities of worthless ones by unscrupulous makers has caused many practitioners to direct plasters to be spread by the pharmacist from official plaster. The perforation, or "porousing," of plasters is usually accomplished on a large scale by expensive apparatus. J. J. Edmondson read a paper before the Pennsylvania Pharmaceutical Association in 1887 giving the process for manufacturing rubber-mass plasters as carried on by Johnson & Johnson, of New York. It is as follows: The ingredients employed are—rubber, two parts; Burgundy pitch, one part, 'gum olibanum, one part. This may vary with some special plasters, but they constitute the component parts of the mass used for the majority.

The crude rubber is at first steeped in hot water, to cleanse and soften it, then the rubber is passed through the washer and crusher, where it is subjected to severe pressure between two corrugated rolls, eight inches in diameter and one foot wide, while a stream of water falling continually washes it thoroughly, and it comes out in sheets somewhat softened. After these sheets are dried, which requires a number of days, they are passed through the grinder, where they are crushed between two smooth rollers, fourteen inches in diameter and thirty-six inches across. This thoroughly softens the rubber and makes it plastic, so that it can be readily worked up with the other ingredients. The principal operation, the mixing, then takes place. The medication must be carefully combined, and the whole manipulation so managed that the plaster will be uniform, so that age or varying temperature shall not

affect it. This operation is performed by means of rollers, sixteen inches in diameter, arranged so that one revolves at twice the speed of the other. Between these large rollers the mass is passed with whatever medication is required: e.g., when a belladonna mass is to be made, a certain amount of the stock mass is taken and extract of belladonna in the proportions corresponding to the formula in the Pharmacopoeia. These are repeatedly passed through the rollers until the extract of belladonna is thoroughly mixed with the mass, care being taken to keep the temperature from rising high enough to decompose or affect the alkaloids. The spreading is also done by rollers, into which the thoroughly mixed mass is fed at the same time that the cloth is fed, the thickness of the plasters being governed by the adjusting of screws on the side of the machine.

The rubber base is pliable, adhesive, it will not become too hard or too soft, but will yield up the medication to the absorbents of the skin, and its properties will be retained indefinitely. For formulas for plasters of former Pharmacopoeias, see *U. S. D.*, 19th edition, p. 436.

EMPLASTRUM CAPSICI. U. S.

CAPSICUM PLASTER Emp. Capsic.

Sparadrapum Capsici; Sparadrap de Capsique, *Fr.*; Capsicumplaster, *G.*

"Oleoresin of Capsicum, Rubber Plaster, spread on fabric, each, a sufficient quantity. Apply oleoresin of capsicum to the surface of rubber plaster so as to form a thin, even coating, leaving a margin around the edges. Each fifteen square centimeters of spread plaster contains 0.25 Gm. of oleoresin of capsicum." *U. S.*

The oleoresin should be laid on very evenly with a camel's-hair brush.

This affords a convenient way of obtaining the rubefacient effects of capsicum; of course, the practice will be for the pharmacist to employ machine-spread adhesive plaster as the base; although, with a little experience, very good work can be done by hand.

EMPLASTRUM MENTHOL. Br.

MENTHOL PLASTER

Emplatre de Menthol, *Fr.*; Mentholpflaster, *G.*

"Menthol, 150 grammes; Yellow Beeswax, 100 grammes; Resin, 750 grammes. Melt the Beeswax and Resin together; when the mixture has cooled to about 70° C. (158° P.), add the Menthol, and stir until dissolved." *Br.*

This is an official plaster of the British Pharmacopoeia, having been introduced in the additions in 1885. It is a mild counter-irritant, intended especially for relief in localized *neuralgia* and *rheumatic pains*.

EMPLASTRUM RESINAE. U. S., *Br.*

ROSIN PLASTER *Emp. Res.* [Rosin Adhesive Plaster, Adhesive Plaster]

Resin Plaster, *Br.*; Emplatre Adhesif. Emplatre Resineux, *Fr.*; Emplastrum adhaesivum, *P. G.*; Heftpflaster, *G.*; Emplastro adesivo, *It.*

"Rosin, in fine powder, one 'hundred and forty grammes [or 4 ounces av., 411 grains]; Lead Plaster, eight hundred grammes [or 28 ornees av., 96 grains]; Yellow Wax, sixty grammes [or 2 ounces av., 51 grains], to make one thousand grammes [or 35 ounces av., 120 grains]. Melt the lead plaster and yellow wax together with a gentle heat, then add the rosin and, when melted, mix thoroughly, strain, and allow the product to cool, stirring until it stiffens." *U. S.*

"Resin, 100 grammes; Lead Plaster, 850 grammes; Hard Soap, 50 grammes. Melt each ingredient separately at as low a temperature as possible; mix." *Br.*

The name of this plaster was changed in the *U. S. P. IX* to rosin plaster, it was formerly termed adhesive plaster. It differs from lead plaster in being more adhesive and somewhat more stimulating. It resembles the common adhesive plaster of commerce, and is much employed for retaining the sides of wounds in contact, and for dressing ulcers according to the method of Baynton, by which the edges are drawn towards each other and a firm support is given to the granulations. The *U. S. P. IX* formula differs from that official in *U. S. P. VIII* in that the use of rubber and petrolatum in place of yellow wax and rosin was abandoned and the old process has been restored. As prepared by the

Dublin College it contained soap, which gave it greater pliability, and rendered it less liable to crack in cold weather, without impairing its adhesiveness, and the process of that College has been adopted in the British Pharmacopoeia. It is usually spread upon muslin, and the spreading is best accomplished, on a large scale, by means of a machine, as described in the general observations upon plasters. It is kept ready spread by the pharmacist; but, as the plaster becomes less adhesive by long exposure to the air, the supply should be frequently renewed. Adhesive plaster originally employed by Baynton contained only six drachms of rosin to the pound of lead plaster. To obviate the possibility of irritating the skin, Herpin recommends the addition of lead tannate, the proportion of which, when adhesiveness is required in the plaster, should not exceed one-twentieth, but under other circumstances may be increased to one-twelfth.

The addition of Burgundy pitch or turpentine is objectionable, as they greatly increase the liability of the plaster to irritate the skin, and thus materially interfere with the purposes for which the preparation was chiefly intended.

The most popular and widely used forms of adhesive plaster used at the present time are those containing zinc oxide as one of the constituents.

EMPLASTRUM SINAPIS. U. S.

MUSTARD PLASTER Emp. Sinap. [Charta Sinapis, U. S. VIII, Mustard Paper]

"A uniform mixture of powdered black mustard (deprived of its fixed oil), and a solution of rubber, spread on paper, cotton cloth or other fabric. Preserve it in tightly-closed containers. A square of 100 square centimeters contains not less than 2.5 Gm. of black mustard deprived of its fixed oil. When moistened thoroughly with tepid water and applied to the skin, the Plaster produces a decided warmth and reddening of the skin within five minutes. Before Mustard Plaster is applied, moisten it thoroughly with tepid water." *U. S.*

Sinapisme en feuille, *Fr. Cod.*; Papier Moutarde, Papier Sinapise, *Fr.*; Charta sinapisata, *P. G.*; Senf-papier, *G.*; Carta senapata, *It.*; Papel sinapico, Charta sinapica. *Sp.*

"Black Mustard, in No. 60 powder, one hundred grammes [or 3 ounces

av., 231 grains]; Rubber, ten grammes [or 154 grains]; Petroleum Benzin, Carbon Bisulphide, each, a sufficient quantity. Pack the Black Mustard in a conical percolator, and gradually pour Petroleum Benzin upon it until the percolate ceases to produce a permanent, greasy stain upon blotting paper. Remove the powder from the percolator, and dry it by exposure to the air. Having meanwhile dissolved the Rubber in a mixture of one hundred cubic centimeters [or 3 fluidounces, 183 minims], each, of Petroleum Benzin and Carbon Bisulphide, mix the purified Mustard with a sufficient quantity of the solution to produce a semi-liquid magma, and apply this, by means of a suitable brush, to one side of a piece of rather thick, well-sized paper, so as to cover it completely, and then allow the surface to dry. A surface of sixty square centimeters should contain about 4 Gm. of Black Mustard deprived of oil. Before it is applied to the skin, Mustard Paper should be dipped in warm water for about fifteen seconds." *U. S. VIII.*

"Black and White Mustard Seeds, equal proportions by weight; Benzol, Solution of India-rubber, of each, a sufficient quantity. Bruise the Mustard Seeds and extract the fixed oil by percolation with the Benzol. Dry the residue by exposure to the air in a warm closet, and reduce to No. 60 powder. Mix seventy-five grains (or five grammes) of the purified mustard with five fluid drachms (or eighteen cubic centimetres) of Solution of India-rubber, and spread by means of a suitable brush over about 30 square inches (or about two square decimetres) of one side of a piece of cartridge paper. Allow it to dry by exposure to the air." *Br.*, 1898.

The name of this preparation was changed in the U. S. P. IX from mustard paper to mustard plaster; from a pharmaceutical point of view this was a mistake, for *mustard leaves* as they are often called are very different from either mustard plasters or mustard poultices. The U. S. P. IX and the British Pharm. (1914) no longer admit a process for making *Charta Sinapis*, the U. S. P. IX merely describing the preparation as found in commerce. The U. S. P. VIII and the Br. Pharm., 1898, processes are given above.

The formula for this preparation was greatly improved by the U. S. P. in 1890 and Br., 1898. The British preparation (1885) was at fault in not providing for the extraction of the fixed oil by previously percolating with petroleum benzin or carbon disulphide; otherwise the paper will be greasy, giving to the plaster an untidy appearance and soiling the linen of the patient. Solution of gutta-percha is unsuited for use in this

preparation, on account of want of adhesiveness, and the tendency of the mixture, when dry, to crack and peel off. We have used instead a solution of 1 part of pure rubber in 30 of equal parts of carbon disulphide and petroleum benzin. On the large scale, by means of a plaster spreading apparatus a uniform coat of this solution may be applied to paper. As the latter passes out from under the apparatus, a sieve containing the powdered mustard is shaken over it; this is fixed by the adhesive coat and firmly retained after the evaporation of the volatile liquids in a warm place. The application of the powdered mustard must be properly regulated according to the speed with which the machine delivers the coated paper. The paper is cut into pieces of convenient size, and needs only to be wetted with tepid water to be ready for use. Owing to the fact that the large manufacturers can put mustard paper upon the market at such low rates that it pays the apothecary better to buy than to prepare it, Charta Sinapis, so far as we can learn, is rarely made in the retail stores.

Uses.—For the uses of the mustard plaster, see *Sinapis*.

Experience has shown that the ready-made mustard papers err rather from too much than from too little activity. Moreover, their action cannot be regulated with the same nicety as can that of the mustard poultice. Unless in the case of travellers, and of others who must wait upon themselves, the domestic application is preferable. The *mustard leaves* can rarely be borne for more than ten or fifteen minutes. Care should be observed to protect the leaves, as they are popularly called, from the action of moist air by keeping them in well closed containers.

EMULSA.

EMULSIONS

Emulsions, *Fr.*; Emulsiones, *G.*; Emulaiones *It, Sp*

Under this head are included in the U. S. Pharmacopoeia liquid preparations in which oleaginous substances are suspended in aqueous fluids by the intervention of gum or other viscid matter. The preparations forming the present class of emulsions were termed Mixtures in earlier pharmacopoeias, and it is to be regretted that under this indefinite term are still grouped liquids of many kinds; the separation of these into proper classes is only a question of time, and the

introduction of this new class into the Pharmacopoeia of 1890 marked the first step in the direction of greater accuracy in defining pharmaceutical preparations, and more system in classification. The object of emulsions is usually to facilitate the administration, to conceal the taste, or to obviate the nauseating effects of unpleasant medicines, and their perfection depends upon the intimacy with which the ingredients are blended. Some skill and care are requisite for the production of uniform and perfect emulsions. As a rule, the body to be suspended should be thoroughly mixed by trituration with the substance intended to act as the intermedium, before the aqueous vehicle is added. In the case of the liquid balsams and oils, if gum arabic is employed as the intermedium it should be previously brought to the state of mucilage of the consistence directed in the U. S. Pharmacopoeia. When a fixed oil, oleoresin, or balsam is to be made into an emulsion, the method most employed abroad is to add one part of gum to two or three of the oil, in a mortar, triturate until the mixture is complete, and then add at once twice as much water as gum used, and triturate rapidly until the oil is completely emulsified, then gradually add the remainder of the vehicle with constant trituration. Agitation in a bottle is sometimes substituted for trituration. The plan most largely used in this country is to make the emulsion with mucilage. Having a broad flat pestle and a mortar perfectly free from grease, put in a little mucilage, rub it around the mortar, add about half as much oil, triturate from the center so as to emulsify this, then add more mucilage, then oil, and so on until the operation is completed. Care is required never to get the oil in excess of the mucilage. This plan seems to accord with the principle laid down by R. Bother, that the most perfect and rapid emulsifier is a perfect emulsion. The proportion of gum and water necessary to make a good emulsion with the fixed oils varies with the oil. Thus, while castor oil requires only two drachms of the gum and three drachms of water to the ounce, most other fixed oils require half their weight of gum, and a weight of water equal to half that of the oil and gum united. These quantities being well rubbed together, any desirable amount of water may afterwards be gradually added, and will readily incorporate with the other ingredients. The white of egg has been frequently ordered by physicians as the suspending substance, but it is inferior for this purpose to the yolk, or to gum arabic. When the white is used it should be well beaten, and incorporated with the oleaginous or balsamic substances before the water is added. When volatile oils are to be emulsified they should be mixed with an equal volume of inert fixed oil to promote stability. Quillaja, saponin, and other substances having

similar properties have been proposed as emulsifying agents, but they are objectionable on account of their medicinal activity. Emulsifying agents should be inert.

Leo Boon (*J. A. Ph. A.*, 1916, v, 496) gives an extensive review of the literature on emulsification and Roon and Oesper have made an important contribution to the theory of emulsification (*J. I. & E. C.* 1917, p. 156). The authors agree with Fischer [*Science* 1916, p. 468] that emulsification is due to, or accompanied by, the formation of a hydrated colloid compound. Both the English and Continental methods of emulsification were studied carefully. The unsatisfactory results obtained by the majority of workers with the English method, are alleged to be due to the fact that the hydration of the emulsifying agent occurs progressively and not all at one time and for the greater part is not accomplished in the presence of the internal phase (oil). In the Continental method all of the emulsifying agent (colloid) is hydrated at one time and in the presence of the internal phase (oil). After experimenting with various proportions of materials, it is stated by the authors that the best and quickest results are obtained by the use of the following proportions in the preparation of the original nucleus: oil 4, water 3, gum 2.

Experimental emulsions were produced of the following substances: hexane, sp. gr. 0.691; chloroform, sp. gr. 1.526; carbon tetrachloride, sp. gr. 1.597; benzene, sp. gr. 0.877; oil of turpentine, sp. gr. 0.85; mineral oil, sp. gr. 0.853; cottonseed oil, sp. gr. 0.921. Gum emulsions and soap emulsions were made of all these and the conclusions, in part, were as follows:

1. The presence of a hydrated colloid is necessary for emulsification.
2. This hydration compound is most efficiently used if formed at the moment of dispersion of the internal phase— in other words, the three constituents, internal phase, emulsifier and water, in critical proportions, must all be mixed at one time in order to form a properly hydrated nucleus.
3. Slight variations from the proper procedure or from the critical proportions yield either less stable emulsions or none at all.
4. No emulsion results if the emulsifier is diluted before the dispersion of

the internal phase.

EMULSUM AMYGDALAE. U. S. (Br.)

EMULSION OF ALMOND Emuls. Amygd. [Milk of Almond]

Mistura Amygdalae, *Br.*; Almond Mixture; *Mistura Amygdalae*, U. S. 1880; *Emulsio Amygdalae*, s. *Amygdalarum*, *Emulsio Simplex*; Milk of Almonds; Simple Emulsion; *Emulsion d'Amande*, *Fr. Cod.*; *Lait d'Amande*, *Fr.*; *Mandelemulsion*, *Mandelmilch*, *G.*; *Emulsione di mandorle dolci*, *It.*; *Emulsion comun*, *Sp.*

"Sweet Almond, sixty grammes [or 2 ounces av., 51 grains]; Acacia, in fine powder, ten grammes [or 154 grains]; Sugar, thirty grammes [or 1 ounce av., 25 grains]; Water, a sufficient quantity[^] to make one thousand mils [or 33 fluidounces, 6% fluidrachms]. Having blanched the almonds, add the acacia and sugar, and beat them, in a mortar, until they are thoroughly mixed. Then rub the mass with nine hundred mils [or 30 fluidounces] of water, at first very gradually added, until a uniform mixture results. Strain this into a graduated vessel, and wash the mortar and strainer with enough water to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the whole thoroughly. This preparation must not be dispensed unless it has been recently prepared." *U.S.*

"Compound Powder of Almonds, 125 grammes; Distilled Water, sufficient to produce 1000 millilitres. Triturate the Powder with a little of the Distilled Water so as to form a thin paste; gradually add the remainder of the Distilled Water; strain through fine muslin." *Br.*

These preparations are essentially the same, the gum and sugar which enter into the U. S. formula directly being ingredients of the compound powder of almonds of the British. The gum arabic in these formulas is introduced not so much for its demulcent properties as to assist in the suspension of the insoluble ingredients of the almonds. The same formula will answer for the preparation of an emulsion of bitter almonds from bitter almond or peach kernels. The oleaginous matter of the almonds is suspended in the water by means of their albumen, gum, and sugar, forming a milky emulsion. When the almonds themselves are employed, as in the U. S. process, care should be taken to reduce them to the consistence of a paste previously to the addition of the water, and

with each successive portion of fluid a uniform mixture should be formed before another portion is added. Common water, when pure, may be properly substituted for the distilled. Great care should be taken to select the almonds perfectly free from rancidity. The emulsion is not permanent and compound powder of almonds often has a taint of rancidity when kept too long. Upon standing, the oil rises like thick cream to the surface, and the separation is effected more quickly by heat, alcohol, and the acids, which coagulate the albumen. The preparation is closely analogous to milk in chemical relations and appearance. In warm weather it soon becomes sour.

Uses.—Emulsion of almond has a bland taste, and may be used as an agreeable, nutritive demulcent in *catarrhal* and *dysenteric affections* and irritation of the urinary passages. To be of service it must be freely employed. It is occasionally employed as an emollient lotion, and as a vehicle for less agreeable medicines, but should not be used with any considerable quantity of tinctures, acidulous salts, or other acid substances.

Dose, two to eight fluidounces (60-240 mils).

EMULSUM ASAFOETIDAE. U. S.

EMULSION OF ASAFOETIDA Emuls. Asafoet. [Milk of Asafoetida]

Asafoetida Mixture; Mistura (Lac) Asafoetidae, Mistura Asafoetida, U. S. P. 1880; Mixture (Lait) d'Asafoetida, *Fr.*; Asafoetidaemulsion, Stinkasantmilch, *G.*

"Asafoetida, in tears or selected masses, forty grammes [or 1 ounce av., 180 grains]; Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Rub the Asafoetida, in a warmed mortar, with nine hundred mils [or 30 fluidounces] of Water, at first very gradually added, until a uniform emulsion results. Then strain the mixture into a graduated vessel, and rinse the mortar and strainer with enough Water to make the product measure one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Mix the whole thoroughly." U. S.

The present 4 per cent. official emulsion slightly exceeds in strength the mixture of the U. S. P., 1870, which contained but 3 per cent. of asafoetida. This emulsion is less stimulant than the tincture, and more

prompt in its action than the pill. Its excessively disagreeable odor and taste are, however, objections, which induce a frequent preference for the last mentioned preparation. It is very often employed as an enema. From two to four fluidounces (60-120 mils) may be given by the rectum. D. Ackerman prepares a concentrated emulsion of asafetida, which will keep if excluded from the light, by using a mixture of three-fourths of pure water and one-fourth of diluted acetic acid as the menstruum. For cleaning mortars in which asafetida has been rubbed, he recommends solution of potassium hydroxide, followed by soap and water.

Dose, one-half to one fluidounce (15-30 mils).

EMULSUM OLEI TEREBINTHINAE. U. S.

EMULSION OF OIL OF TURPENTINE Emuls. Ol. Tereb.

Emulsion d'Essence de Terebenthine, *Fr.*; Terpentinol-emulsion, *G.*

"Rectified Oil of Turpentine, fifteen mils [or 243 minims] ; Expressed Oil of Almond, five mils [or 81 minims]; Syrup, twenty-five mils [or 406 minims]; Acacia, in fine powder, fifteen grammes [or 231 grains]; Water, a sufficient quantity, to make one hundred mils [or 3 fluid-ounces, 183 minims]. Introduce the acacia into a perfectly dry bottle of sufficient capacity, add the rectified oil of turpentine and the expressed oil of almond and shake the bottle thoroughly. Then add thirty mils [or 1 fluid-ounce, 7 minims] of "water and incorporate it by vigorous shaking. When the oil has been completely emulsified add first the syrup, in several portions, shaking after each addition, and then enough "water, in divided portions, shaking after each addition, to make the product measure one hundred mils [or 3 fluidounces, 183 minims]." U. S.

The U. S. P. VIII introduced this emulsion with the view of providing a simple and fairly permanent preparation. Rectified oil of turpentine should be used exclusively. The process is much like the one recommended by J. Winchell Forbes, and a mortar and pestle are not needed to produce a perfect emulsion.

Dose, one-half to one fluidrachm (1.9-3.75 mils).

Ephedra. *Ephedra vulgaris* Eich. (Fam. *Gnetaceae*.)—Nagai has extracted from this Japanese plant an alkaloid, *ephedrine*, which, according to Kinnossuke, produces in the lower animals acceleration of the pulse, with lowering of the blood pressure,

elevation of the rectal temperature, dilatation of the pupils, convulsions, and death by arrest of the heart and respiration. (B. K. W., 1887.) Scriba found that a 10 per cent. solution dilates the pupil with certainty, in from forty to sixty minutes, without irritation, the dilatation not being complete, and the accommodation not at all or only slightly affected, and the pupils returning to normal in from five to twenty hours. An alkaloid has also been discovered in *Ephedra distachya* L., a shrub whose branches and root are used in Siberia as a remedy in gout and syphilis. According to Robert, this alkaloid is essentially different from, *ephedrine*, in not being mydriatic or poisonous. P. Spehr (A. J. P., 1892, 234) considers that *E. vulgaris* contains two alkaloids, *ephedrine* and *pseudo-ephedrine*, isomeric and of the formula $C_{10}H_{15}ON$, while *E. monostachya* contains a crystalline base melting at $112^{\circ} C.$ ($233.6^{\circ} F.$) and having the formula $C_{13}H_{19}ON$. This latter, as stated by Kobert, is not mydriatic or poisonous. See paper by E. Schmidt, A. Pharm., cd, 1912, Nos. 2 and 3, 154, 161. According to Gunsberg, pseudo-ephedrine is a powerful mydriatic, its 10 per cent. solution causing in fifteen minutes dilatation of the eye through excitement of the sympathetic nerve.

Ephedra nevadensis S. Wats and *E. antisiphilitica* C. A. Meyer, which grow abundantly in the extreme Western United States, are used under the names of *caynote*, *canutilo*, *whorehouse tea*, as a remedy in *gonorrhoea*. Loew thinks that their virtues reside in a peculiar tannin. Dose, of fluid-extract, from one to two fluidrachms (3.75-7.5 mils). In Texas *E. trifurca* Torr. is similarly employed.

Epigaea. *Epigaea repens* L. *Trailing Arbutus*. *Ground Laurel*. *Mayflower*. *Gravel Plant*.—This is a small prostrate or trailing ericaceous plant, having bristly woody stems; evergreen, entire, cordate-ovate leaves, and small, very fragrant dimorphic, subdioecious flowers, which appear early in the spring. It is found in the sandy woods or rocky soil, and grows on the sides of hills with a northern exposure. Darlington states that the plant has been supposed to be injurious to cattle, when eaten by them. (*Flora Cestricea*, 259.) Jefferson Oxley has found in this plant *arbutin*, $C_{12}H_{16}O_7$, *urson*, $C_{20}H_{32}O_2$, *ericolin*, $C_{34}H_{56}O_{21}$ (the same constituents as are in *uva ursi*), tannic and formic acids, and a principle allied to gallic acid. (A. J. P., xlv, 253.) Thal gives the simpler formula $C_{26}H_{30}O_3$ to ericolin. Eli Ives of New Haven, Connecticut, in 1849, highly commended epigaea as a substitute for *uva ursi*, and we now know that the two drugs contain the same active principles. The decoction of the leaves and stem may be used freely.

Epilobium. *Epilobium angustifolium* L. (*Chamaenerion angustifolium* Scop.) *Willow-herb*. *Herbe de St. Antoine*, Fr. *Weidenroschen*, *Antonskraut*, G. (Fam. *Onagraceae*).—There are several indigenous species of *Epilobium*, which have the common name of willow-herb, from the resemblance of their leaves to the willow, all of which probably have nearly identical properties. The *E. angustifolium* is the largest of them. Its leaves and roots are said to be demulcent, tonic, and astringent, and yield their virtues to water and alcohol. They are used by the eclectics, generally and locally, in decoction, infusion, or cataplasm, as astringents. Oliver reports (B. M. J., ii, 1897) violent poisoning with epileptiform convulsions caused by *E. hirsutum* L. Under the name of *Kaporie tea*, the leaves of *E. angustifolium* and of *E. hirsutum* are largely

used in Russia as a beverage.

Equisetum. *Equisetum hyemale* L. *Horsetail. Scouring Rush. Prele*, Fr. *Schachtelhalm*, G. (Fam. *Equisetaceae*).—An indigenous plant, with slender annual stems from 3 to 9 dm. high, growing abundantly throughout the United States, and preferring wet places, as the banks of streams, etc. The plant derives its name of scouring rush from its use in scouring, for which it is fitted by the silicious character of the stems. Examined by F. J. Young (*A. J. P.*, 1886, 419), it yielded to petroleum benzin as a solvent 1.4 per cent. of a brownish-green, semi-liquid, fixed oil, which was readily saponified. It also contained a green semi-solid resin, sugar, and mucilage. The infusion of the whole plant is used sometimes in *dropsical* and *renal diseases*, but Cow (*A. E. P. P.*, 1912, lxx, p. 393) has shown that the diuretic action of *equisetum* is very feeble.

Erechthites. *Erechthites hieracifolia* (L.) Raf. *Fire-weed*.—An annual indigenous composite plant, growing in moist woods and recent clearings, and having a rank, somewhat aromatic odor. Its taste is bitterish, slightly acrid, and disagreeable. It yields its virtues to water. It has been especially recommended in dysentery. It is prone to infest the peppermint fields of Michigan, and its oil is said sometimes to deteriorate the oil of peppermint from that region. It has been shown however, that *Erigeron (Leptilon) canadensis* L. is far more injurious (see *Erigeron*).

Erigeron. *Fleabane. Scabious. Sweet Scabious. Daisy Fleabane. Herbe d'erigeron, Herbede Vergerette*, Fr. *Berufkraut*, Gr.—Under this name the U. S. Pharmacopoeia of 1870 recognized the herbal portions of *Erigeron annuus* (L.) Pers. and *E. philadelphicus* L. (Fam. *Compositae*.)

The two species are abundant in the middle portions of the United States, grow in open fields, and are probably of identical medicinal value. They are popularly known as *fleabane*. The whole herb is used, and should be collected while the plants are in flower. It has a feebly aromatic odor and bitterish taste, and imparts its properties to boiling water.

The U. S. Pharmacopoeia also formerly recognized, as *Erigeron canadensis (Leptilon canadense)* (L.) Britt.), *Horseweed. Mare's tail. Fire-weed. Butter-weed. Colt's-tail*.

Canada fleabane is very common throughout the northern and middle sections of the United States, and has become naturalized over the world. It abounds in neglected fields, and is reported to be a very troublesome weed on the peppermint plantations of the West. It blooms in July and August. The plant, all parts of which are medicinal, should be collected while in flower. The leaves and flowers are said to be the most active parts. It has a characteristic odor, and a bitterish, acrid, somewhat astringent taste. Among its constituents, according to De Puy, are bitter extractive, tannin, gallic acid, and volatile oil. Both alcohol and water extract its virtues. Its acrimony is diminished by decoction, in consequence, probably, of the escape of the oil, upon which its virtues in part depend. All of the erigerons are reputed to be diuretic, tonic, and astringent: and useful in *dropsical complaints* and *diarrhea*. They have been given in

substance (dose, a drachm, or 3.9 Gm.), infusion, tincture, or extract (*dose*, ten grains, or 0.65 Gm.), but the oil is the only proper preparation. The oil is of value in *uterine*, *pulmonary*, and other *internal hemorrhages*, in *doses* of from five to fifteen minima (0.3-0.9 mil), every two hours. (See p. 1519.)

For further information concerning these drugs see *U. S. D.*, 19th ed., p. 1479.

Eriobotrya. *Eriobotrya japonica* Lindl. *Loquat. Japanese Medlar. Bibader. Neflier du Japon. Nestole di Giappone.* (Fam. *Rosaceae*)— A small tree, indigenous to Japan and extensively cultivated. The fruit closely resembles the apricot and has a sweetish acid pulp. The seeds of this tree are said to contain amygdalin and emulsin, and to yield hydrocyanic acid in poisonous quantities. (*P. J.*, Aug., 1885.) Herissey, in 1907, stated that Lehmann was incorrect in his conclusions that the glucoside was identical with *laurocerasin*, and states that the glucoside is *amygdalin*. (*A. Pharm.*, ccxiv, 1907.)

ERIODICTYON. U. S.

ERIODICTYON Eriodict. [Yerba Santa]

"The dried leaves of *Eriodictyon californicum* (Hooker and Arnott) Greene (Fam. *Hydrophyllaceae*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter." *U. S.*

Mountain Balm, Consumptive's Weed, Bear's Weed, Gum Bush.

Eriodictyon californicum is a low evergreen shrub growing abundantly upon dry hills in California. It is glabrous, resinous, having short petiolate, long lanceolate leaves, irregularly more or less serrate, sometimes entire, whitened beneath, between the reticulations, by a minute and close tomentum, above glabrous. The corolla is tubular funnel-form; the calyx being sparsely hirsute. The leaf structure has been studied by F. W. Ritter. (See *A. J. P.*, 1895, 565.)

E. tomentosum, which grows often along with *E. californicum*, especially in the southern part of California, is readily distinguished by its dense coat of short villous hairs, whitish or rusty-colored with age. It is also a larger shrub than *E. californicum*, has its corolla somewhat salverform, and its leaves oblong or oval, and obtuse.

Properties.—The leaves of eriodictyon are characterized by the *U. S. Pharmacopoeia* as "Usually in fragments; when entire, laminae lanceolate, from 5 to 15 cm. in length, and from 1 to 3 cm. in breadth;

summits acute; bases slightly tapering into short petioles; margins irregularly serrate or crenate-dentate; upper surfaces yellowish-brown, covered with a more or less glistening resin; under surfaces grayish or yellowish-white, conspicuously reticulate with greenish-yellow veins; minutely tomentose between the reticulations; thick, brittle; odor aromatic; taste balsamic, bitter, becoming sweetish. Under the microscope, transverse sections of the laminas of *Eriodictyon* show upon the upper surface large epidermal cells, the outer walls being very uneven, owing to indentations which appear as striations in surface view; glandular hairs numerous, with short 1-celled stalks and 6- to 8-celled glandular heads; palisade cells very narrow, from 2 to 6 rows deep, containing numerous chloroplastids; cells of dorsal-pneumatic tissue (loose mesophyll) very few; fibro-vascular tissues not strongly developed except in the midrib and more prominent veins; numerous 1-celled, much twisted, thick-walled, non-glandular hairs occurring on the lower surface between the veins. Under the microscope, sections of the stems of *Eriodictyon* show the epidermis usually replaced by strongly lignified cork; cortex of from 10 to 20 rows of more or less rounded cells; bast-fibers deep-seated with thick, more or less strongly lignified walls and occurring in small groups forming a more or less interrupted circle; sieve tissues in a narrow zone; wood-wedges consisting of trachese with spiral thickenings, simple or bordered pores and numerous strongly lignified wood-fibers, separated by medullary rays 1-cell in width; pith very large, the walls of the cells being strongly lignified and with numerous simple pores." *U. S.*

Tunmann (*Ph. Centralh.*, 1908, p. 159) describes and illustrates the pharmaeognostic and microscopic characteristics of *Eriodictyon californicum*, and discusses the morphological importance of the oil glands of eriodictyon. H. S. Wellcome (*The Pharmacist*, 1876, p. 33) found the drug to contain two aromatic resins, while an aqueous infusion of leaves which had been exhausted by alcohol yielded an intensely bitter extract. According to the analysis of Chas. Mohr (*A. J. P.*, 1879, 549), it contains tannic acid and 8 per cent. of an acrid, bitter, resin, upon which its activity is believed to depend, also a minute quantity of volatile oil. R. Rother describes (*A. J. P.*, 1887, p. 225) an acid resin which forms with bases quite soluble salts. The acid resin was obtained at the conclusion of the spontaneous volatilization of the several solvents as a green-yellow transparent mass. Thai (*Ph. Z. R.*, 1883, p. 209) affirmed the presence of *ericolin*, $C_{34}H_{56}O_{22}$. Power and Tutin deny that ericolin is present but find besides volatile oil and resin, *triacontane*, $C_{30}H_{62}$,

penta triacontane, $C_{35}H_{72}$, *eriodictyol*, $C_{15}H_{12}O_6$, *homoeriodiciyol*, $C_{16}H_{14}O_6$, and a phenol, $C_{16}H_{41}O_6$.

Uses.—Eriodictyon has long been used in California as a bitter tonic, and also as a stimulant balsamic expectorant. There is considerable testimony to its usefulness in *asthma*, *chronic bronchitis*, and allied conditions; also in chronic inflammation of the genito-urinary tract. Attention has been called by Kier to its remarkable power of disguising the taste of quinine, and Meyer (Ph. Ztg., 1905) found that it will also mitigate the unpleasantness of hydrastis or aspidium. It is best exhibited in the form of the official fluidextract, the dose of which is one-half to one fluidrachm (1.8-3.75 mils); a solid extract has been made, which may be given in doses of from five to fifteen grains (0.32-1.0 Gm.). In cases of asthma, eriodictyon is often used by smoking. The aromatic syrup is well adapted as a vehicle for quinine.

Dose, fifteen to sixty grains (1.0-3.9 Gm.).

Off. Prep.—Fluidextraetum Eriodictyi, U. S.; Elixir Eriodictyi Aromaticum (from Fluidextract), N. F.; Syrupus Eriodictyi Aromaticus (from Fluidextract), N. F.

Erodium. *Erodium cicutariuin* L. Stork's-oill. —An annual hairy plant belonging to the *Geraniaceae*. It grows in Europe, Asia, Northern Africa and is widely cultivated, being found naturalized about cities in the United States. It is highly recommended by W. Abbots Smith in *dropsy*. (See *Am. J. M. S.*, 1865.)

Eryngium. *Eryngium aquaticum* L. *Button Snakeroot*. *Corn Snakeroot*. *Rattlesnake's Master*.—The button snakeroot or water eryngo is an indigenous umbelliferous plant which grows in low wet places, from New Jersey as far south as Florida and Texas. The root, which is the medicinal portion, has a bitter, pungent aromatic taste, provoking, when chewed, a flow of saliva. It is said to be diaphoretic, expectorant, in large doses emetic, and the plant has been used as a substitute for senega.

Erythrina.—The bark of the Australian species of this genus, *Erythrina Broteroi*, is said to contain an alkaloid, *erythrinine*, while the Mexican species, *Erythrina coralloides* DC., bears poisonous seeds in which Altamirano has found *erythroidine*, a powerful paralyzant of the motor system, *erythroresin*, an emetic, coralin and *erythric acid*. The extract has been suggested as a substitute for curare. (*B. S. Ph. Br.*, 1900) Langham obtained from the seeds of *E. zeyheri* (which have a scarlet pesta), *erythrine*, 15 per cent. (*C. D.*, 1911,134.)

Erythrina lithosperma Blume. (*Hypaphorus subumbrans* Hassk.)— From the seeds of

this beautiful leguminous tree, largely grown for shade in the coffee gardens of Java, P. C. Plugge has obtained *hypaphorine*, a tetanizing alkaloid. (*A.E. P. P.*, xxxii.)

Erythronium. *Erythronium americanum* Ker. *Scrofula Root. Yellow Snowdrop. Rattlesnake Violet. Dogtooth Violet. Yellow Adder's Tongue.*—This is an indigenous, perennial, lilaceous plant, sometimes called, after the European species, *dog's-tooth violet*. It grows in rich woods from New Brunswick to Florida and west to Ontario and Arkansas. It flowers in the latter part of April or early in May. All parts of it are active. In the dose of twenty or thirty grains (1.3 or 2.0 Gm.) the recent bulb is emetic. The leaves are said to be more powerful. The activity of the plant is diminished by drying.

Eschscholtzia. *Eschscholtzia californica*, Chamisso. *California Poppy.*—Attention has been brought to this Californian member of the Papaveraceae, as a powerful soporific and analgesic, which is free from the disadvantages of opium. The plant is extensively cultivated and there are now a number of garden varieties. Bardet and Adrain (*G. H. M. C.*, Nov., 1888) assert that they have obtained a glucoside, an alkaloid, and morphine in the proportion of from five to six grains in two pounds of the dried product. According to Fischer and Tweeden, there are seven alkaloids in *Eschscholtzia californica*; *protopine*, β - and μ -*homochelidonine*, "alkaloid a," "alkaloid b," *sanguinarine* and *chelerythrine*. As far as could be determined from the small quantities obtained, the alkaloids designated as *a* and *b* differ from any other alkaloids thus far known. (*Ph. Archiv.*, 1902, No. 7.) The narcotic power of the drug seems to be very weak, since, according to Bardet, three drachms were necessary to kill a rabbit. Ter-Zakariant (*G. M. P.*, Feb., 1889) states that the alcoholic extract acts as a respiratory depressant and narcotic, affecting in toxic dose also the spinal cord. Dujardin-Beaumez has used the extract in commencing doses of twelve grains (0.78 Gm.), increasing to one hundred and eighty-five grains (12 Gm.) a day, and affirms that it is a harmless soporific and analgesic.

EUCALYPTUS. U. S.

EUCALYPTUS Eucalypt. [Blue Gum Leaves]

"The dried leaves of *Eucalyptus Globulus* Labillardiere (Fam. *Myrtaceae*), collected from the older parts of the tree, without the presence or admixture of more than 3 per cent. of the stems, fruits or other foreign matter." *U. S.*

Blue Gum-tree Leaves, Australian Fever-tree Leaves, Eucalyptus Leaves; Eucalyptus, *Fr. Cod.*; Feuilles d'Eucalyptus, *Fr.*; Eucalyptusblatter, *G.*; Eucalitto, *It.*; Eucalipto (Hoja ide). *Sp.*

The genus *Eucalyptus* was named by L'Heritier in 1788, from the two Greek words meaning ("I cover well," " in allusion to the operculum or

lid which covers the calyx until the stamens are fully formed." The plants, which are known as *Gum trees*, *Woolly butts*, *Iron barks*, etc., by the natives of Australia and Tasmania, are evergreen and vary from shrubs to trees of enormous height, some of them probably being the highest trees known. Kerner gives the height as 140 to 152 meters. They form, it is stated, about three-fourths of the whole vegetation of those countries. At least one hundred and forty species have been described. The leaves frequently vary in shape and in position on both young and mature trees; they are fixed vertically, and not horizontally as the leaves of our trees, the petiole being twisted. The leaves furthermore contain large oil-secreting reservoirs. The flowers are arranged in cymes or axillary umbels and are devoid of petals; the usually whitish stamens are inflexed in the bud and expand when the operculum is removed, giving the name as already stated to the genus. The fruit is a 3- to 6-celled truncated capsule, or pyxis. The seeds are small and very numerous, the sterile ones predominating; this is no doubt one reason why there has been so much difficulty in producing seedlings.

Most of the species do not require excessive heat for their perfecting, and some of them are able to resist moderate frosts. Over forty species are being grown successfully in the United States, and in the neighborhood of Los Angeles and other points in California a pure oil is said to be commercially produced. On account of the rapidity of their growth and the hardness and indestructibility of their timber, many of the species are very valuable for economic purposes. A number of the species are said to be cultivated in the Southwest as a source of honey. (See *Bulletin No. 35 of the U. S. Bureau of Forestry.*)

With a genus of so many species and numerous varieties it was to be expected that there would be considerable confusion in regard to the accurate determination of its members. Tate and Luehman give prominence to the fruit for purposes of classification. Maiden, however, says that all of its characters display a puzzling amount of variation, and concludes that for herbarium work the best characters are afforded by the anthers and fruits; whereas the scientific forester will be largely guided by the nature of the bark and timber. Baker and Smith, in addition to morphological characters, base their deductions on the chemical properties and physical characters of oils, dyes, kinos, etc. See Bentham, *Flora Australiensis*; Baron F. von Mueller's *Eucalyptographia*, 1879 to 1884. Baker and Smith (*A Research on the*

Eucalypts, Sydney, 1902), arrange the species in seven different groups, according to the chemical characteristics of the oils which they produce. It is stated that the leaves of the *E. rebaudianum*, of Paraguay, are used in that country in place of sugar, which they exceed in sweetening power.

Eucalyptus globulus is one of the largest known trees, attaining sometimes a height of 300 or even 350 feet, with a smooth, ash-colored bark. The leaves attain a foot in length, and vary, according to age, from a glaucous white to a bluish-green color. The flowers are large, pinkish-white, axillary, occurring singly, or in clusters. Although its wood is very resinous, hard, and durable, the tree is remarkable for the rapidity of its growth, reaching, under favorable circumstances, fifty feet of height in five or six years. It flourishes best in valleys having a rich, moist soil, and has very largely been naturalized in semi-tropical countries, partly on account of its economic value, but chiefly because of the reputation it enjoys as a means of overcoming malaria. Its sanitary powers appear to be established, numerous notoriously miasmatic stations and districts having been rendered healthful by its growth. It is probable that the destruction of the miasma is due not so much to emanations from the tree as to the fact that it evaporates water so rapidly from its innumerable large leaves as to drain the swamps and marshes in which it is planted. It is possible, however, that the large amount of volatile oil which must escape from it has some effect, and it is even affirmed (*A. J. P.*, 1875, p. 423) that the parasitic phylloxera will not attack grape-vines growing near it.

The eucalyptus oil of commerce is, indeed, composed chiefly of the oils of *E. amygdalina* and *E. dumosa*, which yield a very much larger product than does the official species. The oils of *E. piperita* and *E. haemastoma* have a peppermint odor, and that of *E. citriodora* a citron-like odor, while the oil of *E. staigeriana* exactly resembles the oil of verbena; it is probable that these oils will come into commerce for the purposes of the perfumer.

Properties.—The leaves are the official portion of the plant and are officially described as follows: "Laminas lanceolately scythe-shaped, from 8 to 30 cm. in length and from 2 to 7.5 cm. in breadth; summits when present acute or acuminate; bases unequal, obtuse or more or less rounded and connected with a twisted petiole from 5 to 35 mm. in length; margins slightly uneven, revolute; coriaceous; both surfaces

varying from pale yellowish-green to grayish-green and more or less glaucous, glabrous, glandular-punctate and with numerous small, circular, brown dots of cork; veins of the first order anastomosing with each other and forming a line nearly parallel with the margin; odor slightly aromatic; taste aromatic, bitter, and cooling. Under the microscope sections of Eucalyptus show the upper and lower surfaces with nearly similar cells, the outer walls being strongly cuticularized; stomata occur on both surfaces, a region of palisade cells made up of from 3 to 4 rows of cells occurring beneath each surface; among the palisade cells occur large oil-secretion reservoirs, with a yellowish or orange colored oily content; calcium oxalate crystals in cells of the loose mesophyll in the form of rosette aggregates or monoclinic prisms varying from 0.015 to 0.025 mm. in diameter. At the periphery of the fibro-vascular bundles of the midrib and petiole occurs a more or less interrupted circle of small groups of slightly lignified bast-fibers." U. S.

Hans Kramer (*B. P. G.*, 1907, p. 319) presents an anatomical study of Eucalyptus with the characteristics of the drug in a powdered form.

In March, 1870, Cloez (*J. P. C.*, 4e ser., xii, 201) reported an elaborate chemical study of the eucalyptus leaves, and his results have been substantially confirmed by Debray (*De l'Eucalyptus Globulus*, Paris, 1872), Rabuteau (*Mem. de l'Academic*, Nov., 1872), and Broughton (*P. J.*, 3d ser., iii, 463). Cloez found, besides chlorophyll, resin, tannin, and inert substances, an essential oil, upon which the virtues of the drug appear to depend. Of this oil the fresh leaves afforded 2.75 parts per hundred, the recently dried leaves 6 parts; leaves which had been kept some time yielded a much smaller percentage. In the distillation, the oil for a time comes over freely at from 170° C. (338° F.) to 178° C. (352.4° F.); subsequently another portion of oil distils at 188° C. (370.4° F.) to 190° C. (374° F.), and finally a very minute portion does not volatilize until the temperature reaches 200° C. (392° F.). Cloez believes the oil to be composed of two camphors, differing in their volatility. The bulk of the oil yielded is the portion first distilled; to this Cloez has given the name of *eucalyptol*, or, as it is now also called, *cineol*, C₁₀H₁₈O. Gildemeister and Hoffmann (*Aetherische Oele*, 1899, p. 690) divide the eucalyptus oils into 5 groups according to their constituents, viz.:

Group 1, Cineol (or Eucalyptol) containing oils, of which group *Eucalyptus Globulus* is the most important;

Group 2, Citronellal containing oils, of which group *Eucalyptus maculata* is the most important;

Group 3, Citral containing oils, of which *E. staigeriana* F. von Muell., is the typical example;

Group 4, Peppermint smelling oils, of which *Eucalyptus piperita* is an example;

and Group 5, Less known oils of varying odor.

Schimmel & Co. (*Semi-Annual Report*, April, 1897) gave a list of some fifteen varieties of eucalyptus oils from the different *Eucalyptus* species. In their report for October, 1904, they give the sources and state the properties and components of 109 different eucalyptus oils obtained by them from Baker and Smith, Curators of the Technological Museum of Sydney, N. S. W.

According to Duquesnel, the oil of eucalyptus is adulterated—with alcohol, to be detected by means of fuchsin, which is insoluble in the pure oil but soluble in that containing even a very small percentage of alcohol; with fixed oil, to be detected by boiling with water, when the fixed oil remains on the surface; with volatile oil of copaiba or turpentine, to be detected by means of the boiling point, that of eucalyptol being 170° C. (338° F.), that of oil of turpentine 155° C. (311° F.), that of oil of copaiba 260° C. (500° F.). (J. P. C., 4e ser., xvi, 45.)

Uses.—Whatever medicinal virtue eucalyptus possesses beyond a slight astringency is due to its volatile oil. Preparations of the crude drug are rarely used in this country. The leaves are occasionally rolled into cigarettes to be smoked for the relief of *bronchitis* or *asthma*. For therapeutic properties of the oil of eucalyptus, see page 762.

Dose, of eucalyptus, ten to thirty grains (0.65-2 Gm.); of the oil, five to ten minims (0.3-0.0 mil).

Off. Prep.—Fluidextractum Eucalypti, U. S.

Eucalyptus Manna. *Australian Manna.*—This substance exudes during the summer months from punctures made in the bark and leaves of the Australian tree *Eucalyptus viminalis* Labill. (fam. *Myrtaceae*). It occurs in small round opaque masses, and is said medicinally to resemble ordinary manna. It contains melitrose. A

similar manna is also formed on *Eucalyptus Gunnii* Hook. The "blue-grass manna" of Australia occurs on the stems of *Andropogon annulatus* Forsk. (fam. Gramineae). The latter contains 75 per cent. of mannite.

Eugenia Cheken Hook. et Arn. (*Myrtus Gheken*, Spreng.) *Cheken*. *Chequen*. *Arrayan*. (Fam. *Myrtaceae*).—The leaves of this Chilian plant have entered commerce under the name of *Chekan leaves*. Weiss (*A. Pharm.*, 1888, p. 226) has found in them: (1) *chekenon*, $C_{40}H_{44}O_8$, a crystalline body; (2) *chekenin*, $C_{12}H_{11}O_3$, in yellowish rhombic tables; (3) *chekenetin*, $C_{11}H_7O_6 + H_2O$, in olive-colored crystals; (4) *cheken-bitter*, an amorphous, very soluble bitter substance. (See *P. J.*, 1889, 782, and Wein, *A. Pharm.*, 1888, 665.) The leaves are used in their native country as a remedy in chronic respiratory catarrh, and have been strongly recommended by Murrell and others in chronic bronchitis. Their virtues appear to reside in the tannin, and especially in the volatile oil that they contain. The dose of the fluidextract is from one to three fluidrachms (3.9-11.6 mils).

Eugenia Jambolana Lain. (*Syzygium Jambolana* Lam.) *Jambul*. *Jambol*. *Rose Apple*. *Java Plum*.—Tins is a large tree belonging to the *Myrtaceae*, growing in East India and also in Queensland; well known on account of its popular edible fruit. The bark and seeds are employed in medicine. Jambul bark is a dense, hard bark, about 1.5 cm. in thickness, of a pinkish-brown or reddish-brown color, with a whitish-gray mottled cork or thick bark, the inner surface is of a somewhat silky luster, frequently coarsely marked by waving lines or ridges; the fresh fracture varies from pinkish or purplish to fawn color, sometimes distinctly but shortly fibrous, more commonly absolutely abrupt. The taste is somewhat bitter, astringent, after a time distinctly pungent. The bark contains a resin, tannin, and gallic acid. *Jambul seeds* are grayish-black or blackish-gray, being abruptly truncated at the base, above rounded or dome-shaped. They are from 1 to 2.5 cm. long, and 8 to 12 mm. broad; so hard and dense that they cannot be chewed, and are almost tasteless. The analysis of the seeds by Thomas Christy yields the following results. Essential oil, a trace; chlorophyll and fat, 0.37; resin soluble in alcohol and ether, 0.30; gallic acid, 1.65; albumen, 1.25; colored extractive soluble in water, 2.70; moisture, 10.00; insoluble resin, 83.73. Power and Callan (*P. J.*, 1913, 245) found in these seeds a phenolic substance, *jambulol*, $C_{16}H_3O_4(OH)_5$, which is identical with *ellagic acid*.

In the experiments made by Thomas Christy of London (*P. J.*, 1888), it was found that when sufficient of diastasic matter was mixed with fifty grains of starch to convert 45 per cent. of the latter in fifty minutes into sugar, the addition of twenty-five grains of powdered jambul seeds reduced the conversion of the starch to 12' per cent. We have no knowledge of the effect of jambul or its active properties upon the general organization, but Binz (*Verhandl. der Kongr. fur Innere Med.*, Wiesbaden, 1886) found that when dogs were made diabetic by the administration of phlorizin, according to the method of von Mering, the exhibition of jambul reduced the excretion of sugar from 50 to 90 per cent. without the production of any evidences of poisoning by the jambul. In India, jambul has long been used as a stomachic astringent and carminative in diarrhea, and also in the treatment of diabetes. The first therapeutic trials in Europe appear to have been made by Clacius, who found that the drug

notably reduced the excretion of sugar in diabetic patients. The practice has been largely followed, and there would seem to be no doubt that in occasional cases of glycosuria jambul does good. No cases of poisoning or of disagreeable results from it have been reported.

Nevertheless jambul has failed to establish itself as a practical medicament. It may be that this has been due to the use of too small doses. The dose of the fluidextract usually recommended is ten minims (0.6 mil) ; but according to von Noorden (*Deutsche Praxis*, 1901) half a fluidounce (15 mils) of the fluidextract should be taken in eight fluidounces (240 mils) of hot water, one hour before breakfast and late in the evening.

Jamrosin is a proprietary preparation asserted to be the fluidextract of jambul. It is alleged to possess marked remedial qualities in the treatment of diabetes.

EUONYMI CORTEX. Br.

EUONYMUS BARK

"The dried root bark of *Euonymus atropurpureus*, 'Jacq.' 'Br. " The dried bark of the root of *Euonymus atropurpureus* Jacquin (Fam. *Celastraceae*), without the presence of more than 3 per cent. of wood or other foreign matter." *N.F.*

Euonymus *N. F. IV, Wahoo; Cortex Euonymi; American Indian Arrow-wood; Ecorce d'Evonymus, Fr. Cod.; Spindlebaum, Pfaffenhutchen, Spillbaumrinde, G.*

Euonymus (*Evonymus*) *atropurpureus*, named variously *wahoo*, *spindle-tree*, and *burning-bush*, is a tall, erect shrub, with quadrangular branchlets, and opposite, petiolate, oval-oblong, pointed, serrate leaves. The flowers, which stand in loose cymes on axillary peduncles, are small and dark purple, with sepals and petals commonly in fours. The capsule or pod is smooth and deeply lobed. The plant is indigenous, growing throughout the Northern and Western States, and sometimes cultivated for the beauty of its crimson fruit.

The plants belonging to this genus are shrubs or small trees, presenting in the autumn a striking appearance from the rich red color of their fruit, which has obtained for them the name of *burning-bush*. *E. americanus* L. and *E. europaeus* L. have been cultivated in gardens as ornamental plants. Two or more of the species have been used in medicine. Their properties are probably similar, if not identical. Grundner, who experimented with the fruit of *E. europaeus*, found it to have no other effect than that of a diuretic. (*Ph. Cb.*, 1847, p. 873.) An

oil expressed from the seeds is used in Europe for the destruction of vermin in the hair, and sometimes also as an application to old sores. (*Ibid.*, 1851, p. 641.) Griffith says that the seeds of this and other species are purgative and emetic, and that the leaves are poisonous to sheep and other animals feeding on them. He states also that the inner bark of *E. tingens* Wall. is beautifully yellow, and used in India for dyeing, and in diseases of the eye. (*Med. Bot.*, p. 220.) It is probable that much of the wahoo of our drug stores has been obtained from *E. americanus*, which is distinguished from *E. atropurpureus* by its rough, warty, depressed pods, and almost sessile, thickish leaves.

Properties.—The dried bark is described in the National Formulary as follows: "Usually in transversely curved pieces, occasionally in single quills from 2 to 7 cm. in length; bark from 1 to 2.5 mm. in thickness; very light in weight; outer surface grayish or light brown, somewhat "wrinkled, occasionally transversely fissured from the lenticels and with scale-patches of soft cork; inner surface grayish-white, longitudinally striate and somewhat porous; fracture short with silky, projecting elastic fibers. Odor distinct-taste bitter and acrid. The powder is light brown, and when examined under the microscope shows numerous starch grains, nearly spherical, from 0.003 to 0.012 mm. in diameter; fragments of cork with nearly colorless, thin walls; secretion cells with yellowish or brownish amorphous contents; bast fibers very long, with thin, non-lignified walls possessing numerous small, more or less oblique pores; numerous fragments of starch-bearing parenchyma; calcium oxalate in rosette aggregates from 0.015 to 0.035 mm. in diameter, the amount in different specimens showing some variation. Euonymus yields not more than 12 per cent. of ash." *N F.*

"In quilled or curved pieces, from two to four millimetres thick. Outer layer a soft, friable, greyish cork, marked with dark patches. Inner surface pale tawny-white and smooth. Fracture short, the fractured surface yellowish in color. Transverse section free from sclerenchymatous cells and fibres, and exhibiting, in the secondary bast, laticiferous cells filled with a granular, elastic substance. Faint but characteristic odor; taste somewhat mucilaginous, afterwards bitter and slightly acrid." *Br.*

The drug frequently has as much as 25 per cent. of adhering wood. The amount of the latter with other foreign matter should not exceed 3 per cent. Holm (*Merck's Rep.*, 1909, p. 169) illustrates the structural

characteristics of *E. atropurpureus* and *E. americanus*. Holmes (*P. J.*, 1905) describes the bark of *Alstonia scholaris* which has been used as an adulterant of Euonymus. The name of Wahoo or Waahoo (pronounced *Wawhoo*) was given to it by the Indians. The same name has also been applied to *Ulmus alata*, of the Southern States, and has thus led to mistakes.

It imparts its virtues to water and alcohol. Analyzed by Wm. T. Wenzell, it was found to contain a bitter principle which he named euonymin, asparagin, a soft resin, a crystallizable resin, a yellow resin, a brown resin, fixed oil, wax, starch, albumen glucose pectin, and various salts of organic and inorganic acids. Euonymin was obtained by agitating with chloroform a tincture made with diluted alcohol, separating the chloroformic solution and allowing it to evaporate spontaneously, treating the residue with ether, dissolving what was left in alcohol, adding lead acetate to the solution, filtering, precipitating the lead with hydrogen sulphide, and evaporating". The euonymin obtained was uncrystallizable, intensely bitter, soluble in water and alcohol, and neutral in its reactions. It was abundantly precipitated from its solution by lead subacetate and phosphomolybdic acid. For an examination of commercial *euonymin* (the eclectic resinoid) by Paul Thibault, see *N. R.*, 1883, 294. W. P. Clothier found the bark to yield no volatile oil on distillation. According to the same writer, if a concentrated tincture be poured into water, a dark yellow substance will be thrown down, containing resin and fixed oil, which is the euonymin of the eclectics, very improperly so named, as, though it contains a portion of the active principle, it is a very complex substance. Clothier found the bark to purge actively without griping. (*Ibid.*, 1861, p. 491.) Frank V. Cassaday (*A. J. P.*, 1889, p. 284) found 1.30 per cent. of volatile oil and resin, 1.48 per cent. of *euonic acid* and resin, 2.10 per cent. of euonymin and resin, together with the usual plant constituents. Kubel has discovered in the fresh inner bark of *E. europaeus* a saccharine, orystallizable substance, closely resembling mannite, but differing in its crystalline form and in its melting point. He calls it *euonymite*. (*J. P. C.*, Dec., 1862, 523.)

H. Rogerson (*Ph. J.*, 1912, p. 687) has made a complete chemical examination of this bark with the result that the following definite constituents are reported present: *dulcitol*; *furan B carboxylic acid*, $C_5H_4O_3$; *euonymol*, $C_{21}H_{30}O_4$ (a new crystalline alcohol, having a melting point of $248^{\circ} C.$ [$478.4^{\circ} F.$]); a sugar which yielded *d-phenyl glucozazone*; *euonosteryl*, $C_{31}H_{51}O.OH$; *homoeuonosteryl*, $C_{40}H_{69}O.OH$;

atropurol, $C_{27}H_{44}(OH)_2$; *citrullol*, $C_{22}H_{36}O_2(OH)_2$; and a mixture of palmitic, cerotic, oleic and linoleic acids. No glucoside was found nor could any product corresponding to the euonymin of Wenzell or of Schmiedeberg be found.

Uses.—This bark was first introduced into notice, as a remedy for *dropsy*, under the name of Wahoo, by George W. Carpenter. It exerts a digitalis-like action on the heart, but because of the irregularity of its absorption should not be employed as a systemic remedy. By virtue of its local irritant effects on the intestines it usually exerts a laxative effect but is not to be recommended because of its liability to nauseate and the possibility of circulatory effects. It was formerly used as a diaphoretic in *muscular rheumatism*, *influenza*, *acute coryza*, and similar conditions but it does not appear to have any advantage for this purpose over the other nauseating drugs and has been largely abandoned. The fluidextract may be given in doses of eight minims (0.5 mil).

Dose, of euonymus, five to fifteen grains (0.32-1.0 Gm.).

Caution.—It has been stated that the absorption of Euonymus in the gastro-intestinal tract is uncertain and irregular. To avoid an accumulation of the drug or toxic action, the physician should carefully guard the dosage and determine in each case the tolerance of the patient." *N. F.*

Off. Prep.—Extraction Euonymi, *Br.*, *N. F.*; Fluidextractum Euonymi, *N. F.*

Eupatorium. *N. F. IV (U. S. P. VIII).* *Boneset. Thorough-wort. Herba Eupatorii Perfoliati. Indian Sage. Thorough-stem. Cross-wort. Thorough-wax. Sweating Plant. Herbe d'Eupatoire perfoliee, Berbe a fièvre, Herbe parfaite, Fr. Durchwachsener Wasserhanf or Wasserdost, G.*—"The dried leaves and flowering tops of *Eupatorium perfoliatum* Linne (Fam. *Compositae*)." *N. F.* This is an indigenous perennial plant, with numerous herbaceous stems, which are erect, round, hairy, from two to five feet high, simple below, and trichotomously branched near the summit. The leaves serve to distinguish the species at the first glance. They may be considered either as perforated by the stem, perfoliate, or as consisting each of two leaves, joined at the base, connate. In the latter point of view, they are opposite and in pairs, which decussate each other at regular distances upon the stem; in other words, the direction of each pair is at right angles with that of the pair immediately above or beneath it. They are narrow in proportion to their length, broadest at the base where they coalesce, gradually tapering to a point, serrate, much wrinkled, paler on the under than on the upper surface, and beset with whitish hairs, which give them a grayish-

green color. The uppermost pairs are sessile, not joined at the base. The flowers are white, numerous, supported on hairy peduncles, in dense corymbs, forming a flattened summit. The involucre, which is cylindrical and composed of imbricated, lanceolate, hairy scales, encloses from twelve to fifteen tubular florets, having their border divided into five spreading segments. The anthers are five, black, and united into a tube, through which the bifid filiform style projects.

This species of *Eupatorium* inhabits meadows, the banks of streams, and other moist places, growing generally in bunches, and abounding in almost all parts of the United States. It flowers from the middle of summer to the end of October. All parts of it are active, but the herb only is official. It has a faint odor, and a strongly bitter, somewhat peculiar taste. It is described as "usually more or less broken; leaves opposite, the pair united at the base, from 8 to 20 cm. in length and from 1.5 to 5 cm. in breadth, tapering regularly from near the base to an acute summit, crenate-serrate, rugosely veined, rough and bright green above, yellowish-gray-green, tomentose and resinous-dotted beneath; flower-heads small, numerous, corymbed, with a campanulate involucre of lance-linear, imbricated scales and with from ten to fifteen tubular, yellowish-white florets having a bristly pappus in a single row. Odor faintly aromatic; taste strongly bitter. *Eupatorium* yields not more than 10 per cent. of ash." N. F. The virtues of the plant are readily imparted to water and alcohol. W. Peterson found it to contain a peculiar bitter principle, chlorophyll, resin, a crystalline matter of undetermined character, gum, tannin, yellow coloring matter, extractive, lignin, and salts. (*A. J. P.*, xxiii, 210.) George Latin (*A. J. P.*, Aug., 1880) found a glucoside, eupatorin, and a crystallizable body of the nature of wax. O. F. Dana, Jr., obtained 3.80 per cent. of extract with petroleum benzin; 4.60 per cent. with ether; 33.80 per cent. with alcohol; 24.80 per cent. with water; 5.80 per cent. with alkali. (*A. J. P.*, 1887, p. 229.) Shamel (*Am. Chem. J.*, 1892, p. 224) published an analysis of the nitrate of the crystalline principle giving the formula $C_{20}H_{25}O_{36}HNO_3$.

Eupatorium is, in large doses, emetic and aperient. Because of its nauseating action, the warm infusion tends to increase perspiration and has been used to abort attacks of *muscular rheumatism* or *general cold*. H. S. Wilkins has found the infusion useful in the expulsion of *tapeworm*. (*A. J. P.*, 1874, p. 295.)

As an emetic and cathartic, a strong decoction, prepared by boiling an ounce with three half-pints of water to a pint, may be given in doses of from four fluidounces to a half-pint (120 to 240 mils), or more. (See *Fluidextractum Eupatorii*, N. F., Part III.)

Dose, twenty to thirty grains (1.3 to 2.0 Gm.).

Eupatorium purpureum L., *Joe-Pye Weed*, *Trumpet Weed*, or *Gravel Root*, is a perennial herbaceous plant, with a purple stem, five or six feet in height, and furnished with ovate-lanceolate, serrate, rugosely veined, slightly scabrous, petiolate leaves, placed four or five together in the form of whorls. The flowers are purple, and consist of numerous florets contained in an eight-leaved involucre. It grows in swamps and other low grounds, from Canada to Florida, and flowers in August and September. The root has, according to Bigelow, a bitter aromatic and astringent

taste, and is said to be diuretic. Its vulgar name, 'boneset, indicates the popular estimation of its virtues. J. U. Lloyd found in it an apparently new, yellow, neutral, crystalline principle, *euparin*. (A. J. P., 1890.) This euparin, with a number of derivatives, has been prepared by C. C. Mauger (A. J. P., 1894, 120) and analyzed. The formula $C_{12}H_{11}O_3$ is assigned to it.

Eupatorium verbenaefolium Michx., commonly called *wild horehound*, is also an indigenous perennial, with an herbaceous stem, which is about two feet high, and supports sessile, distinct, ovate, acute, scabrous leaves, of which the lower are coarsely serrate at the base, the uppermost entire. The flower-heads are small, white, composed of five florets within each involucre, and arranged in the form of a corymb. The plant grows in low wet places from New England to Georgia, and abounds in the Southern States. It is in flower from August to November. The whole herb is used. In sensible properties it corresponds with *E. perfoliatum*, though less bitter and disagreeable, and has been used for similar purposes and in like manner. *E. incarnatum* and *E. aromaticum* are said to contain an aromatic principle similar to, if not identical with, coumarin, obtained by Guibourt from *Dipteryx odorata*, or Tonka bean. (See P. J., Oct., 1874, 303.) The roots of *E. aromaticum* are said to be sold in the Western United States under the name of *white snake-root*. *E. cannabinum* of Europe, the root of which was formerly used as a purgative, and *E. triplinerve* Vahl (*E. Aya-pana* Vent.), of Brazil, the leaves of which at one time enjoyed a very high reputation, have fallen into neglect. The *Aya-pana* is an aromatic bitter, like *E. perfoliatum*, but weaker, and is said to be still occasionally met with in European commerce. (A. J. P., 1887, 154; *Ph. Era*, 1898, 293.) *E. villosum* is used in Jamaica, under the name of *bitter-bush*, in the preparation of beer, as a tonic, and as a stimulant in low zymotic diseases. (P. J., Oct., 1866; A. J. P., 1887, 155.) *E. collinum* is included in the Mexican Pharmacopoeia.

Euphorbia. *Wild Ipecac. Wild Hippo. Euphorbe*, Fr. *Wolfsmilch*, G.—The genus *Euphorbia* (Fam. *Euphorbiaceae*) contains numerous species, having the common property of yielding a milky juice. They are herbaceous or shrubby, with or without leaves, and the leafless species, which are chiefly confined to the African deserts, have fleshy, naked, or spiny stems, like those of the cactus. They nearly all afford products which act powerfully as emetics and cathartics, and in overdoses occasion dangerous if not fatal prostration, with symptoms of inflammation of the gastrointestinal mucous membrane. Their milky juice, which concretes on exposure, usually possesses these properties in a high degree, and, in addition, that of powerfully irritating the skin when applied to it. The U. S. Pharmacopoeia formerly recognized the indigenous species *E. corollata* L. and *E. Ipecacuanhae* L. In a full dose the root of *E. corollata* L. acts as an emetic and cathartic and in smaller doses is a nauseating diaphoretic and expectorant. It is, however, too harsh and uncertain in its action for practical use, and has passed entirely out of vogue. The dose of the dried root as an emetic is from ten to twenty grains (0.65-1.3 Gm.), as a cathartic from three to ten grains (0.2-0.65 Gm.). The recent root, bruised and applied to the skin, produces vesication. C. Petzolt (A. J. P., 1873) found in the root of *E. Ipecacuanhae* fixed oil, resin, starch, glucose, and various salts. The resinous matter was a dark mass, of a taste slight at first but after a time nauseous and pungent, readily dissolved by

alcohol, but insoluble in ether and petroleum benzin, and, when swallowed, producing in half grain (0.032 Gm.) doses watery stools, and in one and a half or two grain (0.096 or 0.13 Gm.) doses nausea and vomiting. It gave no evidence of the presence of an alkaloid. The medicinal properties of *E. Ipecacuanha* resemble those of *E. corollata*, though the former is said to be somewhat milder. The indigenous *E. Preslii* Guss. (*E. hypericifolia* A. Gray) and *E. maculata* L. are said by Zollickoffer to be a valuable remedy in *dysentery*, *diarrhea*, *menorrhagia*, and *leucorrhoea*. (See 16th ed., *U. S. D.*, also *A. J. M. S.*, xi.) B. J. D. Irwin, *U. S. A.*, states that, under the name of *gollindrinera*, the native Mexican uses the *Euphorbia prostrata* Ait. in New Mexico and Arizona as a remedy for snakes bites. (*Am. J. M. S.*, 1861.). In Chili the juice of *Euphorbia portulacoides* L. (*E. chilensis* C. Gay) is said to be used as a drastic purgative. (*A. J. P.*, 1866, 102.) The juice of *Euphorbia Drummondii* Boiss. is said in Australia to kill annually a great many sheep and cattle, and in 1886 John Reid (*Australasian Med. Gaz.*; No. 61) announced the discovery in it of a new anesthetic alkaloid, *drummine*, which he obtained in colorless crystals almost insoluble in ether, but freely soluble in chloroform and in water. The report of Alexander Ogsden (*B. M. J.*, Feb., 1887) throws, however, very grave doubts upon the anesthetic power of this new alkaloid. The *E. ocellata* Durand and Hilgard of the Pacific coast is used as an antidote for snake bites, and is said to contain 2.82 per cent. of resin, besides gallo-tannic acid, while *Euphorbia eremocarpus* Auct. of the same region is employed for the purpose of poisoning fish in still pools and streams, and is said to contain a volatile oil, besides acid and resins. (See *Proc. California Coll. Pharm.*, 1885.) The oil of *E. Lathyris* L. is stated to physiologically resemble croton oil. (*Proc. A. Ph. A.*, xxvi, 305.)

The *E. heterodoxa* Muell. Arg., *aveloz* or *aveloz*, a Brazilian species, has been used with asserted extraordinary advantage against cancerous and syphilitic ulcers. It is a powerful irritant, and even mild caustic. The milky juice, preserved with salicylic acid, or a resin obtained by precipitating with water is employed. The ointment of the resin may be made 3 parts in 100 with vaseline. For further information concerning various euphorbia species which have been used in medicine, see *U. S. D.*, 19th ed., p. 1484.

***Euphorbia pilulifera*.** *N. F. IV. Pill Bearing Spurge.*—"The dried herb of *Euphorbia pilulifera* Linne (Fam. *Euphorbiaceae*), collected while flowering and fruiting." *N. F.* This plant is a prostrate or ascending branched annual, found in almost all tropical countries; it is furnished with leaves which are opposite, shortly stalked, ovate to ovate-lanceolate or oblong, from 8 to 35 mm. long, denticulate, very oblique and narrow below, or with a semicordate base. Stipules minute and linear. The flower-heads are small, numerous, crowded in head-like cymes, globular, and are borne on a short stalk in one axil, only, of each pair of opposite leaves. The involucre is small, entire, and without petal-like appendages. According to De Candolle, the seeds are reddish, acutely oblong, four-sided, and transversely wrinkled, the ridges uniting irregularly. It is to be distinguished from *E. parviflora* (L.), which is sometimes substituted for it, by the flower-head of the latter having but few flowers, by the glands of the involucre being furnished with a white, obovate-orbicular appendage, and by the seeds being minutely papillose. The *N. F.* describes the drug as follows: "Roots usually present, small, branched, and reddish; sterna slender, cylindrical,

obliquely erect, dichotomously branched from near the base, branches recurved at apices; branches and stem only sparsely leafed at base, pale greenish-brown, rough or hairy; stems coarsely pilose with yellow hairs which are rather dense on the upper parts but sparse on the lower; pubescence consisting of short, nearly straight, unicellular hairs, becoming almost hispid at the flowering tops; leaves opposite, obliquely oblong, acute, serrulate, rusty pale green, pubescent, especially on the prominent veins on the lower surface, becoming brittle on drying and usually much broken in the drug; flowers small, numerous, in short peduncled axillary clusters; fruits about 1 mm. in diameter, three-celled capsules; seeds about 0.9 mm. in diameter, triangular ovoid, pale brown. Odor aromatic and characteristic; taste faintly bitter, aromatic and acrid. *Euphorbia Pilulifera* yields not more than 12 per cent. of ash." *N. F.* Levison found in it (*A. J. P.*, 1885, 147) several glucoside resins, wax, and volatile matter. Dr. F. B. Power (*C. D.*, 1913, 544) examined *E. pilulifera* from the Fiji Islands and found a monohydric alcohol, *euphosterol*, among other constituents, none of which seem to possess value therapeutically.

A physiological study of *Euphorbia pilulifera* led A. Marsset (*T. G.*, 1885) to the conclusion that the active principle acts directly upon the heart and respiration; that it is not an irritant to the skin, but in large dose it is to the gastric mucous membrane. It has been used by Dujardin-Beaumetz and a number of other clinicians with asserted excellent results in the treatment of *asthma* and *bronchitis*. The best preparation is the fluidextract (see *Fluidextractum Euphorbia, Piluliferae. N. F. IV*), the dose of which is from a half to one fluidrachm (1.8-3.75 mils) three or four times a day.

Euphrasia. *E. officinalis* L. *Eyebright. Eye-wort. Euphrase, Fr. Augentrost, Gr.* (Fam. *Scrophulariaceae.*)—A small annual plant, native of Europe, without odor, and of a bitterish, astringent taste. Enz (*Viertelj. f. Prakt. Pharm.*, viii, 175) obtained a little volatile oil, an acrid and bitter principle, mannite and glucose, and a tannic acid. The name "eyewort" so frequently ascribed to this drug, is derived from the practice of using it in eye affections in older medicine. It is used on the continent to-day as an astringent tonic in the treatment of *jaundice*. G. M. Garland (*A. J. P.*, 1890) states that ten minims (0.6 mil) of a concentrated tincture every two hours is a specific in acute *nasal catarrh*.

Evodia.—Several species of this rutaceous genus are stated, to have medicinal properties. *Evodia, febrifuga* St. Hil (*Esenbechia febrifuga* A. Juss.) of Brazil is astringent and tonic, *E. meliaefolia* Benth. of Japan contains berberine, while *E. longifolia* A. Rich. of the Fiji Islands is used to prevent abortion.

EXTRACTA

EXTRACTS

Extraits, *Fr.*: Ertrakte, *G.*; Eatratti, *It.*; Extractos, *Sp.*

Extracts, as the term is employed in the Pharmacopoeias, are solid preparations, resulting from the evaporation of the solutions of vegetable principles, obtained either by exposing a dried drug to the action of a solvent, or by expressing the juice from a fresh plant. A distinction was formerly made between those prepared from the infusions, decoctions, or tinctures, and those from the expressed juices of plants, the former being called *Extracta*, the latter *Succi Spissati*, but the distinction has been generally abandoned. There is no such essential difference between these two sets of preparations as to require that they should be separately classed, and something is gained in the simplicity of nomenclature, as well as of arrangement, which results from their union.

The composition of extracts varies with the nature of the vegetable, the character of the solvent, and the mode of preparation. The object is generally to obtain as much of the active principle of the plant with as little of the inert matter as possible, though sometimes it may be desirable to separate two active ingredients from each other when their effects upon the system are materially different; this may be accomplished by employing a menstruum which, while it dissolves one, leaves the other untouched. The proximate principles most commonly present in extracts are gum, sugar, starch, tannin, extractive, coloring matter, salts, and the peculiar principles of plants, to which, when an alcoholic solvent is employed, may usually be added resinous substances, fatty matter, and frequently more or less essential oil, gum and starch being excluded when the menstruum is pure alcohol. Of these substances, as well as of others which, being soluble, are sometimes necessarily present in extracts, we have taken occasion to treat under various heads in this commentary. There is one, however, which from its supposed almost uniform presence in this class of preparations, and from the influence it is thought to exert upon their character, deserves particular consideration in this place. We allude to *extractive*, or, as it is sometimes called, *extractive matter*.

It has long been observed that in most vegetables there is a substance, soluble both in water and alcohol, which, in the preparation of extracts, undergoes chemical change during the process of evaporation, imparting to the liquid even if originally limpid, first a greenish, then a yellowish-brown, and ultimately a deep brown color, and becoming itself insoluble. This substance, originally called *saponaceous matter* by Scheele, afterwards received the more expressive name of *extractive*,

derived from its frequent presence in extracts. Its existence as a distinct principle is denied, or at least doubted, by some chemists, who consider the phenomena supposed to result from its presence as depending upon the mutual reaction of other principles. The most important property of extractive is its disposition to pass, by the influence of atmospheric air at a high temperature, into an insoluble substance. If a vegetable infusion or decoction be evaporated in the open air to the consistence of an extract, then diluted, filtered, and again evaporated, and the process repeated so long as any insoluble matter is formed, the whole of the extractive will be separated from the liquid, while the other ingredients may remain. The name of oxidized extractive which has been given to it is incorrect, and Berzelius proposed to substitute for it that of *apothem*,

synonymous with deposit. According to Berzelius, apothem is not completely insoluble in water, but imparts a slight color to that liquid when cold, and is rather more soluble in boiling water, which becomes turbid upon cooling. It is still more soluble in alcohol, and is freely dissolved by solutions of the alkalies and alkaline carbonates, from which it is precipitated by acids. It has a great tendency, when precipitated from solutions, to unite with other principles, and to carry them along with it, thus acquiring properties somewhat different according to the source from which it is obtained. In this way also, even when the extractive of a plant is itself medicinally inert, its conversion into apothem may be injurious by causing a precipitation of a portion of the active principle, and in practical pharmaceutical operations this change should always, if possible, be avoided. We shall treat of the subject under the several heads of (1) the extraction of the soluble principles from the plant; (2) the method of conducting the evaporation; (3) the proper condition of extracts, the changes they are liable to undergo, and the best method of preserving them.

1. Extraction of the Soluble Principles.

There are two distinct modes of obtaining, in a liquid state, the principles which we wish to extract: (1) by expression alone; (2) by the agency of a solvent, with or without expression.

1. By Expression.—This method is applicable to recent vegetable substances. All plants cannot be usefully treated in this way, as many have too little juice to afford an appreciable quantity upon pressure, and of the succulent a considerable portion do not yield all their active

principles with their juice. Succulent fruits, and various acrid and narcotic plants, are proper subjects for this treatment. The plants should be operated upon, if possible, immediately after collection. Battley, of London, recommended that, if not entirely fresh, they should be revived by the immersion of the stalks in water for twelve or eighteen hours, and those only used which recover their freshness by this management. They should then be cut into pieces, and bruised in a stone mortar till brought to a pulpy consistence. When the plant is not very succulent, it is necessary to add a little water during this part of the process, in order to dilute the juice. After sufficient contusion, the pulp is introduced into a linen or canvas bag, and the liquid parts expressed. Brande states that light pressure only should be employed, as the extract is thus procured greener, of a less glutinous or viscid consistence, and, in his opinion, more active than when considerable force is used in the expression. (See *Remington's Practice of Pharmacy*.) The juice thus obtained is opaque, and usually green, in consequence of the presence of green wax or chlorophyll, and of a portion of the undissolved vegetable fiber in minute division. By heating the juice to about 71.1° C. (160° F.) the albumen contained in it coagulates, and, involving the chlorophyll and vegetable fiber, forms a greenish precipitate. If the liquid be now filtered, it becomes limpid and nearly colorless, and is prepared for evaporation. The clarification, however, is not absolutely necessary, and is generally neglected. Sometimes the precipitate carries with it a considerable portion of the active principle, in which case it should be subsequently incorporated with the juice, when reduced by evaporation to the consistence of syrup. Ether added to the expressed juices of plants enables them to be kept long without injurious change. Lepage, of Gisors, France, has kept the juice of belladonna in this way more than ten years, and found it, at the end of that time, to yield an extract identical in physical, chemical, and physiological properties with that obtained from the fresh juice. If this fact is found to be of general applicability, it will be of considerable importance, as enabling the pharmacist to supply himself at pleasure with extracts to be relied on, without reference to the season.

2. By Solution.—The active principles of dried vegetable substances can be extracted only by means of a liquid solvent. The menstruum usually employed is either water or alcohol, or a mixture of the two. Water, on account of its cheapness, is always preferred, when circumstances do not strongly call for the use of alcohol. It has the advantage, moreover, that it may be assisted in its action if necessary

by a higher degree of heat than the latter. Tap water is often unfit for the purpose, in consequence of the quantity of its saline matter, which in some instances may exert an unfavorable influence on the active principle, and must always be left in the extract. Rain, or distilled water should be preferred. Alcohol is employed when the principles to be extracted are insoluble or but slightly soluble in water, as in the case of the resins; when it is desirable to avoid in the extract inert substances, such as gum and starch, which are dissolved by water and not by alcohol; when the heat required to evaporate the aqueous solution would dissipate or decompose the active ingredients of the plant, as the volatile oils; when the reaction of the water itself upon the vegetable principles is injurious; and, finally, when the nature of the substance to be exhausted requires so long a maceration in water as to endanger spontaneous decomposition. The aqueous solution requires to be quickly evaporated, as this fluid rather promotes than counteracts chemical changes, while an alcoholic tincture may be preserved unaltered for an indefinite period. An addition of alcohol to water is sufficient to answer some of the purposes for which the former is preferable, and the employment of both fluids is essential, when the virtues of the plant reside in two or more principles, all of which are not soluble in either of these menstrua. In this case it is usually better to submit the vegetable to the action of the two fluids successively than of both united.

Extracts obtained by the agency of water are called *aqueous extracts*; those by means of alcohol, undiluted or diluted, *alcoholic* or *spirituous extracts*. Sometimes the term *hydro-alcoholic* is applied to extracts obtained by the joint agency of alcohol and water.

Chloroform is frequently used to saturate the water used in making aqueous extracts to prevent fermentation during percolation.

The method of preparing the solution is not a matter of indifference. The drug should be thoroughly bruised, or reduced to a coarse powder, so as to allow the access of the solvent to all its parts, and yet not so finely pulverized as to prevent a ready precipitation of the undissolved or inactive portion. When water is alone employed, it has been customary to boil the medicine for a considerable time, and, if the first portion of liquid does not completely exhaust it, to repeat the operation with successive portions until the whole of the active matter is extracted. This may be known by the sensible properties of the liquid, and by its influence upon reagents. But the boiling temperature produces the

decomposition of many vegetable principles, or at least so modifies them as to render them inert, and the extracts prepared by decoction are usually less efficient than those made with a less degree of heat. From numerous experiments upon extracts, Orfila concluded that their virtues were less in proportion to the heat employed. It has, therefore, been recommended to substitute for decoction the process of maceration, digestion, or hot infusion, in the first of which the liquid acts without heat, in the second is assisted by a moderately increased temperature sustained for a considerable time, and in the third is poured boiling hot upon the vegetable matter and allowed to stand for a short period in a covered vessel. When the active principles are readily soluble in cold water, maceration is often preferable to the other modes, as starch, which is inert, is thus left behind; but in many instances the preparation would spoil before the extraction would be completed. By digestion, though the solvent power of water is moderately increased, the advantage is often more than counterbalanced by the increased disposition to spontaneous decomposition. Hot infusion, therefore, is to be preferred where the vegetable substance does not readily yield its virtues to cold water. It has the advantage, moreover, in the case of albuminous substances, that the albumen is coagulated, and thus prevented from increasing the bulk of the extract, without adding to its virtues. A convenient mode of performing this process is to introduce the solid material into a vessel with an opening near the bottom temporarily closed, or into a funnel having a notched cork in its mouth, then to pour on the boiling water, and, having allowed it to remain a sufficient length of time, to draw it off through the opening. This operation may be repeated until the water comes away without any obvious impregnation.

It is always desirable to obtain the solution in the first place as concentrated as possible, so as to prevent the necessity of long continued evaporation, which injures the extract. It is better, therefore, to incur the risk, both when decoction and infusion are employed, of leaving a portion of the active matter behind, than to obtain a very weak solution. When successive portions of water are employed, those which are least impregnated should be brought by evaporation to the strength of that first obtained before being mixed with it.

Sometimes filtering a turbid infusion or decoction, before evaporation, causes the resulting extract to keep better by removing substances which, beside undergoing decomposition, may act as a ferment, and

occasion the decomposition of the active matter of the extract.

When alcohol is employed as a menstruum, the vegetable substance should be macerated in it for one or two weeks, and care should be taken that the tincture be as nearly saturated as possible. The extraction may be hastened by substituting digestion for maceration, as the moderate heat employed, while it facilitates the action of the alcohol, has in this case no effect in promoting decomposition, and the influence of the atmospheric air may be excluded by performing the process in close vessels.

Acetic acid has been introduced into use as a menstruum in the preparation of extracts. It is supposed to be a better solvent of the active principles of certain substances than either water or alcohol alone. According to Girolamo Ferrari, the acrid narcotics, such as aconite, hemlock, hyoscyamus, and stramonium, yield much stronger extracts with distilled vinegar than with water, and still stronger with alcohol to which strong acetic acid has been added. (*J. P. C.*, 3e ser., i, 239.) Experiments have shown that strong acetic acid (60 per cent.) is a powerful solvent for the active properties of various drugs, particularly those which contain volatile oils, and in many cases a 10 per cent. acetic acid is an excellent menstruum for making extracts; for these the name *acettract* has been proposed. (*Proc. A. Ph. A.*, 1897, 416.) E. R. Squibb has used acetic acid largely for extracts. (*West. Drug.*, 1897, 123.)

Ether also is now used to a considerable extent in the preparation of certain extracts. Having the property of dissolving volatile oil and resin, and of evaporating at a temperature insufficient to volatilize the oil, it is admirably adapted for the preparation of extracts from those substances the virtues of which reside in the two principles referred to. An ethereal tincture is first prepared by the process of percolation, and the ether is then allowed to escape by spontaneous evaporation, or distilled off at a very moderate heat. The oleo resinous extracts thus obtained are usually of a thick fluid or semi-fluid consistence. Several of them now rank among the official preparations, in the U. S. P., under *Oleoresinae*. Acetone is another solvent used much for the same purpose as ether.

The process of *percolation* has in this country been very advantageously applied to the preparation of extracts, both with water and spirituous menstua. It has the following great advantages:

(1) that it enables the soluble principles to be sufficiently extracted by cold water, thereby avoiding the injury resulting from heat in decoction and hot infusion

(2) that it effects the extraction much more quickly than can be done by maceration, thereby not only saving time, but also obviating the risk of spontaneous decomposition; and

(3) that it affords the opportunity of obtaining highly concentrated solutions, thus diminishing the injurious effects of the subsequent evaporation.

While thus advantageous, it is less liable in this particular case than in others to the objection of yielding imperfect results if not well performed, for, though an inexperienced or careless operator may incur loss by an incomplete exhaustion of the substance acted on, and the extract may be deficient in quantity, it may still be of the intended strength and quality, which is not the case with infusions or tinctures unskillfully prepared upon this plan. In the process of percolation the drug must first be reduced to the proper degree of fineness. The U. S. P. (8th Rev.) gives the following directions.

Fineness of Powder.—The fineness of powder is expressed, in the Pharmacopoeia, either by descriptive words (generally so in the case of brittle or easily pulverizable substances), or in terms expressing the number of meshes to a linear inch of the sieve through which the powder will pass. The corresponding values, in terms of metric measures of length, are added below in parentheses, but it has not been deemed advisable, in this revision, to substitute them in the text of the Pharmacopoeia for those at present in use. The diameter of the wire (gauge number) used in making sieve cloth has an important influence upon the size of the mesh, and it is necessary to specify in each case the thickness of the wire, and it was so specified in the U. S. P. VIII but the U. S. Bureau of Standards, owing to the different standards in use by manufacturers of wire gauze determined to standardize the diameter of the particles of the powders, and the U. S. P. IX provides the following statement: "The fineness of powders and granular substances is expressed, in the Pharmacopoeia, by numbers which originally represented only the meshes per inch of the sieve through which the powders would pass. Fineness, so used, has been redefined below in terms of the maximum diameter of the particles of the powder as

measured by the width of the opening of the meshes of the sieves from which they receive their designating numbers. A powder of a specified number must meet the requirements given below for that number of powder, but the larger proportion of it must not pass through a sieve of a lower degree of fineness.

Number of Powder.	Diameter of Particles
No. 100	{ Powder has a fineness, in diameter of } 0.14 millimeter. { particles, less than
No. 80 Very fine powder	{ Powder has a fineness, in diameter of } 0.17 millimeter. { particles, less than
No. 60 Fine powder	{ Powder has a fineness, in diameter of } 0.23 millimeter. { particles, less than
No. 50 Moderately fine powder	{ Powder has a fineness, in diameter of } 0.28 millimeter. { particles, less than
No. 40 Moderately coarse powder	{ Powder has a fineness, in diameter of } 0.38 millimeter. { particles, less than
No. 30	{ Powder has a fineness, in diameter of } 0.54 millimeter. { particles, less than
No. 20 Coarse powder	{ Powder has a fineness, in diameter of } 0.85 millimeter { particles, less than
No. 12 Very coarse powder	{ Powder has a fineness, in diameter of } 1.47 millimeters. { particles, less than
No. 6	{ Powder has a fineness, in diameter of } 3.00 millimeters. { particles, less than

The degree of fineness defined above shall be such as are determined by sieving tests made with sieves of the Standard Screen Scale recommended by the Bureau of Standards." U. S.

Percolation, as directed in the U. S. Pharmacopoeia IX ^consists in subjecting a comminuted substance or a mixture of substances, contained in a vessel called a percolator, to the Solvent action of successive portions of a liquid termed the menstruum in such a manner that the liquid, as it traverses the powder in its descent to the receiver, shall extract the soluble constituents, and pass from the percolator free from insoluble matter:

"When the process is successfully conducted, the first portion of the liquid, or percolate, passing through the percolator will be nearly saturated with the soluble constituents of the substance treated; and if the quantity of menstruum be sufficient for its exhaustion, the last portion of the percolate will be nearly free from color, odor, and taste, other than those of the menstruum itself.

"In preparations which direct the process of percolation, wherever the expression ('until the drug is exhausted' or a similar phrase occurs, it is to be understood that the term 'exhausted' means the point at which the valuable constituents have been as completely extracted 'as is possible or practical, and this must be determined by the judgment and experience of the operator.

"*Percolators.*—The following statement with regard to percolators and the process of percolation is given in order to illustrate a method of percolation. It is not intended as compulsory and it is permissible for manufacturers and others to modify the process to suit their needs. The percolator most suitable for the quantities contemplated by this Pharmacopoeia should be nearly cylindrical, or slightly conical, with a funnel-shaped termination at the smaller end. The neck of this funnel-end should be rather short, and should gradually and regularly become wider toward the orifice, so that a perforated cork, bearing a short glass tube, may be tightly wedged into it. The glass tube, which must not project above the inner surface of the cork, should extend from 3 to 4 cm. beyond the outer surface of the cork, and should be provided with a closely fitting rubber tube, at least one-fourth longer than the percolator itself, and ending in another short glass tube, whereby (when it is desired to interrupt the percolation) the rubber tube may be so suspended that its orifice shall be above the surface of the menstruum in the percolator, a rubber band holding the tube in position.

"The shape of a percolator should be adapted to the nature of the drug to be operated upon. For drugs which are apt to swell, particularly when a feebly alcoholic or an aqueous menstruum is employed, a *conical* percolator is preferable. A *cylindrical* or only slightly tapering percolator may be used for drugs which are not liable to swell, particularly if difficult to exhaust, also when the menstruum is strongly alcoholic, or when ether or some other volatile liquid is used for extraction. The size of the percolator selected should be in proportion to the quantity of drug

extracted. When properly packed in the percolator, the drug should not occupy more than two-thirds of its height. The percolator is best constructed of glass, but, unless otherwise directed, may be made of any suitable material not affected by the drug or menstruum. For hot percolation glass percolators are unsuited, as they are liable to fracture. Metallic percolators in such cases are required.

"The percolator is prepared for percolation by gently pressing a small tuft of purified cotton into the neck, and this may then be moistened by pouring a few drops of menstruum upon the cotton, to facilitate the passage of the first portion of percolate, which is often very dense.

"The Process.—The powdered substance to be percolated (which should be uniformly of the fineness directed in the formula, and should be perfectly air-dry before it is weighed) is put into a suitable dish, sufficient menstruum is poured on, and the powder thoroughly stirred until it is uniformly moistened. The moist powder is then passed through a coarse sieve—No. 40 powders, and those which are finer, requiring a No. 20 sieve, and No. 30 powders require a No. 15 sieve for this purpose. Powders of a less degree of fineness usually do not require this additional treatment after the moistening. The moist powder is now transferred to a sheet of thick paper and the whole quantity poured from this into the percolator. It is then shaken down lightly and allowed to remain in that condition for a period varying from fifteen minutes to several hours, unless otherwise directed; after which the powder is pressed, by the aid of a plunger of suitable dimensions, more or less firmly, in proportion to the character of the powdered substance and the alcoholic strength of the menstruum, strongly alcoholic menstrua, as a rule, permitting firmer packing of the powder than the weaker. The percolator is now placed in position for percolation, and, the rubber tube having been fastened at a suitable height, the surface of the powder is covered by an accurately fitting disk of filtering paper, held in place by a glass stopper or percolator weight, and a sufficient quantity of the menstruum poured on through a funnel reaching nearly to the surface of the paper. If these conditions are accurately observed, the menstruum will penetrate the powder equally until it has passed into the rubber tube and has reached, in this, a height corresponding to its level in the percolator, which is now closely covered to prevent evaporation. The apparatus is then allowed to stand at rest for the time for maceration specified in the formula.

"To begin percolation, the rubber tube is lowered and its glass end introduced into the neck of a bottle previously marked for a quantity of liquid to be received, if the percolate is to be measured, or of a tared bottle, if the percolate is to be weighed; and by raising or lowering this receiver the rapidity of percolation may be increased or decreased as may be desirable. A layer of menstruum must constantly be maintained above the powder, so as to prevent the access of air to its interstices, until all has been added, or the requisite quantity of percolate has been obtained. This is conveniently accomplished, if the space above the powder will admit of it, by inverting a bottle containing the entire quantity of menstruum over the percolator in such a manner that its mouth may dip beneath the surface of the liquid, the bottle being of such shape that its shoulder will serve as a cover for the percolator.

"Unless otherwise directed when the dregs of a tincture, or of a similar preparation, are to be subjected to percolation, after maceration with all or with the greater portion of the menstruum, the liquid portion should be drained off as completely as possible, the solid portion packed in a percolator, as before described, and the liquid poured on, until all has passed from the surface, when immediately a sufficient quantity of the directed menstruum should be poured on to displace the retained liquid, until the prescribed quantity has been obtained.

"Repercolation or Fractional Percolation.— Authority is given to employ, where it may be applicable, the process of repercolation, without change of the initial menstruum. This process is used in Type Process C for fluidextracts.

"Rate of Flow.—It is obvious that the success of the process of percolation largely depends upon the regulation of the flow of the percolate; if this should be too rapid, incomplete exhaustion will result, but if too slow, valuable time may be wasted. The rate of flow for fluidextracts for 1000 Gm. of powder should not exceed ten drops a minute; for official quantities of tinctures and preparations of about the same strength twenty drops a minute, and the word 'slowly' throughout the text is understood to mean a rate of flow corresponding to this; it is evident that the proper rate of flow should vary with the quantity and character of the drug employed and the density of the menstruum.

"Maceration.—Percolation is not suitable for exhausting some drugs, and the process of maceration is employed for some of the tinctures

(Aloes, Asafetida, Sweet Orange Peel, Tolu, etc.). Specific directions will be found in the text, and maceration should be conducted preferably at a temperature of from 15° to 20° C. (59°-68° F.)." U. S.

For an account of E. R. Squibb's process of repercolation, see *Fluidextracta*.

Some prefer the mode of expression to that of percolation. This also is applicable both to aqueous and to alcoholic menstrua. The substance to be acted upon is mixed with the menstruum, cold or hot according to circumstances, and the mixture is allowed to stand from twelve to twenty-four hours. The liquid part is then filtered off, and the remainder submitted to strong pressure, in a linen bag, by means of a common screw press, or other convenient apparatus. Another portion of the menstruum may then be added, and pressure again applied, and, if the substance is not sufficiently exhausted, the same operation may be performed a third time. Frequently only a single expression is required, and very seldom a third. The quantity of menstruum added must vary with the solubility of the principles to be extracted. According to Mohr, the method of expression has the advantages over that of the percolation, that it yields solutions of more uniform concentration, that it does not require the materials to be so carefully powdered, or otherwise so skilfully managed, in order to insure favorable results, and, finally, that it occupies less time.

2. Mode of Conducting the Evaporation.

In evaporating the solutions obtained in the modes above described, attention should always be paid to the fact that the extractive matter is constantly becoming insoluble at high temperatures with the access of air, and that other chemical changes are going on, sometimes not less injurious than this, while the volatile principles are expelled with the vapor. The operator should, therefore, observe two rules: (1) to conduct the evaporation at as low a temperature as is consistent with other objects; (2) to exclude atmospheric air as much as possible, and, when this cannot be accomplished, to expose the liquid the shortest possible time to its action. The injurious influence of atmospheric air is much greater at the boiling point of water than at a less heat, even allowing for the longer exposure in the latter case, and therefore a slow evaporation at a moderate heat is preferable to the more rapid effects of ebullition. Bearing these principles in mind, we shall proceed to examine

the different modes in practice. First, however, it is proper to observe that decoctions generally let fall, upon cooling, a portion of insoluble matter, and it is a question whether this should be rejected, or retained so as to form a part of the extract. Though it is undoubtedly in many instances inert, as in that of the insoluble substance formed during the decoction of certain vegetable substances, yet, as it frequently also contains a portion of the active principle which a boiling saturated solution necessarily deposits on cooling, and as it is difficult to decide with certainty when it is active and when otherwise, the safest plan, as a rule, is to allow it to remain.

The method of evaporation formerly resorted to in the case of aqueous solutions is rapid boiling over a fire. The more quickly the process is conducted, the better, provided the liquid is to be brought to the boiling point, for the temperature cannot exceed this, and the length of exposure is diminished. But, where this method is employed, it should never be continued until the completion of the evaporation, for when most of the water has escaped, the temperature can no longer be kept down to the boiling point, and the extract is burnt. The caution, therefore, should always be observed of removing the preparation from the fire before it has attained the consistence of thick syrup, and completing the evaporation, either by means of a water bath, or in shallow vessels at a moderate heat. When large quantities of liquid are to be evaporated, it is best to divide them into portions and evaporate each separately, for, as each portion requires less time for evaporation than the whole, it will thus be a shorter time exposed to heat. But the mode of evaporation by boiling is always objectionable, and should be employed only in cases where the principles of the plant are so fixed and unchangeable as to authorize their extraction by the method of decoction.

Evaporation by means of a water bath, from the commencement of the process, is safer than the plan just mentioned, as it obviates all danger of burning the extract; but, as the heat is not supplied directly from the fire, the volatilization of the water cannot go on so rapidly, and, the temperature being nearly the same, when the water bath is kept boiling, there is greater risk of injurious action from the air. The liquid should be stirred during the process. The use of the steam bath has become very general in this country, as it requires a smaller consumption of fuel, and the heat imparted to the liquid, while sufficient to evaporate it, may be less than 100° C; (212° F.). The

apparatus consists of an ordinary boiler, containing water, the vapor of which is conducted through a pipe into the evaporating vessels, communicating with each other by means of iron steam pipes. These vessels have the form of an ordinary copper basin, to the inside of which is riveted a shallow tinned copper evaporating basin, intended to contain the liquid to be evaporated. The vapor from the boiler circulates between these vessels, and the water into which it condenses is allowed to escape through a steam valve attached to the bottom of each vessel. The liquid to be evaporated is first distributed in two or three basins, but when considerably concentrated, is transferred to a single one, where it is stirred towards the close of the process to hasten the evaporation. The heat applied to the liquid can be easily regulated by the steam valves.

As the heat capable of being applied by boiling water to the evaporating liquid does not exceed 93.3° C. (200° F.), while that by steam can, by a moderate pressure, be increased to the boiling point or beyond it, the evaporation by the latter agency may be much more rapid than by the former, when the pressure is from ten to twenty pounds to the square inch; so that there is a temptation to raise the heat to a degree seriously injurious to the product. Evaporation, therefore, by steam heat always requires caution and a stirring device should be used. The water bath is much less liable to be abused. In this respect the latter method has the advantage.

A good plan of evaporation, though slow, is to place the liquid in a broad, shallow vessel, exposed in a stove or drying room to a temperature of about 37.8° C. (100° F.), or a little higher, taking care that the air have free access in order to facilitate the evaporation. This mode is particularly applicable to those cases in which maceration or infusion is preferred to decoction for extracting the active principles. Berzelius says that we may thus usually obtain the extract in the form of a yellowish transparent mass, while extracts prepared in the ordinary way are almost black, and are opaque even in very thin layers. Even when the liquid is boiled at first, the process may often be advantageously completed in this manner. It has been proposed to effect the evaporation at the common temperature, by directing a strong current of air, by means of a pair of smith's bellows, over the surface of the liquid, and in reference to substances which are injured by heat and not by atmospheric air the plan will be found useful.

Plans have been proposed and carried into execution for performing evaporation without the admission of atmospheric air. The apparatus for *evaporation in vacua*, now largely used by manufacturing pharmacists, is well calculated to meet this object, at the same time that, by removing the atmospheric pressure, it enables the water to rise in vapor more rapidly, and at a comparatively low temperature.

A convenient plan of excluding the air, though it does not at the same time meet the object of reducing the degree of heat, is to distil off the water in close vessels. Berzelius says that this is the best mode of concentration next to that in *vacuo*. Care, however, must be taken that the fire be not too long applied, lest the extract should be burnt. The process should, therefore, be completed by means of the water bath.

In the concentration of alcoholic solutions, distillation should always be performed, as not only is the atmospheric air thus excluded, but the alcohol is recovered, if not absolutely pure, certainly fit for the purpose to which it was originally applied. Here also the water bath should be employed, to obviate any possible risk of injury from the fire. When the decoction or infusion and the tincture of the same vegetable have been made separately, they should be separately evaporated to the consistence of syrup, and then mixed together while they are of such a consistence as to incorporate without difficulty. The object of this separate evaporation is that the spirituous extract may not be exposed to the degree of heat, or lengthened action of the air, which is necessary in the ordinary mode of concentrating the infusion or decoction.

In every instance, care should be taken to prevent any portion of the extract from becoming dry and hard on the sides of the evaporating vessel, as in this state it will not readily incorporate with the remaining mass. The heat therefore, should be applied to the bottom and not to the sides of the vessel.

Inasmuch as the yield of extracts is largely dependent on the character of the menstruum used in the percolation, it follows that there must necessarily be a great variation in the strength of commercial extracts. C. H. LaWall has prepared a valuable table giving' the yield of extract by various drugs. (*Proc. A. Ph. A.*, 1897, 414.) For methods of assay, see various official processes.

"Pilular Extracts are solid or semi-solid products prepared by

exhausting drugs with appropriate solvents and carefully evaporating the solutions to the proper consistence. These extracts preserve the useful constituents of the drug in a concentrated, relatively uniform and permanent condition, and in a form suitable for medication.

"The solvents or menstrua employed in the preparation of pilular extracts are water, alcohol, or mixtures of these in the proportions stated in the formulas. A few drugs require for their extraction the addition of an acid or an alkali to the solvent. Where alcohol is used in the extraction it may be recovered by distillation.

"In the preparation of pilular extracts the concentration of the solutions should be completed without delay, and undue exposure to heat must be avoided. The limit of temperature for the evaporation, as stated in the formulas, should not be exceeded. In the manufacture of these extracts on a large scale an apparatus for distilling and evaporating under reduced pressure should be used. It is also important that the residue be frequently stirred so as to hasten the evaporation and to obtain a uniform product.

"Pilular extracts are extensively used in pill masses and in ointments and, to facilitate their use in these preparations, the degree of concentration is commonly directed to be that of a 'pilular consistence.'

"Pilular extracts should be protected from exposure to sunlight and air by being kept in tightly-covered glass or earthen-ware containers.

"Powdered Extracts differ from pilular extracts in that they are dry, fine powders. Powdered extracts are often preferred to pilular extracts for general use, because they can be more accurately weighed, more easily dispensed, and more conveniently preserved in tightly-stoppered bottles.

"In the preparation of powdered extracts, it is necessary to use solvents that will extract the active principles of the drugs, and only a minimum amount of the inert substances. Where the drug contains an oily constituent that would be extracted by the menstruum directed, it becomes necessary to adopt in the process of manufacture a method for the separation of this oil so that the product will retain a satisfactory, pulverulent form.

"The concentration of the liquids containing the extractive should be

completed without delay and undue exposure to heat must be avoided.

"The limit of temperature as stated in the formulas should not be exceeded, and the use of apparatus for concentrating under reduced pressure is recommended. The final drying of the soft extract can be greatly facilitated by spreading it upon plates of glass or tinned metal and exposing it to currents of warm, dry air. Powdered extracts must be thoroughly dried, powdered and mixed with the diluent and preserved in tightly-stoppered, small, wide-mouthed, amber-colored bottles, and stored in a cool and dry place.

"Alkaloidal standards have been adopted for Extracts that can be reliably assayed. Assay methods are directed for the determination of their strength, and to provide for standardization. When necessary, an inert diluent is directed to reduce the product to the standard. In the official formulas glucose is directed for the diluent in pilular extracts and dried starch and magnesium oxide are directed for powdered extracts, but it is permissible for the manufacturer to use as inert diluents for the latter, sugar, sugar of milk, powdered glycyrrhiza, magnesium carbonate or the finely powdered drug or marc from which the respective extract was made. For the convenience of the prescriber, the standards of strength for the Extracts have been adjusted, wherever possible, so that each bears a definite relation to that of the respective drug of average strength, and a statement of the standard precedes the formula," U. S.

3. Condition and Preservation of Extracts.

Extracts may be prepared of three different degrees of consistence: soft, so that they may be readily made into pills, hard, in order that they may be pulverized, and in a fine, dry powder. The soft extracts always contain a notable percentage of water. In astringent extracts, the evaporation should be carried to dryness. Those obtained from the expressed juices of plants are apt to attract moisture from the air, in consequence of the deliquescent nature of the salts existing in the juice. They are thus rendered softer, and more liable to become mouldy upon the surface. Others, especially such as contain much chlorophyll, harden by time, in consequence of the escape of their moisture, and it not unfrequently happens that small crystals of saline matter are formed in their substance; sodium chloride in small cubes is sometimes found in certain old extracts, having slowly crystallized as they

hardened. John Attfield of London, has made a chemical examination of the crystals found in numerous extracts, and ascertained that in a large number they consisted of potassium chloride, and in a comparatively few of potassium nitrate. Potassium chloride was detected in the extracts of belladonna, hemlock, sarsaparilla (compound), colchicum seed, stramonium seed, and aconite; potassium nitrate in the extracts of belladonna, hyos-cyamus, and lettuce; and sodium sulphate in extract of stramonium seed. (*P. J.*, March, 1862, p. 448.) The air, moreover, exercises an unfavorable chemical influence over the softer extracts, which are enfeebled, and ultimately become nearly inert, by the same changes which they undergo more rapidly in the liquid state at an elevated temperature. If an extract be dissolved in water, and the liquid be saturated with common salt or any other very soluble salt of difficult decomposition, the greater part of it will be precipitated, in consequence of the insolubility of this class of substances in saline solutions. The precipitate may be again dissolved in pure water.

Abstracts, which were official in the U. S. P., 1880, were not re-introduced in the U. S. P. (8th Rev.), as they did not come into general use; this is unfortunate, as they had many advantages, and are used in certain sections of the country. A description and a typical formula, with comments, will be found in the U. S. Dispensatory, 19th edition, p. 466.

Extracts, in order that they may keep well, should be placed in glazed earthenware, glass, or porcelain jars, and completely protected from the access of the air. This may be effected by covering their surface with a layer of melted wax, or with a piece of paper moistened with strong spirit, then closing the mouth of the vessel with a cork, spreading wax or rosin over this, and covering the whole with leather or a piece of bladder. The application of alcohol to the surface has a tendency to prevent mouldiness. Should the extract become too moist, it may be dried by means of a water bath; should it, on the contrary, be too dry, the proper consistence may be restored by softening it in the same manner and incorporating with it a little distilled water. Martin proposes to preserve extracts in a soft condition by surrounding the vessel containing the extract by another of larger diameter, which is furnished with a tight cover, the space between the two vessels being filled with crystallized sodium sulphate, which gradually parts with its water of crystallization and prevents the extract from becoming hard and dry.

When extracts which are too soft are subjected to a moderate

temperature, fermentation may set in; E. Coccardas describes the various forms of "Penicillium-ferment" which are found in such extracts, and concludes that the ferment causes them to undergo changes similar to those effected by heat—viz., the absorption of oxygen and the disengagement of carbon dioxide. (*P. J.*, 1886, p. 590.)

It is preferable to add a definite weight of the glycerin to the percolate. If it were added to the menstruum, owing to the variation in the yield, of extracts from plants, some would be too soft, and at another time, in the case of a large yield of extract, the quantity of glycerin would be insignificant.

Extracts from recent plants should be prepared at the season when the plant is medicinally most active; a good rule is to prepare them once a year; but the demand for extracts from fresh drugs has declined rapidly of late, as it has been found that properly dried drugs yield extracts of uniform strength.

Powdered Extracts.—These extracts are largely superseding soft extracts for reasons given in preceding paragraphs; the difficulty of making them arises from the injurious influence of heat upon concentrated percolates of organic substances, but by the use of vacuum apparatus, suitable absorptive diluents and care, they should be made successfully.

Some extracts when powdered have a tendency to cohere. According to Geiseler, this may be obviated by the addition of sugar of milk or powdered licorice root, two or three parts of the former and one part of the latter to one of the extract being sufficient for the purpose. (*Ph. Cb.*, 1850, p. 238.) Mohr recommends the following plan of drying and preserving extracts. Take equal parts of powdered licorice-root and of the extract, rub them well together in a mortar, put the resulting paste into an earthen vessel with a flat bottom, place this in another of iron, a little deeper, containing calcium chloride thoroughly dried by heat insufficient to melt it; then enclose the whole with a cover fitted to the iron vessel, and allow them to stand for a day or more. When the mixture is quite dry, powder it, and add so much of the powdered root as to make the weight double that of the original extract. This process was substantially adopted in the German Pharmacopoeia (1882). The old process of using dextrin as a diluent was found very objectionable, principally on account of the tendency of the extracts to reabsorb

moisture. Four parts of extract are now mixed with three parts of finely powdered licorice-root, and dried in a porcelain dish at 40° to 50° C. (104°-122° F.) until the mixture ceases to lose weight. The mass is then rubbed to powder, and sufficient powdered licorice-root added to make the whole weigh eight parts, or double the weight of extract used. In our opinion, this method is not so good as that formerly adopted for abstracts. The German powdered extracts are always half the strength of the extracts, no relation whatever with the drug is established, and the variations in the yield of extract from different drugs have been repeatedly shown to be great. Kirchmann proposes exsiccated sodium sulphate as a diluent instead of dextrin, licorice-root, etc. (*Ph. Ztg.*, 1881, 116.) A. B. Lyons, of Detroit (1898), has introduced scale extracts. These do not, as a class, bear a definite relation to the drug; they are assayed, however, and acacia is used as a means of preserving their dry condition; they are easily pulverized, and are very convenient for dispensing.

The plan of incorporating a little glycerin with extracts has been recommended for such extracts as require it, 10 per cent. of glycerin being added to the liquid extract before evaporating to a pilular consistence. By its unchangeable liquid character, glycerin keeps the extract soft, so that it can be readily made into pills, and it also exercises a favorable influence through its chemical properties. The U. S. P. (8th Rev.) directs the use of glycerin for this purpose as follows: "When it is desired to preserve a solid extract (for instance, of Gentian, Taraxacum, etc.) in a plastic condition, suitable for making pills, or for other purposes, it is recommended that there be incorporated with it, after it has been evaporated to the proper consistence, and while it is still warm, 10 percent. of its weight of glycerin." U. S.

Eight extracts were dismissed at the last revision of the U. S. Pharmacopoeia, these were as follows: Aloes, digitalis, euonymus haematoxylon, krameria, leptandra, quassia, and scopola; five extracts were added as follows: Aconite, oxgall, gelsemium, hydrastis, viburnum pruni-folium.

EXTRACTUM ACONITI. U. S.

EXTRACT OF ACONITE Ext. Aconit. [Powdered Extract of Aconite]

" Extract of Aconite yields not less than 1.8 per cent. nor more than 2.2 per cent. of the ether-soluble alkaloids of aconite and, if assayed biologically, the minimum lethal dose should not be greater than 0.00001 Gm. for each gramme of body weight of guinea-pig. One gramme of. the Extract represents about four grammes of aconite." U. S.

"Aconite, in No. 60 powder, one thousand grammes [or 35 ounces av., 120 grains]; Tartaric Acid, five grammes [or 77 grains]; Purified Petroleum Benzin, Starch, dried at 100° C. (212° F.), Alcohol, each, a sufficient quantity. Dissolve the tartaric acid in five hundred mils [or 16 fluidounces, 435 minims] of alcohol, moisten the drug with this solution and pack it in a cylindrical glass percolator; then add sufficient alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, an[^], having closely covered the percolator, macerate- for forty-eight hours. Then allow the percolation to proceed very slowly, adding alcohol as required. Reserve the first one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of percolate and continue the percolation, until the second percolate measures one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] or until the drug is exhausted. Transfer this second percolate to a suitable apparatus and distil off the alcohol at as low a temperature as practicable, until a residue measuring about one hundred mils remains then add the reserved percolate and continue distillation until the residue in the still is of syrupy consistence. Transfer this syrupy residue to a flask, using a little warm alcohol to rinse the still, and adding the rinsing to the flask. When it has cooled, add two hundred and fifty mils [or 8 fluidounces, 218 minims] of purified petroleum benzin and shake the mixture thoroughly for several minutes. Allow the liquids to separate and decant the benzin layer as closely as possible; add again to the residue two hundred and fifty mils [or 8 fluidounces, 218 minims] of purified petroleum benzin, agitate and decant the benzin layer as before. Transfer the syrupy residue to a shallow evaporating dish, rinse the flask with twenty mils [or 325 minims] of warm alcohol, adding the rinsings to the residue in the dish, and then incorporate fifty grammes [or 1 ounce av., 334 grains] of the thoroughly dried starch. Evaporate

the mixture by a very gentle heat on a water bath, frequently stirring, and, -when the mass has become thick, spread it on glass plates and continue the drying in an air bath at a temperature not exceeding 70° C. (158° F.) until thoroughly dry. Reduce the product to a fine powder and weigh it. Assay a portion of this product as directed below, and, from the alkaloidal content thus determined, ascertain by calculation the amount of alkaloids in the remainder of the powder and add to this enough of the dried starch to make the finished Extract contain 2 per cent. of the ether-soluble alkaloids of aconite. Mix the powders thoroughly, pass the Extract through a fine sieve, transfer it to small, wide-mouthed bottles and stopper them tightly.

"Assay.—Introduce 3 Gm. of Extract of Aconite into a 250 mil flask, add 10 Gm. of washed sand and mix thoroughly. Then add 150 mils of ether and 2 mils of ammonia water, shake the mixture vigorously every few minutes during a half hour, and when the dregs have settled decant 100 mils of the clear liquid, representing two grammes of the Extract. Proceed as directed under *Belladonna Radix*, modifying the process there given by using ether instead of chloroform for the final shaking out of the alkaloids.

" Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 64.539 milligrammes of the ether-soluble alkaloids of aconite." *U. S.*

For a biological method of assaying Extract of Aconite, see *Aconitum*.

This extract is an undesirable addition to the U. S. P. IX and requires the utmost care in its preparation, for notwithstanding the addition of both a chemical and biological assay it is often variable in strength as found in commerce.

Dose, one-eighth to one-fourth grain (0.008-0.015 Gm.).

EXTRACTUM ALOES. Br.

EXTRACT OF ALOES

Extrait d'Aloes, Fr.; Extractum Aloes, P. G.; Aloeextract, G.; Estratto di aloes acquoso, It.

"Aloes, in small fragments, 1000 grammes; Distilled Water, boiling,

10,000 millilitres. Add the Aloes to the Distilled Water and stir well until they are thoroughly mixed; set aside the mixture for twenty-four hours; decant; strain; evaporate the strained liquid to dryness at a temperature not exceeding 60° C. (140° F.)." *Br.*

The object of this preparation is to afford an aloes purified from mechanical impurities. The process is based upon the British formulas for extracts of Barbados aloes and Soeotrine aloes, formerly official. With an official purified aloes, the necessity for this preparation is not obvious. The U. S. P. IX dismissed Extract of Aloes and Aloe Purificata, but added tests for Aloes which exclude inorganic impurities, gum, etc. See *Aloe*. A powdered extract is official in the N. F. IV. An extract made with cold distilled water was formerly official in the German Pharmacopoeia, as was also the vitriolated extract, "*Extractum Aloes Acido Sulfurico Correctum*," made by suspending eight parts of extract of aloes in thirty-two parts of distilled water, adding drop by drop one part of pure sulphuric acid, and evaporating in a porcelain vessel to dryness.

Dose, one to five grains (0.06-0.3 Gm.).

Off. Prep.—Decoctum Aloes Compositum, *Br.*; Extractum Colocynthidis Compositum, *Br.*; Pilulae Antiperiodicae, *N. F.*; Tinctura Antiperiodica, *N. F.*

EXTRACTUM CANNABIS. U. S. (Br.)

EXTRACT OF CANNABIS Ext. Cannab. [Extractum Cannabis Indicee, U S. P. VIII]

"Extract of Cannabis, when assayed biologically, produces incoordination when administered to dog's in a dose of not more than 0.004 Gm. of Extract per kilogramme of body weight." *U.S.*

Extractum Cannabis Indicae, *Br.*; Extract of Indian Hemp: *Br.*; Extrait de Chanvre de l'Inde, *Fr. Cod.*; Indischer Hanfextrakt, *G.*

"Cannabis, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, a sufficient quantity. Moisten the powder with sufficient alcohol, pack it firmly in a cylindrical percolator and add enough alcohol to saturate the powder and leave a stratum above it.

When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding alcohol, until the drug is exhausted. Recover the alcohol from the percolate by distillation and evaporate the residue with frequent stirring, at a temperature not exceeding 70° C. (158° F.), to a pilular consistence. Mix the mass thoroughly and weigh it. Assay a portion of this extract, and from the result thus obtained adjust the weight of the finished Extract, by the addition of glucose, to conform to the required biological standard.

"Assay.—Proceed as directed under Biological Assays." U. S. (See under Cannabis.)

"Exhaust Indian Hemp, in coarse powder, with Alcohol (90 per cent.) by the percolation process; recover the alcohol by distillation, and evaporate the residue to a soft extract." *Br.*

The continuation in the *Br. Pharm.* of the name of Indian Hemp is unfortunate because of the possibility of its being mistaken for the root of *Apocynum cannabinum*, which is also called Indian Hemp. Several mistakes have occurred through this unfortunate confusion of nomenclature.

Although there is some difference in the details of the two processes, the preparations of the U. S. and *Br. Pharmacopoeias* are practically identical. The U. S. P. IX provides a biological test.

Great care is necessary in the manufacture of this extract not only in the selection of the crude drug, but also there is reason to believe that excessive heat in evaporating may have an injurious effect on the quality of the preparation. The only means of ascertaining its activity is by means of the biological test. The preparation varies exceedingly in strength, so that it is wisest to begin with a small dose, one-quarter of a grain (0.016 Gm.), and rapidly increase the amount given until some effect is produced.

Dose, one-fourth to three-fourths of a grain (0.015-0.045 Gm.).

Off. Prep.—Tinctura Cannabis Indicae, *Br.*; Mistura Chlorali et Potassii Bromidi Composita, *N.F.*

EXTRACTUM CASCARA SAGRADAЕ. U. S. (Br.)

**EXTRACT OF CASCARA SAGRADA Ext. Casc. Sagr.
[Extractum Rhamni Purshianae, U. S. VIII, Powdered Extract
of Cascara Sagrada]**

"One gramme of the Extract represents three grammes of cascara sagrada." *U. S.*

Extractum Cascarae Sagradae Siccum, Br.; Dry Extract of Cascara Sagrada; *Extrait de Cascara Sagrada, Fr. Cod.;* Cascara Sagrada-Extrakt, *Amerikanisches Faulbaumrindeuextrakt, G.;* Extracto alcoholico de cascara sagrada, *Sp.*

"Cascara Sagrada, in No. 20 powder, nine hundred grammes [or 31 ounces av., 327 grains] ;

Magnesium Oxide, twenty-five grammes [or 386 grains]; Starch, dried at 100° C. (212° F.), Boiling Water, each, o sufficient quantity, to make three hundred grammes [or 10 ounces av., 255 grains]. Mix the cascara sagrada with four thousand mils [or 135 fluidounces, 122 minims] of boiling water and macerate the mixture during three hours. Then transfer it to a metallic percolator, allow it to drain and pour on boiling water until the percolate measures five thousand mils [or 169 fluidounces, 33 minims], or the drug is exhausted. Evaporate the percolate to dryness on a water bath or steam bath, reduce the extract to a fine powder, weigh it, add the magnesium oxide and enough of the dried starch to make the product weigh three hundred grammes [or 10 ounces av., 255 grains]. Mix the powders thoroughly, pass the Extract through a fine sieve, transfer it to small, wide-mouthed bottles and stopper them tightly." *U. S.*

"Exhaust Cascara Sagrada, in No. 20 powder, with Distilled Water by the *percolation process*; evaporate the percolate to dryness on a water-bath;" *Br.*

This powdered extract was made official in the U. S. P. VIII for the first time; 1 part of the extract represented 4 parts of the drug; in the U. S. P. IX 1 part represents 3 parts of the drug.

The British preparation (1914) is a dry extract. It well represents the virtues of the bark, and furnishes a good means of administering this

purgative in pilular form.

Dose, from two to eight grains (0.13-0.5 Gm.).

Off. Prep.—*Pilulae Aloini, Strychninas et Belladonnae Compositae, N. F.*

EXTRACTUM CIMICIFUGAE. U. S.

EXTRACT OF CIMICIFUGA Ext. Cimicif. [Powdered Extract of Cimicifuga]

“One gramme of the Extract represents four grammes of cimicifuga.” *U. S.*

Extract of Black Cohosh; Extrait d'Actee a grappes, *Fr.*; Cimicifuga-extrakt, *G.*

“Cimicifuga, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, Starch, dried at 100° C. (212° F.), each, a sufficient quantity, to make two hundred and fifty grammes [or 8 ounces av., 358 grains]. Moisten the drug with sufficient alcohol, pack it in a cylindrical percolator, and add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, adding alcohol as required until the drug is exhausted. Recover the alcohol from the percolate by distillation and evaporate the residue to dryness, with frequent stirring, at a temperature not exceeding 70° C. (158° F.). Weigh the residue and add sufficient of the dried starch to make the product weigh two hundred and fifty grammes [or 8 ounces av., 358 grains]. Reduce the mixture to a fine powder, mix thoroughly, pass the Extract through a fine sieve, transfer it to small, wide-mouthed bottles and stopper them tightly.” *U. S.*

In the U. S. P. VIII this extract was made from the fluidextract, but the U. S. P. IX gives a process. This extract was introduced for the reason that although the fluidextract and tincture represent the virtues of cimicifuga, the alcohol present in both may be therapeutically contra-indicated, and the exceedingly disagreeable taste of the drug is entirely masked if the extract be prescribed in the form of a pill, with proper additions, such as extract of licorice, or if the pill be coated or enclosed in

a capsule. It is used in the treatment of *chorea*.

Dose, of the extract, from three to ten grains (0.2-0.65 Gm.).

EXTRACTUM COLCHICI CORMI. U. S. (Br.)

EXTRACT OF COLCHICUM CORM Ext. Colch. Conn. [Powdered Extract of Colchicum Conn]

" Extract of Colchicum Corm yields not less than 1.25 per cent. nor more than 1.55 per cent. of colchicine. One gramme of the Extract represents about four grammes of colchicum corm." U.S.

Extractum Colchict, *Br.*; Extractum Colchici Radicis, *U. S.*, 1890; Extrait de Colchique acetique, *Fr.*; Zeitlosen Esaigextrakt, *G.*

"Colchicum Corm, in No. 60 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, Purified Petroleum Benzin, Starch, dried at 100° C. (212° F.), each, a sufficient quantity. Moisten the drug with sufficient alcohol, pack it in a cylindrical percolator and add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, adding alcohol as required, until the percolate measures two thousand mils or until the drug is exhausted. Recover the alcohol from the percolate by distillation at as low a temperature as practicable until a residue measuring about one hundred and fifty mils [or 5 fluidounces, 35 minims] remains in the still. Transfer this residue to a flask, using a little warm alcohol to rinse the still, and add the rinsing's to the flask. When it has cooled, add two hundred and fifty mils [or 8 fluidounces, 218 minims] of purified petroleum benzin and shake the mixture thoroughly for several minutes. Allow the liquids to separate and decant the benzin layer as closely as possible; again add to the residue one hundred and fifty mils [or 5 fluidounces, 35 minims] of purified petroleum benzin, agitata and decant the benzin layer as before, repeat the washing with one hundred mils [or 3 fluidounces, 183 minims] of purified petroleum benzin and reject the benzin washings. Transfer the residue to a shallow evaporating dish, rinse the flask with a little warm alcohol, adding the rinsings to the residue in the dish, and evaporate it on a water bath to a thick extract. To this add fifty grammes [or 1 ounce av., 334 grains] of

the dried starch, mix well, spread the mixture on glass plates and continue the drying in an air bath at a temperature not exceeding 70° C. (158° F.) until thoroughly dry. Reduce the product to a fine powder and weigh it. Assay a portion of this product as directed below, and, from the alkaloidal content thus determined, ascertain by calculation the amount of alkaloid in the remainder of the powder and add to this enough of the dried starch to make the finished Extract contain 1.4 per cent. of col-chicine. Mix the powders thoroughly, pass the Extract through a fine sieve, transfer it to small wide-mouthed bottles and stopper them tightly." U. S.

"Crush fresh *Colchicum Corms*, deprived of their coats; press out the juice; allow the feculence to subside, decant; heat the clear liquid to 100° C. (212° F.); strain through flannel, and evaporate at a temperature not exceeding 70° C. (158° F.) to a soft extract." *Br.*

The U. S. VIII extract was an acetic extract of the corm, but in the IT. S. P. IX process the acetic acid "was omitted. The British extract is made by evaporating the juice of fresh conns.

In Great Britain a preparation called *preserved juice of colchicum* is given in the dose of five minims (0.3 mil) or more. It is made by expressing the fresh corm, allowing the juic'e to stand for forty-eight hours that the starchy matter may subside, then adding one-fourth of its bulk of alcohol, allowing it again to stand for a short period, and ultimately filtering.

"**Assay.**—Proceed as directed under *Colchici Semen*, modifying the process there given by using 6 Gm. of the Extract of *Colchicum Corm* instead of 15 Gm. of colehicum seed. The final weight will be the amount of colchicine from two grammes of Extract of *Colchicum Corm*." *U. S.*

As the fresh colchicum corm is rarely to be had in this country, the U. S. Pharmacopoeia employs the dried corm; its process, if properly conducted, will afford a very efficient extract. In preparing this extract according to the British process, by expression from the recent corm, there will be experienced some inconveniences, which would seem to render the U. S. process under all circumstances preferable. (*P. J.*, xiii, 62.) The acetic extract of colchicum made from fresh conns was abandoned by the Br. Ph., 1898, and by the U. S. P. IX, but the acetic acid menstruum is a good solvent for colchicine.

Dose, from one-fourth to one grain (0.016-0.065 Gm.).

EXTRACTUM COLOCYNTHIDIS. U. S.

EXTRACT OF COLOCYNTH Ext. Colocynth. [Powdered Extract of Colocynth]

"One gramme of the Extract represents four grammes of colocynth." *U. S.*

Extractum Colocynthidis Alcoholicum: Extrait de Coloquinte, *Fr. Cod.*; Extractum Colocynthidis, *P. G.*; Kolo-quintenextrakt, *G.*; Estratto di coloquintide idroalcolico, *It.*

"Colocynth, in No. 20 powder, one thousand grammes (freed from the seeds) [or 35 ounces av., 120 grains]; Diluted Alcohol, Starch, dried at 100° C. (212° F.) each, a sufficient quantity, to make two hundred and fifty grammes [or 8 ounces av., 358 grains]. Moisten the drug with two thousand mils [or 67 fluidounces, 301 minims] of diluted alcohol and macerate it in a closed vessel for twenty-four hours, then transfer the moist drug to a cylindrical percolator, shake it down evenly without packing, and gradually pour diluted alcohol upon it, allowing the percolation to proceed slowly, until the percolate measures five thousand mils [or 169 fluidounces, 33 minims]. Recover the alcohol from the percolate by distillation and evaporate the residue to dryness on a water bath or steam bath. Reduce the extract to a fine powder, weigh it, and add sufficient of the dried starch to make the product weigh two hundred and fifty grammes [or 8 ounces av., 358 grains]. Mix the powders thoroughly, pass the Extract through a fine sieve, transfer it to small, wide-mouthed bottles and stopper them tightly." *U. S.*

The colocynth should always be deprived of its seeds, following the directions of the *U. S. Pharmacopoeia*, before being submitted to the action of the menstruum. Boiling water extracts such a large amount of pectin and mucilage from colocynth that either the decoction or the hot infusion gelatinizes on cooling, and the extract made by means of it is therefore loaded with inert matter, and, besides, is liable to become mouldy, or so tough and hard as to resist trituration and formation into pills. Hence many years ago the London College, following in this respect the old French Codex, directed, in the last edition of its *Pharmacopoeia*, maceration with cold water; but diluted alcohol has

been found to be a much better menstruum, and has accordingly been adopted in the U. S. Pharmacopoeia process, while in the British Pharmacopoeia the simple extract has been discarded altogether. The chief, if not exclusive, use of the alcoholic' extract is in the preparation of the compound extract.

This preparation should never be substituted for an extract prepared with a menstruum containing a larger percentage of water, because the water extracts a large quantity of mucilaginous and inert matter. Commercial extract of colo-cynth may be often found in the market made with an aqueous menstruum.

Dose, one-half grain (0.032 Gm.).

Off. Prep.—Extractum Colocynthis Compositum, *U. S.*; Pilulae Colocynthis Compositae, *N. F.*; Pilulae Colocynthis et Hyoscyami, *N. F.*

EXTRACTUM COLOCYNTHIDIS COMPOSITUM. U. S., Br.

COMPOUND EXTRACT OF COLOCYNTH Ext. Colocynth. Co. [Powdered Compound Extract of Colocynth]

Estrait de Coloquinte compose, *Fr.*; Zusammengesettes Koloquintenextrakt, *G.*

“Extract of Colocynth, one 'hundred and sixty grammes [or 5 ounces av., 282 grains] ; Aloes, five hundred grammes [or 17 ounces av., 279 grains]; Cardamom Seed, in No. 60 powder, fifty grammes [or 1 ounce av., 334 grains]; Resin of Scammony, in No 60 powder, one hundred and forty grammes [or 4 ounces av., 411 grains]; Soap, dried and in powder, one hundred and fifty grammes [or 5 ounces av., 127 grains], to make one thousand grammes [or 35 ounces av., 120 grains]. Triturate the ingredients until the product is reduced to a No. 60 powder. Pass the Extract through a fine sieve, transfer it to small, wide-mouthed bottles and stopper them tightly.” *U. S.*

“Colocynth Pulp, 150 grammes; Extract of Aloes, 300 grammes; Scammony Resin, 100 grammes; Curd Soap, in powder, 75 grammes; Cardamom Seeds, in powder, 25 grammes; Alcohol (60 per cent.), 4000 millilitres. Macerate the Colocynth Pulp in the Alcohol for four days; press out the tincture; recover the alcohol by distillation; evaporate to

dryness; add the Extract of Aloes, Scammony Resin, and powdered Cardamom Seeds; powder; mix the powder with the Curd Soap." *Br.*

The *Br. Pharm.* (1914) directs Extract of Aloes instead of Barbados Aloes, and decreased the proportion of soap from four to three ounces. The object of the soap is to improve the consistence of the mass, which, when hardened by time, it renders more soluble in the gastric juices. It may possibly also serve the purpose of modifying the action of the aloes. In the

U. S. process the extract is in the form of powder, which is very convenient for admixture with other substances; while if given uncombined, it may be readily made into pills by suitable additions. The alternative of using the scammony or its resin, in the first British formula, which appeared to us very objectionable, has been abandoned in the present edition, and the resin only directed. The plan of having the powders simply mixed was liable to the objection that the mixture was not likely to be so thoroughly effected as to obtain a uniform result, and hence the U. S. Pharm., 1880, adopted Squibb's suggestion, to melt together all the ingredients unpowdered, except the cardamom, add a little alcohol, and, when the mixture is thoroughly made, to stir in the powdered aromatic, and finally to reduce the whole to a fine powder. The U. S. P. IX, however, relies upon trituration as an assurance of thorough commingling.

This extract is an energetic and safe cathartic, possessing the activity of its three purgative ingredients, with comparatively little of the drastic character of the colocynth and scammony. It may be still further and advantageously modified by combination with rhubarb, jalap, calomel, etc., with one or more of which it is often united in prescription.

Dose, as a laxative, one to two grains (0.065-0.13 Gm.); as a purgative, five to ten grains (0.32-0.65 Gm.).

Off. Prep.—*Pilulae Catharticae Compositae, U. S.*; *Pilulae Catharticae Vegetabiles, N. F.*; *Pilulae Antidyspepticae, N. F.*; *Pilulae Colocynthidis et Podophylli, N. F.*; *Pilulae Laxativae Post Partum, N. F.*

EXTRACTUM EUONYMI Br.

EXTRACT OF EUONYMUS

Dry Extract of Euonymus; Extract of Wahoo; Extrait d'Evonymus atropurpureus, *Fr. Cod.*; Extrait dc Fusain Americaine, *Fr.*; Spindelbaumextrakt, Spillbaumrindenextrakt, *G.*

“Exhaust Euonymus Bark in No. 20 powder with Alcohol (45 per cent.) by the *percolation process*. Evaporate the percolate and thoroughly dry the residue. Powder the product as far as possible and mix it with one-fourth of its weight of Calcium Phosphate, continuing the drying and powdering until a sufficiently dry preparation is obtained; transfer this to a well-closed bottle.” *Br.*

This extract was not admitted to the U. S. P. IX, but was retained in the *Br. Pharm.* (1914) and introduced into the National Formulary IV which directs the percolation of euonymus in No. 40 powder with alcohol 4 volumes and water 1 volume. The percolate is evaporated or distilled and the residue dried and mixed with dried starch so that 1 Gm. of the extract represents 4 Gm. of euonymus. On account of the reports of physicians of cumulative effects the following note was inserted:

" CAUTION—It has been stated that the absorption of Euonymus in the gastro-intestinal tract is uncertain and irregular. To avoid an accumulation of the drug or toxic action, the physician should carefully guard the dosage and determine in each case the tolerance of the patient." *N. F. IV.* Dry and powdered extract of euonymus is frequently but erroneously termed "*euonymin*."

Dose, one to three grains (0.065 to 0.2 Gm.).

EXTRACTUM GELSEMI. U. S.

EXTRACT OF GELSEMIUM Ext. Gelsem. [Powdered Extract of Gelsemium]

"One gramme of the Extract represents four grammes of gelsemium." *U. S.*

“Gelsemium, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, Magnesium Oxide, Starch dried at 100° C.

(212° F.), each, a sufficient quantity, to make two hundred and fifty grammes [or 8 ounces av., 358 grains]. Moisten the drug with sufficient alcohol, pack it in a cylindrical percolator and add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, adding alcohol as required, until the drug is exhausted. Recover the alcohol from the percolate, by distillation at as low a temperature as practicable, until a residue measuring about five hundred mils [or 16 fluidounces, 435 minims] remains in the still. Transfer this residue to a shallow dish, and evaporate it to a soft extract with frequent stirring, at a temperature not exceeding 70° C. (158° F.). Then add fifty grammes [or 1 ounce av., 334 grains] of a mixture of one part of magnesium oxide and three parts of the dried starch, mix well, spread the mass in a thin layer on glass or tinned-metal plates or in a porcelain dish and continue the drying in an air bath, at a temperature not exceeding 70° C. (158° F.), until thoroughly dry. Reduce the extract to a fine powder, weigh it, and add sufficient of the mixture of magnesium oxide and dried starch, made in the same proportion as before, to make the finished product weigh two hundred and fifty grammes [or 8 ounces av., 358 grains]. Mix the powders thoroughly, pass the Extract through a fine sieve, transfer it to small, wide-mouthed bottles and stopper them tightly." *U. S.*

Dose, one-eighth to one-fourth of a grain (0.008-0.016 Gm.).

EXTRACTUM GENTIANS. U. S., Br.

EXTRACT OF GENTIAN Ext. Gentian.

Extrait de Gentiane, *Fr. Cod.*; Extractum Gentianse, P. G.; Enzianextrakt, G.; Estratto di genzian acquoso, *It.*; Extracto acuoso de genciana, *Sp.*

"Gentian, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains]; Water, a sufficient quantity. Moisten the powder with sufficient water, and allow it to macerate for twenty-four hours; then pack it in a conical percolator, and gradually pour water upon it until the drug is exhausted. Reduce the liquid to two thousand mils [or 67 fluidounces, 301 minims] by boiling, strain it, and then evaporate it to a pilular consistence on a water bath." *U. S.*

“Infuse Gentian Root in ten times its weight of Distilled Water for two hours; boil for fifteen minutes; pour off; press; strain; evaporate the liquid to a soft extract.” *Br.*

The plan of percolation with cold water is admirably adapted to the extraction of the active principles of gentian. By the use of cold water, starch and pectic acid are left behind, while any albumen that may be taken up is disposed of by the subsequent boiling and straining.

The extract, however, may be advantageously made by macerating the root in two parts of water for thirty-six hours, then expressing in a powerful press, again macerating with additional water, and in like manner expressing, and evaporating the united expressed liquors. Guibourt and Cadet de Vaux obtained by maceration in cold water an extract not only greater in amount, but also more transparent, more bitter, and possessing more of the color and odor of the root, than that prepared by decoction. Guibourt attributes this result to the circumstance that, as gentian contains little if any starch, it yields nothing to boiling which it will not also yield to cold water, while decoction favors the combination of a portion of the coloring matter with the lignin. But this opinion requires modification, now that it is understood that gentian contains pectic acid, which water will extract when boiling hot, but not when cold. Gentian, according to Brande, yields half its weight of extract by decoction.

As ordinarily procured, the extract of gentian has an agreeable odor, is very bitter, and of a dark brown color approaching to black, shining, and tenacious. It is frequently used as a tonic, in the form of pill, either alone or in connection with metallic preparations; but the practice of some pharmacists of using it indiscriminately as a pill excipient is deserving of severe censure.

Dose, from two to eight grains (0.12-0.5 Gm.).

Off. Prep.—*Pilulae Antiperiodicae, N. F.*; *Pilulae Ferri, Quininae, Aloes, et Nucis Vomicee, N. F.*

EXTRACTUM GLYCYRRHIZAE. U. S.

EXTRACT OF GLYCYRRHIZA Ext. Glycyrrh, [Extract of Licorice]

"The commercial Extract of Glycyrrhiza." U. S.

Extractum Liquiritiae; Liquorice, Licorice; Extraitde Reglisse, *Fr. Cod.*; Sue de Reglisse, Sucre noir, *Fr.*; Succus Liquiritiae, *P.G.*; Lakriz, Lakritzensaft, Susshoizsaft, *G.*; Estratto di liquirizia, Sugo di liquirizia. *It.*; Extracto acuoso deregaliz, Regaliza en hallos, *Sp.*

Licorice is an article of export from the north of Spain, particularly Catalonia, where it is obtained in the following manner. The roots of the *G. glabra*, having been dug up, thoroughly cleansed, and half dried by exposure to the air, are cut into small pieces, and boiled in water until the liquor is saturated. The decoction is then allowed to rest, and, after the dregs have subsided, is decanted, and evaporated to the proper consistence. The extract, thus prepared, is formed into rolls from five to six inches long by an inch in diameter, which are dried in the air, and wrapped in laurel leaves.

The British Pharmacopoeia gives a process for making extract of licorice. The U. S. Pharmacopoeia directs that not less than 60 per cent. of it should be soluble in cold water.

Much licorice is prepared in Calabria, according to Fee, from the *G. echinata*, which abounds in that country. The process is essentially the same as that just described, but conducted with greater care, and the Italian licorice is purer and more valuable than the Spanish. It is in cylinders, generally somewhat smaller than the Spanish, and usually stamped with the manufacturer's brand. Most of the extract brought to this country comes from Messina and Catania in Sicily and Naples, from Seville and Saragossa in Spain, and from Smyrna in Turkey. Perhaps in no other part of the world is more licorice consumed than in the United States, from four to five thousand tons having been imported annually before 1860; but the article is now made on an extensive scale in this country, very successfully, with the best modern appliances, and of such good quality as to have almost driven the foreign article out of the market. The principal use of Extract of Licorice is in the manufacture of chewing tobacco, that in the form of rolls as sold by the druggists being a comparatively small portion of the whole amount

consumed.

Crude Licorice, Licorice Paste, or Licorice Mass, as it is variously termed, is found in the market in cases ranging from two hundred and fifty to four hundred pounds, of a hard pilular consistence and, as its name implies, in a mass, which has been run into the case while hot and then allowed to cool.

Licorice is usually in cylindrical rolls, somewhat flattened, and often covered with bay-leaves. We have seen it abroad and in this market in large cubical masses. When good, it is black, dry, brittle, breaking with a shining fracture, of a peculiar sweet and slightly acrid or bitterish taste, and almost entirely soluble, when pure, in boiling water.

It is described officially as "in flattened cylindrical rolls or in masses, of a glossy black color externally; fracture brittle, sharp, smooth, conchoidal; taste characteristic and sweet. When pulverized it yields a brown powder. Not less than 60 per cent. of Extract of Glycyrrhiza is soluble in cold water. The yield of ash does not exceed 6 per cent." *U. S. Neumann* obtained 460 parts of aqueous extract from 480 parts of Spanish licorice. It is, however, considerably less soluble in cold water. It is often impure from accidental or fraudulent addition or careless preparation. Starch, sand, the juice of prunes, etc., are sometimes added, and carbonaceous matter, and even particles of copper, are found in it, the latter arising from the boilers in which the decoction is evaporated. In different commercial specimens examined by *Chevallier* he found from 9 to 50 per cent. of insoluble matter. (*J. P. C.*, xxx, 429.) This is by no means, however, always impurity. In the preparation of the extract by decoction, a portion of matter originally insoluble, or rendered so by decoction, is taken up, and is, in fact, necessary to the proper constitution of the licorice. When this is prepared with cold water, or even with hot water by simple displacement, the extract attracts moisture from the air, becomes soft, and loses the characteristic brittleness of the drug. The additional substances taken up in decoction serve to protect the extract against this change. *Delondre* has obtained the same result by using steam as the solvent. He prepares from the root an excellent licorice, having all the requisite qualities of color, taste, and permanence, by passing steam, in suitable vessels, through the coarse powder of the root. The vapor thoroughly penetrates the powder, and is drawn off as it condenses. With about 500 lbs. of the root, this treatment is continued for twelve hours, and repeated at the end of five days. The

liquors are collected, decanted, clarified with about 4 lbs. of gelatin, and quickly evaporated. After being put into the form of cylinders, the extract is kept for ten days in a drying room, at a temperature of 25° C. (77° F.). A bitter or empyreumatic taste is a sign of inferior quality in licorice. As ordinarily found in commerce, it requires to be purified. (See *Extractum Glycyrrizae Purum*, also *Glycyrrhizinum Ammoniatum*.)

Licorice contains *glycyrrhizin*, C₂₄H₃₆O₉, a glucoside, partly free and partly in combination with ammonia, to which combination the characteristic sweet taste of licorice is due. The glycyrrhizin when boiled with dilute acids decomposes into *glycyrrhetin*, C₁₈H₂₆O₄, and a fermentable sugar.

According to Mellor (*A. J. P.*, 1898, 23, 54, 136) the best process for estimating glycyrrhizin is as follows: The best menstruum with which to treat the commercial powdered extract is a mixture of 40 mls ammonia water, 240 mls of alcohol, and sufficient water to make a liter. After extraction, filter, and precipitate with diluted sulphuric acid. Of twelve samples examined, the highest was a Greek licorice with 27.78 per cent., and the lowest a Spanish with 5.28 per cent. of glycyrrhizin. Of insoluble matter, the highest was a Spanish with 36.52 per cent., and the lowest a Greek with 5.95 per cent. The average yield, however, was strongly in favor of American licorice. In determining the per cent. of glycyrrhizin in the commercial extract, the tobacco manufacturers dissolve 10 Gm. in 100 mls of water, add 200 mls of alcohol, and allow it to stand over night. The insoluble matter will then have mostly settled; the filtrate may be acidulated with sulphuric acid, and the precipitated glycyrrhizin dried and weighed. For an improvement on the foregoing method see Dwier's article in the *Analyst* for 1913, p. 367, translated from *Ann. Falsif.*, 1913, p. 252; Also Evans' Sons, Lescher and Webb method. *Proc. A. Ph. A.*, 1911, 57 from *Chem. Ztg.*, 1911, No. 92.

The so called *refined licorice*, found in commerce in small cylindrical pieces not thicker than a pipestem, is prepared by dissolving the impure extract in water without boiling, straining the solution, and evaporating. The object of this process is to separate not only the insoluble impurities, but also the acrid oleoresinous substance which is extracted from the licorice root and is necessarily mixed with the unrefined extract. It is customary to add, during the process, a portion of sugar, gum, flour, starch, or perhaps glue. These additions, or

something equivalent, are necessary to obviate the deliquescent property of the pure licorice. According to Delondre, 15 per cent. of gum is the proper proportion, when this substance is used; Geiseler has found sugar of milk to lessen the disposition of the extract to absorb moisture; but he considers the best addition, on the whole, to be very finely powdered licorice root, which should be used in the proportion of 1 part to 16 of the purified extract. (*A. J. P.*, xxviii. 225.) The preparation is sometimes attacked by small worms, probably in consequence of the farinaceous additions. Excellent licorice is prepared in some parts of England, from the root cultivated in that country. The Pontefract cakes are small lozenges of licorice made in the vicinity of Pontefract, England. For methods of assaying extract of licorice, see *A. J. P.*, 1896, 663; also 1898, 23, 136.

Uses.—Licorice has some demulcent property and is a popular addition to various lozenges. In large quantities it is somewhat laxative. Its most important role in medicine, however, is for the purpose of disguising the taste or covering the acrimony of various drugs such as quinine or ammonium chloride. It is also used to impart consistency to pills and troches.

Off. Prep.—Trochisci Ammonii Chloridi, U. S.; Trochisci Cubebae, U. S.

EXTRACTUM GLYCYRRHIZAE PURUM. U. S. (Br.)

PURE EXTRACT OF GLYCYRRHIZA Ext. Glycyrrii. Pur.

Extractum Glycyrrhizas, *Br.*; Extract of Liquorice; Extractum Glycyrrhizae Depuratum, Succus Liquiritiae, Depuratus; Extrait de Reglisse pur, *Fr.*; Succus Liquiritisiae depuratus, *P. G.*; Gereinigter Sussholzaaft, Reines.Lakriz, *G.*

"Glycyrrhiza, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains];

Ammonia Water, one hundred and fifty mils [or 5 fluidounces, 33 minims]; Water, Chloroform Water, each, a sufficient quantity. Mix the ammonia water with three thousand mils [or 101 fluidounces, 212 minims] of water, and, having moistened the powder with one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms] of the mixture, allow it to macerate in a closed vessel for twenty-four hours. Then pack it lightly in a cylindrical percolator, and gradually pour upon it, first the remainder

of the menstruum, and then chloroform water, until the glycyrrhiza is exhausted. Evaporate the liquid in a porcelain dish on a water bath, to a pilular consistence." *U. S.*

"Licorice Root, in No. 20 powder, 1000 grammes; Chloroform Water, 5000 millilitres. Mix the Licorice Root with one-half of the Chloroform Water; set aside for twenty-four hours; strain; press; to the pressed marc add the remainder of the Chloroform Water and set aside for six hours; strain; press; mix the strained liquids; heat to 100° C. (212° F.); strain through flannel; evaporate to a soft extract." *Br.*

The necessity for a pure extract of licorice must be apparent to every pharmacist; the very variable quality of the commercial extract has frequently led to disappointment. The official process affords a preparation which is unexceptionable, the ammonia rendering the glycyrrhizin soluble, yet care must be taken in its evaporation, as it is very easily injured by too much heat, which gives it an empyreumatic taste, destroying at once its usefulness as an agreeable adjuvant. Extract of licorice is incompatible with acids of all kinds which precipitate the glycyrrhizin.

Off. Prep.—Mistura Glycyrrhizae Composita, *U. S.*; Mistura Ammonii Chloridi, *N. F.*

EXTRACTUM HYDRASTIS. U. S.

EXTRACT OF HYDRASTIS Ext. Hydrast. [Extract of Golden Seal, Powdered Extract of Hydrastis]

"Extract of Hydrastis yields not less than 9 per cent. nor more than 11 per cent. of the ether-soluble alkaloids of hydrastis. One gramme of the Extract represents about four grammes of hydrastis." *U. S.*

"Hydrastis, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]; Tartaric Acid, five grammes [or 77 grains]; Alcohol, Magnesium Oxide, Starch, dried at 100° C. (212° F.), each, a sufficient quantity. Dissolve the tartaric acid in one thousand mils [or 33 fluidounces, 6½ fluidrachms] of alcohol, moisten the drug with sufficient of this solution and pack in a cylindrical percolator; then add enough of the acidified alcohol, followed by alcohol if necessary, to saturate the powder and leave a stratum above it. When the liquid

begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, adding alcohol as required, until the drug is exhausted. Recover the alcohol from the percolate by distillation, and evaporate the residue to a soft extract, with frequent stirring, at a temperature not exceeding 70° C. (158° F.). Add fifty grammes [or 1 ounce av., 334 grains] of a mixture of one part of magnesium oxide and three parts of the dried starch, mix thoroughly and spread the mass in a thin layer on glass or tinned-metal plates or in a porcelain dish and continue the drying in an air bath at a temperature not exceeding 70° C. (158° F.), until thoroughly dry. Then reduce the extract to a fine powder and weigh it. Assay a portion of this product as directed below, and, from the alkaloidal content thus determined, ascertain by calculation the amount of alkaloids in the remainder of the powder and add to this enough of the mixture of magnesium oxide and dried starch, made in the same proportion as before, to make the finished Extract contain 10 per cent. of the ether-soluble alkaloids of hydrastis. Mix the powders thoroughly, pass the Extract through a fine sieve, transfer it to small, wide-mouthed bottles and stopper them tightly." *U. S.*

"Assay.—Introduce 3 Gm. of Extract of Hydrastis into a 250 mil flask, add 10 Gm. of washed sand and mix thoroughly. Then add 150 mils of ether and 5 mils of ammonia water. Shake the mixture vigorously every ten minutes during a half hour, and when the dregs have settled decant 100 mils of the clear liquid, representing two grammes of the Extract. Proceed as directed under *Belladonna Radix*, eleventh line of the Assay, beginning with the word "Filter," modifying the process there given by using ether instead of chloroform for the final shaking out of the alkaloids, and drying the residue to constant weight at 100° C. (212° F.), instead of titrating it. The weight will be the amount of ether-soluble alkaloids from two grammes of Extract of Hydrastis," *U. S.*

Uses.—This extract was introduced into the U. S. P. IX to furnish a convenient method of administering hydrastis (see Hydrastis).

Dose, five to ten grains (0.3-0.6 Gm.).

EXTRACTUM HYOSCYAMI. U. S., Br.

EXTRACT OF HYOSCYAMUS Ext. Hyosc.

"Extract of Hyoscyamus yields not less than 0.22 per cent. nor more than 0.28 per cent. of the alkaloids of hyoscyamus. One gramme of the Extract represents about four grammes of hyoscyamus." U. S. " Extract of Hyoscyamus contains in 100 grammes 0.3 gramme of the alkaloids of Hyoscyamus Leaves." *Br.*

Extract of Henbane; Extrait de Jusquiame (feuille), *Fr. Cod.*; Extractum Hyoscyami, *P. G.*; Bilsenkrantextrakt, *G.*; Estratto di giusquiamo idroalcoolico. *It.*; Extracto alcoholico de beleno, *Sp.*

"Hyoscyamus, in No. 40 powder, one thousand grammes [or 35 ounce's av., 1.20 grains]; Glucose, Alcohol, Water, each, a sufficient quantity. Moisten the powder with sufficient of a mixture of three volumes of alcohol and one volume of water, pack it firmly in a cylindrical percolator and add enough menstruum, using the same proportion of alcohol and water as before, to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding menstruum of the same strength until the drug is exhausted. Recover the alcohol by distillation and evaporate the residue, with frequent stirring, at a temperature not exceeding 70° C. (158° F.), until it is reduced to a pilular consistence. Mix the mass thoroughly and weigh it. Assay a portion of this extract as directed below, and, from the alkaloidal content thus determined, ascertain by calculation the amount of alkaloids in the remainder of the mass and to this add enough glucose to make the finished Extract contain 0.25 per cent. of the alkaloids of hyoscyamus. Mix thoroughly." *U. S.*

"Hyoscyamus Leaves, in No. 40 powder, Alcohol (70 per cent.) of each, a sufficient quantity. Reduce ten grammes of the Hyoscyamus Leaves to No. 60 powder, and determine the proportion of alkaloids present by the process described under 'Belladonna Folia.' Moisten one thousand grammes of the Hyoscyamus Leaves with two hundred and fifty millilitres of the Alcohol, pack firmly in a percolator, and percolate with more of the Alcohol until four-thousand millilitres of percolate have been obtained. Determine the proportion of total solids in the percolate by evaporating twenty millilitres, drying the residue at 80° C. (176° F.),

and weighing. Determine also the proportion of alkaloids in the percolate by the process described under 'Tinctura Belladonnae.' Having thus determined the proportion of total solids and of alkaloids in the percolate, proceed as directed under (Extractum Belladonnae Siccum' to prepare a dry Extract of Hyoscyamus containing 0.3 per cent. of alkaloids. Examined by the process described under 'Extractum Belladonnae Siccum,' Extract of Hyoscyamus is found to contain in 100 grammes 0.3 gramme of the alkaloids of Hyoscyamus Leaves. *Limit of error* 0.015 gramme in excess or defect." *Br.*

"This Extract may be used when the Extractum Hyoscyami of the International Agreement is required. It contains 0.3 per cent. of the alkaloids of Hyoscyamus Leaves." *Br.*

" **Assay.**—Proceed as directed under Extractum Belladonna Foliorum (Pilular), modifying the process there given by using 5 Gm. of Extract of Hyoscyamus instead of 2 Gm. of extract of belladonna leaves. Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 28.92 milligrammes of the alkaloids of hyoscyamus." *U. S.*

The U. S. P. IX introduced a special process for this extract, instead of evaporating the fluid extract as did the U. S. P. VIII. The British Pharm., 1914, discarded the process for making the extract from the fresh leaves and adopted percolation and evaporation of the percolate of dried leaves so that both pharmacopoeias are practically in accord. The strength is not quite the same, the U. S. P. IX requires not less than 0.22 per cent. nor more than 0.28 per cent. of alkaloids while the Br. Pharm., 1914, requires not less than 0.3 per cent. of alkaloids. For an account of the disadvantages of the extract from the fresh leaves see U. S. Dispensatory, 19th ed., p. 478.

Dose, from one to two grains (0.065-0.13 Gm.).

Off. Prep.—Pilulae Cartharticae Vegetabiles, *N. F.*; Pilula Colocynthidis et Hyoscyami, *Br. (N. F.)*; Pilulae Laxativse Post Partum, *N. F.*

EXTRACTUM KRAMERIAS. Br.

EXTRACT OF KRAMERIA

Extract of Rhatany; Extractum Ratanhae; Extrait de Ratanhia, *Fr. Cod.*;

Ratanhtextrakt, *G.*; Estratto di ratania acuoso, *It.*; Extracto acuoso de ratania, *Sp.*

"Exhaust Krameria Root, in No. 10 powder, with Distilled Water by the *percolation process*; evaporate the percolate to dryness." *Br.*

This extract was deleted from the U. S. P. IX, but has been introduced in the N. F. IV as a powdered extract (see Part III). In the U. S. P. VIII it was made by percolating' the drug with water and evaporating the liquid as in the British process above. The wood of the root yielded to Procter only 6.8 per cent. of extract, while the bark separated from the wood yielded 33 per cent. As the wood is of difficult pulverization, the inference is obvious that, in powdering the roots, the ligneous portion may be rejected with advantage. (*A. J. P.*, xiv, 270.) As a prolonged exposure of the infusion to the air is attended with the absorption of oxygen and the production of insoluble apothem, it is desirable that the evaporation should be conducted rapidly, or in a vacuum. There scarcely appears to be occasion, in the case of rhatany, for heating and filtering the infusion before evaporation as required by the U. S. P. VIII process as the only use of which is to get rid of albumen, and this is not among the recognized ingredients of the root.

Very inferior extracts of rhatany are often sold. Such is the South American extract, which has been occasionally imported. As the product obtained by decoction is greater than that afforded by the official plan, the temptation to substitute the former is not always resisted, although it has been shown to contain nearly 50 per cent. of insoluble matter. Some druggists prepare the extract with an alcoholic menstruum, with a view to the greater product, but the extract thus prepared has from 20 to 30 per cent. less of the active principle than the official.

Extract of krameria should have a reddish-brown color, a smooth shining fracture, and a very astringent taste, and should be almost entirely soluble in water. Its virtues may be considered as in proportion to its solubility. It is much used for all the purposes for which the astringent extracts are employed.

Dose, from five to twenty grains (0.32-1.3 Gm.).

Off. Prep.—Trochiscus Krameriae, *Br.*; Trochiscus Krameriae et Cocainae, *Br.*

EXTRACTUM MALTI. U. S.

EXTRACT OF MALT Ext. Malt.

Essence (Extrait) de Malt, *Fr.*; Malzextrakt, *G.*

“Malt, in coarse powder, not finer than No. 12, one thousand grammes [or 35 ounces av., 120 grains]; Water, a sufficient quantity. Pour one thousand mils [or 33 fluidounces, 6¹/₂ flui-drachms] of water upon the powder contained in a, suitable vessel and macerate for six hours, then add four thousand mils [or 135 fluidounces, 122 minims] of water, heated to 60° C. (140° F.), and digest the mixture for one hour on a water bath at a temperature not exceeding 60° C. (140° F.). Strain the mixture, express, filter the strained liquid, and, by means of a water bath or vacuum apparatus, evaporate the liquid, at a temperature not exceeding 60° C. (140° F.), until it has a specific gravity of not less than 1.350 nor more than 1.400 at 25° C. (77° F.).” *U.S.*

Under the name of extract of malt, two distinct preparations have been put upon the market, the one being a liquid similar to beer, the other, the official extract prepared from malt, composed chiefly of dextrin and glucose, with some albumen and phosphates. The object of the U. S. process is to obtain all of the soluble principles of malt in a permanent form. To secure this, strict attention to the details of the process is necessary. Good extract of malt should contain no starch, have the consistence of thick honey, a brown color, and should be free from empyreumatic taste. A great deal of commercial extract of malt is adulterated with glucose to a surprising extent. A dry extract of malt has come into extensive use as an infant's food, made by artificially drying the thick syrupy extract. It is in the form of a straw-colored, coarse powder, and is given dissolved in milk or water.

O. F. Romer and H. R. Randoll of Brooklyn, have patented several improvements in the process of making extract of malt,—namely, 1, the properly ground malt is treated with an alkaline solution, in order to neutralize the fatty acids which usually impart a bad taste to the product; 2, the extract is separated from the solid matters by pressing in press cloths, whereby it is obtained as a clear liquid with scarcely any loss. (*N. R.*, 1880, 179.) Pharmaceutically, extract of malt has been used as an emulsifying agent; it makes a good basis for a cod liver oil emulsion, for which purpose it is admirably adapted therapeutically.

For therapeutic properties see *Maltum*.

Dose, from one to four fluidrachms (3.75 to 15 mils).

Off. Prep.—Emulsum Olei Morrhuæ cum Malto, *N. F.*

EXTRACTUM RHEI. U. S., Br.

EXTRACT OF RHUBARB Ext. Rhei [Powdered Extract of Rhubarb]

"One gramme of the Extract represents two grammes of rhubarb." *U. S.*

Extractum Rhei Alcoholicum; Extrait de Rhubarbe, *Fr. Cod.*; Extractum Rhei, *P. G.*; Rhabarberextrakt, *G.*; Estratto di rabarbaro acquoso. *It.*; Extracto acuoso de ruibarbo, *Sp.*

"Rhubarb, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]; Magnesium Oxide, fifty grammes [or 1 ounce av., 334 grains]; Starch, dried at 100° C. (212° F.), Alcohol, Water, each, a sufficient quantity to make five hundred grammes [or 17 ounces av., 279 grains]. Moisten the drug -with sufficient of a mixture of four volumes of alcohol and one volume of water, pack it in a cylindrical percolator and add enough of this menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding menstruum of the same proportion of alcohol and water as before until the drug is exhausted. Recover the alcohol from the percolate by distillation at as low a temperature as practicable, and continue distillation until a residue of syrupy consistence remains in the still. Transfer this to a shallow dish, rinse the still with a little warm menstruum, add the rinsings to the residue in the dish, and evaporate the mixture to dryness, with frequent stirring, at a temperature not exceeding 70° C. (158° F.). Weigh the dry extract and add the magnesium oxide and sufficient of the dried starch to make the product weigh five hundred grammes [or 17 ounces av., 279 grains]. Reduce the mixture to a fine powder, mix thoroughly, pass the Extract through a fine sieve, transfer it to small, wide-mouthed bottles and stopper them tightly." *U. S.*

"Exhaust Rhubarb, in No. 20 powder, with Alcohol (60 per cent.) by the percolation process. Recover most of the alcohol from the percolate by distillation, and evaporate the residual liquid to dryness." Br.

The British extract (1914) is now nearly identical with the U. S. preparation; the menstruum used for the former is, however, slightly more aqueous. Rhubarb yields all its active matter to water and alcohol; but, unless the evaporation be performed with great care and with a moderate heat, it is certain that the purgative principle is to a greater or less extent injured or dissipated in the process, and the extract may thus become even less efficient than the root. When properly prepared, the extract has decidedly the peculiar odor of rhubarb. Dose, from two to ten grains (0.13-0.65 Gm.).

EXTRACTUM SUMBUL. U.S.

EXTRACT OF SUMBUL Ext. Sumbul

Extract of Muskroot; Extrait de Racine de Sumbul, *Fr.*; Sumbulwurzelextrakt, Moschuswurzelextrakt, *G.*

"Sumbul, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, Water, each, a sufficient quantity. Moisten the powder with sufficient of a mixture of four volumes of alcohol and one volume of water and pack it in a cylindrical percolator; then add enough of this menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding menstruum of the same strength until the drug is exhausted. Recover the alcohol from the percolate by distillation and evaporate the residue with frequent stirring, at a temperature not exceeding 70° C. (158° F.), to a pilular consistence." *U. S.*

Dose, two to five grains (0.13-0.32 Gm.).

EXTRACTUM TARAXACI. U. S., Br.

EXTRACT OF TARAXACUM Ext. Tarax.

Extract of Dandelion; Extrait de Dent-de-lion, *Fr.*; Lowenzahnextrakt, *G.*; Estratto di tarassaco acquoso, *It.*

"Taraxacum, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, Water, each, a sufficient quantity. Mix one hundred and twenty-five mls [or 4 fluidounces, 109 minims] of alcohol with eight hundred and seventy-five mls [or 29 fluidounces, 282 minims] of water, and, having moistened the powder with a portion of the mixture, pack it in a cylindrical percolator, then add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for twenty-four hours. Then allow the percolation to proceed, gradually adding menstruum of the same strength until the drug is exhausted. Recover the alcohol from the percolate by distillation and evaporate the residue with frequent stirring, on a water bath, to a pilular consistence." U. S.

"Crush Taraxacum Root; press out the juice; allow the starchy matter to subside; decant; heat the liquid to 100° C. (212° F.), and maintain the temperature for ten minutes; strain; evaporate to a soft extract." *Br.*

The inspissated taraxacum juice of the former U. S. Pharmacopoeias has been superseded by the present hydro-alcoholic extract, because of the very variable quality of the former; if the root is of good quality a better extract can be made by percolation and evaporation in the usual way.

The extract made from the juice is undoubtedly stronger when prepared from the root alone than from the whole plant. It is important that the root should be collected at the right season. The juice expressed from it in the spring is thin, watery, and of a feeble flavor; in the latter part of the summer, and in autumn, thick, opaque, cream-colored, very bitter, and abundant, amounting to one-third or one-half its weight. It may be collected in August, and afterwards until severe frost. According to Squire, frost has the effect of diminishing the bitterness and increasing the sweetness of the root. An extract prepared by inspissating the juice is more efficient than that prepared in the old way by decoction. The inspissation should be effected by exposing the juice in shallow vessels to a current of warm dry air, or by evaporation in a vacuum, and should not be unnecessarily protracted. Long exposure during evaporation changes the bitterness of the juice into sweetness, which is a sign of inferiority. In the British process it is wisely directed that before the evaporation of the juice it shall be exposed for a short time to a heat sufficient to coagulate the albumen, which is then separated and

rejected as useless; it is indeed injurious, by favoring decomposition. As often found in the shops, the extract is dark-colored, sweet, and in all probability nearly inert. Houlton took more than an ounce of it in a day, without any sensible effect. (*P. J.*, i, 421.) When prepared from the root and leaves together, it has a greenish color. Brande states that one cwt. of the fresh root affords from twenty to twenty-five pounds of extract by decoction in water. The expressed juice yields from 11 to 25 per cent. of extract, the greatest product being obtained from plants collected in November, and the least in April and May. This extract deteriorates by keeping. It is conveniently given in an aromatic water.

Dose, from fifteen grains to a drachm (1-3.9 Gm.) three times a day.

EXTRACTUM VIBURNI PRUNIFOLII. U. S.

EXTRACT OF VIBURNUM PRUNIFOLIUM Ext. Viburn. Prun. [Powdered Extract of Viburnum Pruniifolium]

“One gramme of the Extract represents five grammes of viburnum prunifolium.” U. S.

“Viburnum Prunifolium, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains] ; Magnesium Oxide, five grammes [or 77 grains]; Starch, dried at 100° C. (212° F.), Diluted Alcohol, each, a sufficient quantity, to make two hundred grammes [or 7 ounces av., 24 grains]. Moisten the powder with sufficient diluted alcohol and pack it in a cylindrical percolator; then add enough diluted alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, adding diluted alcohol as required until the viburnum prunifolium is exhausted. Recover the alcohol from the percolate by distillation at as low a temperature as practicable and evaporate the residue to a soft extract in a shallow dish on a water bath, at a temperature not exceeding 70° C. (158° F.). Add the magnesium oxide, incorporate it thoroughly, spread the extract on glass plates and dry it by exposure to currents of warm air. Reduce the extract to a fine powder, weigh it, and add sufficient of the dried starch to make the finished product weigh two hundred grammes [or 7 ounces av., 24 grains]. Mix the powder thoroughly, pass the Extract through a fine sieve, transfer it to small, wide-mouthed bottles and stopper them

tightly." U. S.

Dose, five to ten grains (0.3-0.65 Gm.).

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Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Fabiana. *Fabiana imbricata* Ruiz and Pavon. *Pichi*. (Fam. *Solanaceae*)—This is a small shrub growing in Bolivia, Peru, Chili and the Argentine Republic. The plant somewhat resembles a Juniper. The branches are brownish-gray and about 5 mm. in diameter; the wood is yellowish and tough; leaves scale-like, about 1 mm. in length, closely imbricated and bluish-green; the flowers are about 12 mm. in length and possess a white or purplish corolla; the fruit is a capsule containing a few sub-globular seeds. The odor of the drug is aromatic and the taste bitter and terebinthinate. For microscopic structure, see *Ph. Ztschr. f. Russland*, 1891, No. 44; *Apoth. Zeit.*, 1892, p. 22.

A. B. Lyons obtained from it a fluorescent body resembling sesculin, a neutral crystalline principle, some volatile oil, resin, and apparently traces of an alkaloid. (*A. J. P.*, 1886, 65.) Henry Trimble and J. M. Schroeter (*A. J. P.*, 1889, 407) considered the crystalline principle to be a resin, and gave it the formula $(C_{18}H_{31}O_2)_x$. H. Kunz-Krause (*A. J. P.*, 1900, p. 80) made a full study of pichi and found a tannin which he named *fabiana-tannoid*, a fluorescent substance proven to be *chrysotropic acid* (β -methyl aesculetin), $C_9H_5(CH_3)O_4$, while no alkaloids are present, the sole basic principle being choline. The volatile oil he names *fabianol* and gives it the formula $C_{54}H_{90}O_2$. The resin he calls *fabiana-resin* and gives to it the formula $(C_{18}H_{30}O_2)_3$. The resin appears in microscopical crystals, melting at 280° C. The tannin proved to be like caffetannic acid, which Kunz-Krause had previously shown to be *glycosyl-dioxy-cinnamic acid*. It contains volatile oil, a characteristic soft resin and tannin.

Pichi appears to be a terebinthinate diuretic, to which also are attributed tonic and cholagogue properties. It has been used to a considerable extent in the treatment of acute and chronic vesical catarrh, giving especially favorable results in cases in which the urinary irritation is kept up by gravel. It is said even to calm the irritability and aid in the expulsion of renal, urethral, or cystic calculi. It has been further recommended in the treatment of jaundice and dyspepsia, with lack of biliary secretion. It is somewhat irritating, and is usually said to be contra-indicated by the existence of organic disease of the kidneys; but cases have been reported in which renal hemorrhage connected with Bright's disease has been greatly benefited by the remedy. It has also been employed in gonorrhoea and in gonorrhoeal prostatitis. The solid extract may be used in the dose of from two to ten grains (0.13-0.65 Gm.); the

fluidextract, in the dose of from ten to forty minims (0.6-2.5 mls). It is probable that the resinoid precipitate, made from a strong tincture by means of water, would be the best preparation of the drug. The fluidextract does not mix with water unless the solution be made alkaline. It may be administered in capsules.

Fig. *Ficus*. N. F. IV (U. S. P. VIII). *Caricae*. *Ficus Passa*, *Fici*, *Fructus Caricae*. *Figue*, Fr. Cod. *Feigen*, G. *Fichi*, It. *Higos*, Sp.—"The partially dried fruit of *Ficus Carica* Linne (Fam. *Moraceae*)."
N. F. "The dried fleshy receptacles of *Ficus Carica*, Linn." Br., 1898.

The genus *Ficus* yields a number of economic products. Many species possess a milky juice containing caoutchouc, as *F. elastica* Roxb., of Sumatra, etc. Some of the juices are employed externally as well as internally, as that of *F. indica* L. Some possess anthelmintic properties, as *F. anthelmintica* Mart. Some yield gum lac or shellac as a result of the puncture of an insect, as *F. religiosa* L., *F. laccifera* Roxb.; and some are esteemed for their fruits, as *F. Carica* L., *F. religiosa* L., etc.

Ficus Carica, or fig tree, though often not more than twelve feet high, sometimes rises in warm climates twenty-five or even thirty feet. Its trunk, which, seldom exceeds seven inches in diameter, is divided into numerous spreading branches, covered with a brown or ash-colored bark. Its large, palmate leaves, usually divided into five obtuse lobes, are deep green and shining above, pale green and downy beneath, and stand alternately on strong, round foot-stalks. The flowers are situated within a common receptacle, placed upon a short peduncle in the axils of the upper leaves. This receptacle, the walls of which become thick and fleshy, constitutes what is commonly called the fruit; though this term is, strictly speaking, applicable to the small seed-like bodies found in great numbers on the internal surface of the receptacle, to which they are attached by fleshy pedicles. Cultivation has produced in the fig, as in the apple and peach, a great diversity in shape, size, color, and taste. It is usually, however, turbinate, or top-shaped, umbilicate at the large extremity, of the size of a small pear, of a whitish, yellowish, or reddish color, and of a mild, mucilaginous, saccharine taste. The dried figs can be partially restored to their original shape by soaking. The fig tree is supposed to have come originally from the Levant. It was introduced at a very early period into various parts of the south of Europe, and is now very common throughout the whole basin of the Mediterranean, particularly in Italy and France. Large numbers of Syrian fig trees were planted in the Pomona Valley, California, in 1890, and California figs are now commercial articles. To hasten the ripening of the fruit, it is customary to puncture it with a sharp pointed instrument covered with olive oil. *Caprification* consists in attaching branches of the wild fig tree to the cultivated plant. The fruit of the former contains great numbers of the eggs of insects of the genus *Cynips*, the larvae of which, as soon as they are hatched, spread themselves over the cultivated fruit, and, by conveying the pollen or the male organs over which they pass to the female florets, hasten the impregnation of the latter, and cause to quickly come to perfection the fig which might otherwise ripen very slowly, or wither and drop off before maturity. In California the great difficulty in cultivating figs was found to be to get a *Cynips* which would flourish in the climate. According to Landerer, the unripe fig contains an irritant juice, which inflames the skin, and may

even disorganize it. (See A. J. P., xxxiii, 215.) The figs, when perfectly ripe, are dried by the heat of the sun, or in ovens. Those imported into this country come chiefly from Smyrna, packed in drums or boxes. They are more or less compressed, and are usually covered in cold weather with a whitish saccharine efflorescence, which softens in the middle of summer and renders them moist. The best are yellowish or brownish, somewhat translucent when held to the light, and filled with a sweet viscid pulp, in which are lodged numerous small yellow achenes. They are much more saccharine than is the fresh fruit. Their chief constituents are grape sugar, and gum or mucilage. An average of several analyses of dried figs as quoted by Konigs (*Nahrungs und Genussmittel*, ate Aufl., Ed. i, 781) gives —water, 31.20; nitrogenous material, 4.01; sugar, 49.79; ash, 2.86. Reckoned on the weight of absolutely dry material, the nitrogenous matter amounted to 5.75 per cent. and the sugar to 72.26 per cent. They are officially described as "usually compressed, of irregular rounded shapes, from 2.5 to 5 cm. in diameter, fleshy, light brown to yellow, frequently with an efflorescence of sugar; summit with a small, scaly orifice; base with a scar or short stalk; internally hollow, with numerous small, brownish-yellow, glossy, and hard akenes. Odor distinctive, fruity; taste sweet, pleasant." *N. F.*

Figs are nutritious, laxative, and demulcent. In the fresh state they are considered, in the countries where they grow, a wholesome and agreeable ailment, and have been employed from time immemorial. They are prone, however, when eaten freely, to produce flatulence, pain in the bowels, and diarrhea. The latex of the fig has been used as an anthelmintic against intestinal parasites. Their chief medicinal use is as a laxative article of diet in constipation. They occasionally enter into demulcent decoctions, and, roasted or boiled, and split open, are sometimes applied as a cataplasm to inflamed gums.

Flindersia. *Flindersia maculosa* (Lindl.) F. Muell. *Leopard Tree*.—This is a tree of New South Wales, belonging to the *Meliaceae*. During the summer it yields large masses of a clear amber-colored gum, which has a pleasant taste and is eaten by the aborigines; it is used as a remedy for diarrhea. Leopard tree gum occurs in pieces as large as pigeons' eggs; dissolves rapidly in cold water, and has been found by J. H. Maiden to contain eighty per cent. of arabin but no metarabin. (*P. J.*, vol. xxi, 1890.)

FLUIDEXTRACTA. U. S. (Br.)

FLUIDEXTRACTS

Extracta Liquida, *Br.*; Fluid Extracts; Extraits liquides, *Fr.*; Extracta fluida, *P. G.*; Fluidextrakte, Flussige Extrakt. *G.*

"Fluidextracts are concentrated liquid preparations of vegetable drugs, containing alcohol either as a solvent or as a preservative, and bearing a uniform relation to the drug used so that one mil of the fluidextract closely represents the activity of one gramme of the air-dried and powdered drug of standard quality." U. S.

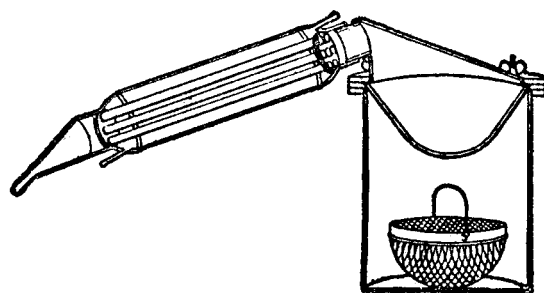
The Latin title *Extractum* ——— *Fluidum* formerly used for Fluid Extracts was dropped by the U. S. P. VIII because of the confusion which resulted from the necessary bringing together of the extracts and fluid extracts due to a strict alphabetical arrangement; the name "*fluidextractum*" is now used for "*fluidextract*" and the latter made one word; this, of course, brings the fluidextract under the letter F instead of the letter E under which extracts and fluidextracts were formerly both classed.

Fluidextracts were first introduced into the U. S. P. of 1850 as a distinct class of preparations, the fluidextract of sarsaparilla being the only one previously directed, either in our own official code or by the British Colleges. Now we have one hundred and fifty-seven that are official in the U. S. P. IX, British Pharm., 1914, and National Formulary IV, besides large quantities 'of non-official fluidextracts annually produced. They are now perhaps the most important class of liquid preparations in use. Their distinctive character is the concentration of the active ingredients of medicinal substances into a small bulk, in the liquid form, a cubic centimeter, mil, or fluidgramme of any one of them now representing a gramme of the crude drug. In addition to convenience of administration, the advantage of these preparations is that, evaporation not being carried so far as in ordinary extracts, the active principles are less liable to be injured by heat. Formerly their main difficulty was the liability of substances in the liquid state to undergo spontaneous decomposition. In the U. S. P. of 1850 this was counteracted by means of sugar and of alcohol, but in 1865 (*A. J. P.*, 1865, p. 50) Taylor proposed the use of glycerin, which was adopted in the U. S. P., 1870, revision. Glycerin, while it exerts a powerful preservative influence, possesses the valuable property of dissolving matters deposited by some of the fluidextracts when made with sugar, as in the old official recipes. Consequently these fluid-extracts were much clearer and better preparations than were the old ones. Subsequent experience with these fluidextracts showed that the use of glycerin should be circumscribed, and that it had been employed too freely in the U. S. P., 1870, formulas. The solvent powers of glycerin are so great that the fluidextracts were frequently loaded with many inert principles, which it dissolved, giving them a dense, rich appearance, without increasing their activity. As the primary object of fluidextracts is concentration, suitable menstrua should in each case be selected with the single object of dissolving and retaining permanently the active constituents of the drug.

The present fluidextracts are of the same strength as those formerly official, and the formulas are based upon the theory that from a given weight of drug an amount of fluidextract shall be made equal in measure to the bulk of the same weight of distilled water; in other words, upon the relation of gramme to millilitre. Although the metric system is admirable in practice, some may prefer to use ordinary weights and measures; in such cases, to make 20 *fluidounces* of a fluidextract 19 *troyounces* of drug will be required, while if *avoirdupois* weight is preferred, the most convenient relation to recollect will be that 50 *avoirdupois ounces* are required to make 48 *fluidounces*, or *three pints*, of a fluidextract. It has been repeatedly proposed to make 50 per cent. tinctures or half-strength fluidextracts, the main object being 'to secure more representative preparations when made on the small scale. Experiments by Sayre, Gregory, Patch, and others prove that half-strength fluidextracts possess no advantages over those of official strength. (*D. C.*, 1897, 119, 147.) The precipitation experienced heretofore, when the evaporated weak percolate was added to the reserved portion, is considerably diminished by causing the former to be evaporated to a soft extract. This precipitation, formerly noticed more particularly in alcoholic fluidextracts, was due to the greater volatility of the alcohol in the weak percolates, which, when evaporated, left the residue to a great extent aqueous; when this was added to the strongly alcoholic reserved portion, a precipitation of resinous and frequently active matter took place, which necessitated the storing of the fluidextract until precipitation ceased, and subsequent filtration. This is not altogether avoided by evaporating to a soft extract, but the loss of activity through precipitation is thus greatly diminished. Fluid-extracts invariably deposit insoluble matter upon standing, and those made in warm weather, owing to the greater solvent powers of the menstrua (due to the elevated temperature) are found to deposit more freely than the same kind of fluidextracts if made in the winter time with menstrua correspondingly reduced in temperature.

A useful distillatory apparatus has been contrived by Joseph P. Remington for recovering alcohol from weak percolates, and for general pharmaceutical uses. The still shown in the cut is the new form. It is made of tinned copper, the still body holding about three gallons; the condenser has seven straight tubes surrounded with the cold water introduced by a rubber tube from a hydrant or bucket of water placed higher than the still, and carried off as it becomes warmed by the tube

shown at the upper part of the condenser.



By a siphon arrangement not shown in the cut, the still can be fed from a reservoir while distillation is in progress, thus using a three gallon where otherwise a much larger one would have been necessary. The joints are carefully ground, and troublesome lutes and water joints are entirely superseded. The condenser, having straight tubes instead of a spiral one, is easily cleaned, and is powerful enough to condense a gallon of alcohol in thirty minutes. The still may be set into a kettle partly filled with water and thus used as a water bath, or a shallow tinned copper dish with flat rim, which accompanies the still, may be placed between the two brass ring bands and clamped securely. (*A. J. P.*, May, 1879.) Remington's *Practice of Pharmacy*, Fourth ed., page 158.

For valuable papers on percolation and fluid-extracts, by William Procter, E. R. Squibb, Alonzo Robbins, and others, see *Proc. A. Ph. A.*, 1859, p. 265; 1863, p. 222; *A. J. P.*, 1878, pp. 209, 329; 1873, pp. 85, 189.

Several methods have been suggested for preparing fluidextracts more economically. The use of acetic acid as a menstruum to replace alcohol or diluted alcohol has the merit of economy. (See Extracta, also *A. J. P.*, 1899, 1-14; *Proc. Pennsylvania Pharm. Assoc.*, 1898, 116; *A. J. P.*, 1898, 543; *A. J. P.*, 1899, 67; *Ph. Era*, 1898, 796; *Proc. Minnesota Pharm. Assoc.*, 1902, 103; *West. Drug.*, 1903, 652.)

The most important modification is the plan of repercolation, as proposed by E. R. Squibb, for this class of preparations as well as the dry extracts.

Repercolation.—In consequence of the existing high price of alcohol, it is important to adopt some plan by which, while the ends aimed at are attained, the consumption of the menstruum used in percolation may be diminished. This object has been accomplished, to a considerable extent, by E. B. Squibb, of Brooklyn, N. Y., by a modification of the process of

percolation to which he has given the name at the head of the present paragraph. As defined by the author, repercolation consists in the successive application of the same percolating menstruum to fresh portions of the substances to be percolated. The result is that the same menstruum, acting repeatedly on unexhausted portions of the substance, becomes concentrated to the greatest possible extent, so that much of the menstruum is saved, while subsequent evaporation is avoided, which is itself an object of great importance in the preparation of extracts. It is obvious that repercolation is not applicable to the preparation of infusions, decoctions, tinctures, etc., in which the object in general is less a high degree of concentration than precision in the strength of the preparation, and consequently in the dose. It is to the extracts and fluidextracts that the process is peculiarly adapted, and there now remains no doubt whatever of the great value of the improvement. One of its disadvantages is that the substance treated is less completely exhausted than when the proceeding is inverted, and fresh portions of menstruum are made to act on the same material until the latter is deprived of all its soluble matter. But the loss in this way is trifling, compared with the gain when a menstruum as high-priced as alcohol is employed.

Another practical disadvantage is the inconvenience of keeping the weak percolates, as these have to be labelled, numbered, and stored away for use until the same operation is repeated. In deciding when to adopt it, the operator will, of course, be influenced by the relative value of the drug and the menstruum. In order to secure the most favorable results in repercolation, certain methods of proceeding are advisable in various steps of the process, differing with the character of the substance to be acted on; and these can be determined only by a careful study, confirmed by repeated experiment. Squibb used repercolation exclusively on the large scale in the manufacture of extracts and fluidextracts, and applied it especially to the preparation of fluidextracts of cinchona; and since his first paper, which was reproduced in the 14th revision of the U. S. Dispensatory, p. 1164, he introduced several improvements, which are intended to make the process useful to the apothecary in his every-day work. See Type Process C.

The plan of N. Spencer Thomas consists in exposing the substance to be acted on to successive expressions, by means of a press, with the menstruum divided into different portions, so that fresh portions of liquid are brought to act on the same solid body in different stages of

exhaustion, and then mixing the expressed liquids. The due proportion between the weight of the medicine and the bulk of the ultimate fluidextract is secured by regulating the measure of the last added portion of menstruum, which, in the process as described by Thomas, is the third. Whatever may be the advantages of this method—and it is not without its recommendations—it is liable to the objection of loss of alcohol through exposure during expression. Another method of limiting the quantity of alcohol used has been proposed by S. P. Dutfield, of Detroit. It consists in macerating, for from six to ten days, the medicine to be acted on, previously deprived, by means of a vacuum apparatus, of all the air, and of all readily volatilizable matter contained in its pores, with a certain volume of the menstruum, which is forced through a tube into the vacuum pan by atmospheric pressure, and thus brought into the most intimate contact with all parts of the powder. The process is completed by submitting the mass thus impregnated to hydraulic pressure, and, after allowing the liquid to settle in glass carboys, drawing off the clear liquid into bottles. It is obviously inapplicable to substances whose virtues depend in any considerable degree upon readily volatilizable constituents. Campbell (*A. J. P.*, xlii, 17) proposed a method for doing away with the use of heat, which, however, although in some cases it may do well, cannot be relied upon for the complete exhaustion of all drugs. Sixteen troyounces of the powder are moistened with four to six fluid-ounces of the menstruum (usually alcohol), and packed in a glass funnel, a piece of sponge having previously been put in the beak of the funnel; the surface of the powder is covered with a disk of paper, and twelve fluidounces of menstruum poured on. When the sponge becomes saturated, the beak of the funnel is corked tightly and the whole set aside for four days, at the end of which time the percolation may be allowed to proceed without further addition of menstruum. J. W. Mill has called attention to the advantage of separating the powder into fine and coarse parts by means of sieves and packing the finer powder at the bottom.

H. Biroth (*Pharm.*, April, 1877) proposes the method which he termed "*insuccation*" for making non-alcoholic fluidextracts; the advantages claimed for it are simplicity and economy. Colaz prepared fluidextracts from fresh plants by bruising and crushing them, and placing the mass in a dialyzer suspended in 90 per cent. alcohol; when the dialysis is completed, the liquid is evaporated to free it from alcohol, the remaining aqueous liquid retaining the active constituents in the proportions in which they are found in the plant. (*Ph. Post*, xxix, 271.) Haussmann (*A.*

J. P., 1895, 291), after examining a large number of commercial fluidextracts, recorded his results in tabular form, and considered that there is great variation in the quality, due to deviation from pharmacopoeial processes.

J. U. Lloyd proposes to recover the alcohol which remains absorbed by the residue after percolation, by mixing the wet residues with an equal bulk or less of dry sawdust, and then percolating this with water. (*A. J. P.*, June, 1877.) Wm. M. Thomson, of Philadelphia, devised a very complete method of preparing fluidextracts on a large scale; the principles of his process are maceration and percolation in vacua, and although the principles which have been applied have long been known, and similar apparatus used by Duffield and others, there are many useful practical points which merit a notice in detail. The percolators are egg-shaped, and made of tinned copper; they are capable of being tightly covered, and communicate by means of stopcocks above and below, and iron and stout rubber tubing, with a very efficient double acting air pump. The moistened powder is packed tightly in the percolator, and the cover securely bolted on. The stopcock in the cover is now opened, which communicates with the air pump and a partial vacuum created in the space above the moistened drug; the stopcock is now closed and another stopcock in the cover opened, which communicates by a tube with the reservoir containing the menstruum. The menstruum, of course, quickly penetrates the powder, taking the place of the interstitial air, and when the powder is saturated it is permitted to macerate in vacuo a sufficient length of time. To start percolation, a receiver is connected with the beak of the percolator, and, the air being exhausted from it, the percolate at once makes its appearance. When the flow slackens, air may be forced by the pump in the space above the powder, if desired, and the receiver again exhausted below. In this way, it can be seen, entire control of these powerful physical forces may be secured. The advantages are very apparent in preventing the loss of volatile principles and alcohol, while protecting from chemical change caused by exposure to the air. It is quite possible to make official fluidextracts without recourse to subsequent evaporation of weak percolate. For a cut of this apparatus, see *A. J. P.*, 1882.

Assaying Fluidextracts.—The number of assay processes for fluidextracts was materially increased in the U. S. P. (9th Rev.) for preparations made from alkaloidal drugs. The process in each case

differs but slightly from the process used for the corresponding drug; they will be found in the succeeding pages under their appropriate headings.

A new method of assay for alkaloidal fluid-extracts, especially adapted to the mydriatic leaf drugs in that the interfering chlorophyll is removed, making only one shaking out operation necessary, was proposed by LaWall (*J. A. Ph. A.*, 1912, 29), as follows: Place 25 Gm. of sodium chloride in a 100 mil graduated cylinder, with water sufficient to make 85 mils. Agitate well for 1 minute, then pour upon a dry filter and collect 50 mils of clear filtrate, which can be shaken out as directed in the final shake out of the ordinary assay process, using the solvent directed for the particular drug which is being assayed. The method does not work with cinchona, guarana or other drugs containing large amounts of alkaloids in the form of cincho-tannates.

Fluidextracts U. S. P. IX.

"The fluidextracts of this Pharmacopoeia, with few exceptions, may be classified according to the menstrua used in the extraction of the drugs and the processes of manufacture employed. Several drugs require special manipulation to obtain satisfactory fluidextracts, and for these appropriate formulas have been devised and are printed in full in the text. The following type processes are described, and in each formula the process to be used is designated by reference to the type process:

"Type Process A—In this class are included those fluidextracts that are made with a menstruum of alcohol or a mixture of alcohol and water by the usual process of percolation. Moisten one thousand grammes [or 35 ounces av., 120 grains] of the powdered drug directed with a sufficient quantity of the prescribed menstruum to render it evenly and distinctly damp and to maintain it so, after macerating for six hours in a tightly-covered container. Then pack it in a cylindrical percolator and add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding more menstruum until the drug is exhausted. Reserve the first eight hundred and fifty mils [or 28 fluidounces, 356 minims] of the percolate (unless otherwise specified in the formula);

recover the alcohol from the remainder and concentrate the residue to a soft extract at a temperature not exceeding 60° C. (140° F.); dissolve this in the reserved portion, mix thoroughly, and finally add a sufficient quantity of the menstruum to obtain one thousand mils [or 33 fluidounces, 6½ fluidrachms] or the volume determined by calculation from the assay.

"Type Process B—In this class are included those fluidextracts in which glycerin or an acid is used in the extraction and two menstrea are successively employed. Menstruum I contains the glycerin or acid in definite proportion to the amount of the drug, and Menstruum II, a mixture of alcohol and water intended for completing the exhaustion of the drug. Moisten one 'thousand grammes [or 35 ounces av. 120 grains] of the powdered drug directed with a sufficient quantity of the prescribed Menstruum I, to render it evenly and distinctly damp and to maintain it so after macerating for six hours in a tightly-covered container. Then pack it in a cylindrical percolator, add the remainder of Menstruum I, and, when this has just disappeared from the surface, gradually add Menstruum II, constantly maintaining a stratum of liquid above the drug. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours, and then allow the percolation to proceed slowly, gradually adding Menstruum II until the drug is exhausted. Reserve the first eight 'hundred and fifty mils [or 28 fluidounces, 356 minims] of the percolate (unless otherwise specified in the formula) ; recover the alcohol from the remainder and concentrate the residue to a soft extract at a temperature not exceeding 60° C. (140° F.); dissolve this in the reserved portion, mix thoroughly, and finally add a sufficient quantity of Menstruum II to obtain one thousand mils [or 33 fluidounces, 6½ fluidrachms] or the volume determined by calculation from the assay.

"Type Process C—The process of fractional or divided percolation. This is especially recommended for drugs containing volatile ingredients or constituents injured by exposure to heat. This process may likewise be used as an alternative process in the formulas in which Type Process A is directed. Divide one thousand, grammes [or 35 ounces av., 120 grains] of the powdered drug directed into three portions of five hundred grammes [or 17 ounces av. 279 grains] three hundred grammes [or 10 ounces av. 255 grains] and two hundred grammes [or 7

ounces av. 24 grains] respectively. Moisten the first portion of the drug (500 Gm.) [or 17 ounces av., 279 grains] with a sufficient quantity of the prescribed menstruum to render it evenly and distinctly damp and to maintain it so after macerating for six hours in a tightly-covered container. Then pack it in a cylindrical percolator and add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours and then allow the percolation to proceed slowly, gradually adding more of the menstruum. Reserve the first two hundred mls [or 6 fluidounces, 366 minims] of percolate and continue the process until the additional percolate measures fifteen hundred mls [or 50 fluidounces, 345 minims], the latter being collected in successive portions of three hundred mls [or 10 fluidounces, 69 minims] each.

"Moisten the second portion of the powdered drug (300 Gm.) [or 10 ounces av. 255 grains] with a sufficient quantity of the percolate collected in the preceding operation immediately after the reserved portion, to render it evenly and distinctly damp and to maintain it so after macerating for six hours in a tightly-covered container. Then pack it in a cylindrical percolator and macerate and percolate as directed for the first part of the drug, using as menstruum the several portions of percolate from the preceding operation in the order in which they have been collected, and, if this be insufficient, follow with some of the original menstruum. Reserve the first three hundred mls [or 10 fluidounces, 69 minims] of percolate and continue the process until the additional percolate measures eight hundred mls [or 27 fluid-ounces, 24 minims] collecting the weaker percolate in successive portions of two hundred mls [or 6 fluidounces, 366 minims] each.

" Moisten the third portion of the powdered drug (200 Gm. [or 7 ounces av. 24 grains]) with a sufficient quantity of the percolate collected in the preceding operation immediately after the reserved portion, to render it evenly and distinctly damp and to maintain it so after macerating for six hours in a tightly-covered container. Then pack it in a cylindrical percolator and macerate and percolate as before, using as menstruum the several portions of percolate from the preceding operation in the order in which they have been collected, and, if this be insufficient, follow with more of the original menstruum. Collect five hundred mls [or 16 fluidounces, 435 minims] of percolate and mix this with the two portions previously reserved so as to make one thousand mls [or 33

fluid-ounce's, 6¹/₂ fluidrachms] of finished fluidextract.

"When Type Process C is directed for fluidextracts which are adjusted by assay to a definite alkaloidal standard, collect only four hundred and twenty mils [or 14 fluidounces, 97 minims] of percolate from the third portion of drug instead of the five hundred mils [or 16 fluid-ounces, 435 minims] directed above. Mix this percolate with the two portions previously reserved, assay a portion of the mixture and then adjust its volume, by the addition of the menstruum directed, so that each one hundred mils [or 3 fluidounces, 183 minims] of finished fluid-extract will contain the prescribed amount of alkaloid.

"Type Process D—In this class are included those fluidextracts in which extraction is effected by infusion and percolation with boiling water, alcohol being added to the concentrated liquid as a preservative.

To one thousand grammes [or 35 ounces av., 120 grains] of the ground drug add five thousand mils [or 169 fluidounces, 33 minims] of boiling water, mix thoroughly and allow it to macerate in a covered container for two hours in a warm place. Then transfer the moist drug to a tinned or enameled metallic percolator and allow percolation to proceed, gradually adding boiling water until the drug is exhausted. Evaporate the percolate on a water bath or steam bath to the volume specified and when cold add the alcohol directed and mix thoroughly." U. S.

"In the preparation of fluidextracts by either Process A, B, or C, the rate of percolation must be carefully controlled and, for the quantities directed in the formulas of the Pharmacopoeia, the flow should not exceed ten drops per minute until the reserved percolate is collected, and twenty drops per minute thereafter. As a rule one thousand grammes [or 35 ounces av., 120 grains] of powdered drug may be exhausted by percolation with sufficient menstruum to yield three thousand mils [or 101 fluidounces, 212 minims] of percolate.

"Fluidextracts should be kept in tightly-stoppered containers for one month and then, if perfectly clear, they should be stored in amber-colored bottles protected from sunlight and extremes of temperature. If sedimentation has occurred the clear portion should be decanted, the remainder filtered and the liquids thoroughly mixed before storing.

" The percentage of alcohol in fluidextracts made by type processes A, B,

or C is variable and always less than that in the menstruum employed, due, among other causes, to loss of alcohol by evaporation during manufacture, to the presence of a variable proportion of water in the air-dried drug, and to the extraction from the drug of its soluble constituents, which also often vary greatly in different lots of the same drug. The percentage of alcohol in the finished product can therefore only be ascertained by an actual determination.

FLUIDEXTRACTUM AROMATICUM. U. S.

AROMATIC FLUIDEXTRACT Fldext. Aromat

Extrait liquids aromatique, *Fr.*; Flüssiges Aromatisches Extrakt, *G.*

"Aromatic Powder (see PULVIS AROMATICUS), one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process C, using alcohol as the menstruum." *U. S.*

This is a valuable fluidextract; it is an excellent aromatic in concentrated form, and will be found very useful not only as an addition to liquids when an aromatic is desired, but its concentrated form permits its use in small quantities with dry powders, like pepsin, bismuth subnitrate, etc., when desired for administration. It is rarely used alone.

Dose, from ten to twenty minims (0.6-1.3 mils), diluted with water, or dropped on sugar.

FLUIDEXTRACTUM ASPIDOSPERMATIS. U. S.

FLUIDEXTRACT OF ASPIDOSPERMA Fidext. Aspidosp. [Fluidextract of Quebracho]

"Aspidosperma, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains], Prepare a Fluidextract by Type Process B, using a mixture of one hundred and ten mils [or 3 fluidounces, 345 minims] of glycerin, six hundred and seventy mils [or 22 fluidounces, 315 minims] of alcohol and two hundred and twenty mils [or 7 fluidounces, 211 minims] of water as Menstruum I, and a mixture of two volumes of alcohol and one volume of water as Menstruum II." *U. S.* (See *Aspidosperma*)

Dose, one fluidrachm (3.75 mils).

FLUIDEXTRACTUM AURANTII AMARI. U. S.

FLUIDEXTRACT OF BITTER ORANGE PEEL Fldext. Aurant. Amar.

Extrait liquide d'Ecorce d'Orange amere, *Fr.*; Flussiges Pomeranzenschalenextrakt, *G.*

"Bitter Orange Peel, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process C, using a mixture of three volumes of alcohol and one volume of water as the menstruum." U. S.

This fluidextract is useful as a tonic; when dry, the bitter orange peel having very little oil present, there is necessarily little agreeable orange flavor to the fluidextract. Monroe Bond recommends a *Fluidextract of Sweet Orange Peel*, made with a menstruum of seven parts of alcohol and one of glycerin. (*A. J. P.*, 1873, p. 482.)

Dose, fifteen to thirty minims (0.9-1.8 mils).

Off. Prep.—Vinum Rhei Compositum, IV. F.

EXTRACTUM BELAE LIQUIDUM. Br.

LIQUID EXTRACT OF BAEL

"Bael Fruit, bruised, 1000 grammes; Chloroform Water, 15000 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Macerate the bruised Bael Fruit for twelve hours in five thousand millilitres of the Chloroform Water; pour off and reserve the clear liquid; repeat the maceration a second and a third time for one hour in each case, using' for each maceration five thousand millilitres of the Chloroform Water; press the marc; strain the mixed liquids through flannel. Evaporate to seven hundred and fifty millilitres; cool; add sufficient of the Alcohol to produce the required volume; filter.'" *Br.*

This represents whatever therapeutic virtues may reside in Bael Fruit. (See *Belae Fructus*)

Dose, one to two fluidrachms (3.75-7.5 mils).

FLUIDEXTRACTUM BELLADONNAE RADICIS. U. S. (Br.)

FLUIDEXTRACT OF BELLADONNA ROOT Fldext. Bellad. Rad.

"One hundred mils of Fluidextract of Belladonna Root yields not less than 0.405 Gm. nor more than 0.495 Gm. of the alkaloids of belladonna root." U. S.

"Liquid Extract of Belladonna contains in 100 millilitres, 0.75 gramme of the alkaloids of Belladonna Root." *Br.*

Extractum Belladonnae Liquidum, *Br.*, Liquid Extract of Belladonna; Extrait liquide de Racine de Belladone, *Fr.*; Flussiges Tollkirschenwurzelextrakt, *G.*

"Belladonna Root, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]." *U. S.*

"Prepare a Fluidextract by Type Process A, using a mixture of five volumes of alcohol and one volume of water as the menstruum, and reserving the first eight hundred mils [or 27 fluidounces, 24 minims] of the percolate.

"After dissolving the soft extract in the reserve liquid, assay a portion as directed below, and, from the result thus obtained, ascertain by calculation the amount of alkaloids in the remainder of the liquid and dilute this with enough menstruum to make one hundred mils of the finished Fluidextraet contain 0.45 Gm. of the alkaloids of belladonna root." U. S.

"Belladonna Root, in No. 20 powder, 1000 grammes; Alcohol (90 per cent.), Distilled Water, of each a sufficient quantity. Exhaust the Belladonna Root with a mixture of seven volumes of the Alcohol and one volume of Distilled Water by the repercolation process until from every three grammes of the Root one millilitre of strong percolate has been obtained." *Br.*

Assay.—Introduce 10 mils of Fluidextract of Belladonna Root into a separator and add 10 mils of distilled water and 2 mils of ammonia water. Completely extract the alkaloids by shaking out repeatedly with

chloroform and then extract the alkaloids from the chloroform solution by shaking out repeatedly with weak sulphuric acid until the alkaloids are completely removed. Collect the acid washings in a separator, add ammonia water until the solution is decidedly alkaline to litmus, and completely extract the alkaloids by shaking out repeatedly with chloroform. Evaporate the combined chloroform washings to dryness, dissolve the alkaloids from the residue in exactly 5 mls of tenth-normal sulphuric acid V.S. and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S., using cochineal 1.8. as indicator.

"Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 28.92 milligrammes of the alkaloids of belladonna root (see Proximate Assays, Part III)." U. S.

"Determine the proportion of alkaloids in this strong percolate by the following process: Introduce into a separator 10 millilitres of the strong percolate, 50 millilitres of water, 2 millilitres of diluted sulphuric acid, and 10 millilitres of chloroform. Shake vigorously, set aside until complete separation has taken place, draw off the lower layer, and wash it with two successive portions, each of 10 millilitres, of water acidified with diluted sulphuric acid. Add the washings to the upper layer left in the separator. Make the mixture distinctly alkaline with solution of ammonia, and extract the alkaloids by shaking with three successive portions, each of 10 millilitres of chloroform. Mix the chloroformic solutions, shake with 10 millilitres of water, allow separation to take place, draw off the lower layer into a beaker, and set aside for the chloroform to evaporate. Heat the residue on a water-bath for thirty minutes, add 10 millilitres of N/20 solution of sulphuric acid, warm gently until dissolved, and titrate back with N/20 solution of sodium hydroxide, tincture of cochineal being used as indicator. Deduct the number of millilitres of alkaline solution required from 10; the remainder, multiplied by 0.01446, gives the number of grammes of the alkaloids contained in 10 millilitres of the strong percolate. To the remainder of the strong percolate add sufficient of the alcoholic menstruum to produce .a Liquid Extract of Belladonna containing 0.75 gramme of the alkaloids of Belladonna Root in 100 millilitres. Examined by the foregoing process, Liquid Extract of Belladonna is found to contain in 100 millilitres 0.75 gramme of the alkaloids of Belladonna Root. Limit of error 0.05 gramme in excess or defect. This Liquid Extract contains 0.75 gramme of the alkaloids of Belladonna Root in 100 millilitres; 110 minims contains $\frac{3}{4}$ grain." *Br.*

The British liquid extract, 1914, represented several radical improvements in British pharmacy,—i.e., the use of repercolation with absence of heat in the process, and standardization, thus making the end product bear a definite relation towards the quantity of active constituents found in the root (0.75 per cent.). It is based upon the formula proposed by R. A. Cripps. (*P. J.*, 1895, 795.) It will be observed that the alkaloidal standards of the U. S. and Br. Pharmacopoeias are not identical; the U. S. fluid-extract is made from the standardized drug (belladonna root) (0.45 per cent.); the British liquid extract is made from the unstandardized drug and hence the standard for the liquid extract can be made stronger (0.75 per cent.). The fluidextract of the root is a good preparation, of reddish-brown color, very different in appearance from the deep-green fluidextract of the leaves which is often seen in the market.

Dose, from one to two minims (0.06-0.12 mil) of the British liquid extract, not more than one minim (0.06 mil).

Off. Prep.—Emplastrum Belladonnae, Br.; Extractum Belladonnae Siccum, Br.; Linimentum Belladonnae, U. S., Br.; Unguentum Belladonnae, Br.

FLUIDEXTRACTUM BUCHU. U. S.

FLUIDEXTRACT OF BUCHU Fidext. Buchu.

Extrait liquide de Bucco, *Fr.*; Fliissiges Buccoextrakt, *G.*

"Buchu, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using alcohol as the menstruum." *U. S.*

The menstruum selected for this fluidextraet has been alcohol, although experience has shown that with the weaker alcohol used in the U. S. P. VIII formula it was possible to percolate buchu leaves satisfactorily. We prefer as a menstruum that of the U. S. P. VIII, i.e., alcohol 3, water 1.

This fluidextract is of a dark green color, and shows in a high degree the sensible properties of the leaves. It acquires the odor of mint when long kept, showing that some change takes place in its volatile oil. This

fluidextract affords the best means at our command for the exhibition of buchu.

Dose, thirty minims to a fluidrachm (1.8-3.75 mils), three to five times a day.

Off. Prep.—Elixir Buchu, N. F.

FLUIDEXTRACTUM CANNABIS. U. S.

FLUIDEXTRACT OF CANNABIS Fldext. Cannab. [Fluidextractum Cannabis Indicae, U. S. P. VII]

"When assayed biologically Fluidextract of cannabis produces incoordination when administered to dogs in a dose of not more than 0.03 mil per kilogramme of body weight." U. S.

Extrait liquide de Chanvre Indien, *Fr.*; Flussiges Indisch-Hanfextrakt. *G.*

"Cannabis, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using alcohol as the menstruum. After dissolving the soft extract in the reserve liquid, assay a portion as directed below and from the result thus obtained adjust the volume of the finished Fluidextract to conform to the above biological standard.

"Assay.—Proceed as directed under Cannabis and also under Biological Assays," U. S.

Uses.—The fluidextract of cannabis represents the therapeutic virtues of that drug in a convenient form. The smallness of the dose is an advantage over the tincture and many believe that the extract is injured by the evaporation. Unfortunately the fluidextract, even when properly made, does not retain its powers and after a year is almost worthless. For this reason the commercial samples vary so greatly in power that it is impossible to assign the proper dose. The only satisfactory way to use it is to start in with doses of one or two minims, increasing each day until some effect is obtained.

Dose, one to four minims (0.06-0.25 mil).

Off. Prep.—Collodium Salicylici Compositum, N.F.

FLUIDEXTRACTUM CASCARAE SAGRADAЕ. U. S. (Br.)

FLUIDEXTRACT OF CASCARA SAGRADA Fldext. Case. Sagr. [Fluidextractum Rhamni Purshianae, U. S. VIII]

Extractum Cascarae Sagradae Liquidum, Br.; Liquid Extract of Cascara Sagrada; Extrait liquide de Cascara Sagrada, *Fr.*; Flussiges Cascara-Sagrada-extrakt, *G.*

"Cascara Sagrada, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains];

Alcohol, two hundred and fifty mils [or 8 fluid-ounces, 218 minims]. Prepare a Fluidextract by Type Process D. Evaporate the aqueous percolate to seven hundred and fifty mils [or 25 fluidounces, 173 minims] and when cold gradually add the alcohol and, if necessary, sufficient water to make the product measure one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]." *U. S.* "Cascara Sagrada, in No. 20 powder, 1000 grammes; Alcohol (90 per cent.), 250 millilitres; Distilled Water, sufficient to produce 1000 millilitres. Exhaust the Cascara Sagrada with the Distilled Water by the percolation process; evaporate the percolate to six hundred millilitres; add the Alcohol previously mixed with one hundred and fifty millilitres of the Distilled Water, or with sufficient to produce the required volume." *Br.*

This fluidextract is a good preparation, but the aromatic fluidextract is more largely used.

The emodin strength of this and similar preparations of cascara, which has been arbitrarily set by most manufacturers at 1.50 grammes in each 100 mils of the fluidextract, may be estimated by the method of Vanderkleed. and. Ewe (*Proc. Pa. Pharm. Assoc.*, 1913, p. 325.)

Dose, fifteen minims to one fluidrachm (0.9— 3.75 mils).

Off. Prep.—Extractum Casearae Sagradea Siccum, Br.; Syrupus Cascarae Aromaticus, Br.

FLUIDEXTRACTUM CASCARSE SAGRADAЕ AROMATICUM.

U. S.

AROMATIC FLUIDEXTRACT OF CASCARA SAGRADA **Fldext. Case. Sagr. Arom. [Fluidextractum Rhamni Purshianae** **Aromaticum.U. S. VIII]**

Tasteless Fluidextract of Cascara Sagrada; Extrait liquid Aromatique de Cascara Sagrada, *Fr.*; Bitterloses flussiges Cascara-Sagradaextrakt, *G.*

"Cascara Sagrada, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]; Magnesium Oxide, one hundred and twenty-five grammes [or 4 ounces av., 179 grains] ; Pure Extract of Glycyrrhiza, forty grammes [or 1 ounce av., 180 grains]; Glycerin, two hundred mils [or 6 fluidounces, 366 minims] ; Alcohol, two hundred and fifty mils [or 8 fluidounces, 218 minims]; Benzosulphinide, one gramme [or 15 grains]; Oil of Anise, two and five-tenths mils [or 40 minims]; Oil of Cinnamon, two-tenths of a mil [or 3 minims]; Oil of Coriander, one-tenth of a mil [or 1¹/₂ minims]; Methyl Salicylate, two-tenths of a mil [or 3 minims]; Boiling Water, a sufficient quantity, to make one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Thoroughly mix the cascara sagrada "with the magnesium oxide, moisten the mixture with two thousand mils [or 67 fluidounces, 301 minims] of boiling water, set it aside for two hours, stirring occasionally, and then pack it in a percolator. Now pour on boiling water and allow the percolation to proceed until the drug is exhausted. Evaporate the percolate to five hundred mils [or 16 fluid-ounces, 435 minims] and while yet warm dissolve in it the extract of glycyrrhiza. When cold, add the glycerin, then the alcohol in which the benzosulphinide and the oils have been dissolved, and finally sufficient water to make the Fluidextract measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]." U. S.

An aromatic fluidextract was introduced into the U. S. P. VIII for the first time. It is given as a laxative, the object of the addition of magnesium oxide is to destroy the bitter taste of the cascara sagrada. Lime is sometimes used instead of magnesia but it has been shown that lime acts injuriously upon the laxative principles of cascara sagrada.

Dose, fifteen minims to one fluidrachm (0.9-3.75 mils).

Off. Prep.—Elixir Cascarae Sagradse, *N. F.*; Elixir Cascarae Sagradae

Compositum, N. F.

FLUIDEXTRACTUM CIMICIFUGAE. U. S.

FLUIDEXTRACT OF CIMICIFUGA Fldext. Cimicif. [Fluidextract of Black Cohosh, Fluidextract of Black Snakeroot]

Extractum Cimicifugae Liquidum, Br. 1898, Liquid Extract of Cimicifuga; Liquid Extract of Actaea Racemosa; Extrait liquide d'Actaea Grappes, *Fr.*; Flussiges Cimicifugaextrakt. *G.*

"Cimicifug'a, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using alcohol as the menstruum." U. S.

There probably cannot be two opinions about the menstruum, although it has been asserted that a good fluidextract can be made with a menstruum of three parts alcohol and one part water. The probabilities are, however, that a portion of the resinous principle would precipitate on standing. This fluidextract is of a deep reddish-brown color, and thoroughly represents the drug.

Dose, from ten to thirty minims (0.6-1.9 mils).

Off. Prep.—Elixir Sodii Salicylatis Compositum, *N. F.*; Syrupus Cimicifugas Compositus, *N. F.*

FLUIDEXTRACTUM CINCHONA. U. S. (Br.)

FLUIDEXTRACT OF CINCHONA Fldext. Cinchon. [Fluidextract of Calisaya Bark]

"One hundred mils. of Fluidextract of Cinchona yields not less than 4 Gm. nor more than 5 Gm. of the alkaloids of cinchona." U. S. "Liquid Extract of Cinchona contains in 100 millilitres 5 grammes of the alkaloids of -Red Cinchona Bark." Br.

Extractum Cinchona; Liquidum, Br., Liquid Extract of Cinchona; Extractum Chinae Calisayae Fluidum; Extrait liquide da Quinquina jaune, *Fr.*; Flussigea Kalisayarinden extrakt, Flussiges Chinaextrakt, *G.*

"Cinchona, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process B, using a mixture of one hundred mils [or 3 fluidounces, 183 minims] of glycerin, one hundred mils [or 3 fluidounces, 183 minims] of diluted hydrochloric acid and eight hundred mils [or 27 fluidounces, 24 minims] of alcohol as Menstruum I and a mixture of four volumes of alcohol and one volume of water as Menstruum II. After dissolving the soft extract in the reserve liquid, assay a portion as directed below, and, from the result thus obtained, ascertain by calculation the amount of alkaloids in the remainder of the liquid, and dilute this with enough of Menstruum II to make each one hundred mils of the finished Fluidextract contain 4.5 Gm. of the total alkaloids of cinchona." U.S.

"Red Cinchona Bark, in No. 60 powder, 1000 grammes; Hydrochloric Acid, 31 millilitres; Glycerin, 125 millilitres; Alcohol (90 per cent.), Distilled Water, of each a sufficient quantity. Mix the Red Cinchona Bark with five thousand millilitres of the Distilled Water, to which the Hydrochloric Acid and Glycerin have been added; set aside in a covered vessel for forty-eight hours, stirring frequently; transfer to a percolator; when the liquid ceases to pass continue the percolation with Distilled Water until the percolate ceases to give a precipitate with excess of solution of sodium hydroxide. Evaporate the percolate in a porcelain or enamelled iron vessel at a temperature not exceeding 85° C. (185° F.), until it is reduced to one thousand millilitres." *Br.*

Assay of Fluidextract of Cinchona.— " From a pipette drop 5 mils of Fluidextract of Cinchona evenly over the surface of 10 Gm. of purified sawdust (see Part III) and evaporate it to dryness at a temperature not exceeding 80° C. (176° F.). Transfer the mixture to a 500 mil flask, and proceed as directed under Cinchona, third line of the Assay, beginning with the words 'and add' modifying the process there given by increasing the amount of ammonia water to 10 mils, using this in divided portions to rinse the dish in which the mixture was evaporated, and adding the rinsings to the flask.

"The weight of the residue is the amount of total alkaloids from 4 mils of Fluidextract of Cinchona." *U. S.*

British Assay.—"Determine the proportion of alkaloids in the liquid product by the following process: Transfer 5 millilitres to a stoppered glass separator; add 15 millilitres of benzolated amylic alcohol and 10

millilitres of N/1 alcoholic solution of potassium hydroxide; shake well, set aside in a warm place for a few minutes, shaking occasionally, and then allow the liquids to separate; pour off the clear -upper layer into a second separator and repeat the shaking with two further portions of 15 and 10 millilitres of benzolated amylic alcohol. Shake the mixed alcoholic liquids with two portions, each of 5 millilitres, of water, and reject the aqueous liquid; then shake vigorously with a warm mixture of 12 millilitres of diluted hydrochloric acid and 60 millilitres of water, using three successive portions of 30, 30, and 12 millilitres, and drawing off the acid liquids into a separator. To this acid liquid add 15 millilitres of chloroform and distinct excess of solution of ammonia, shake vigorously, allow the liquids to separate and draw off the chloroformic layer into a tared dish; repeat the shaking and separating with further portions, each of 10 millilitres, of chloroform until the aqueous liquid, after acidification with diluted sulphuric acid, gives no further precipitate with solution of potassio-mercuric iodide. Add the chloroformic solutions to that in the dish, allow the chloroform to evaporate slowly; dry the residue in the dish at a temperature of about 110° C. (230° F.) and weigh. The weight of the residue is that of the total alkaloids in 5 millilitres of the liquid product. Having thus ascertained the alkaloidal strength of the liquid product, bring every volume of it containing 5 grammes of total alkaloids to eighty-five millilitres, either by evaporation or by dilution with Distilled Water as may be necessary, add twelve and a half millilitres of the Alcohol, and finally sufficient Distilled Water to produce one hundred millilitres of the Liquid Extract. Examined by the foregoing process, Liquid Extract of Cinchona is found to contain in 100 millilitres 5 grammes of the alkaloids of Red Cinchona Bark. Limit of error 0.2 gramme in excess or defect. This

Liquid Extract contains 5 grammes of the alkaloids of Red Cinchona Bark in 100 millilitres; 110 minims contain 5 grains." *Br.*

The process for this fluidextract was changed in the U. S. P. IX by the addition of diluted hydrochloric acid to the menstruum of alcohol, glycerin and water.

The U. S. fluidextract of cinchona is a moderately thin, dark reddish-brown, translucent fluid, of a bitter, astringent taste.

Dose, five to twenty minims (0.3-1.3 mils).

FLUIDEXTRACTUM COLCHICI SEMINIS. U. S.

FLUIDEXTRACT OF COLCHICUM SEED Fldext. Colch. Sem.

"One hundred mils of Fluidextract of Colchicum Seed yields not less than 0.36 Gm. nor more than 0.44 Gm. of colchicine." *U. S.*

Extrait liquide do Semences de Colchique, *Fr.*; Flussiges Zeitlosensamenextrakt, *G.*

"Colchicum Seed, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]; Purified Petroleum Benzin, a sufficient quantity. Pack the colchicum seed in a cylindrical percolator and slowly percolate with purified petroleum benzin until a few drops of the percolate leave no greasy stain when evaporated on a piece of filter paper. Reject the benzin solution, remove the powder from the percolator and dry it by exposure to the air. Then proceed to make the Fluidextract by Type Process A, using a mixture of two volumes of alcohol and one volume of water as the menstruum. After dissolving the soft extract in the reserve liquid, assay a portion as directed below, and, from the result thus obtained, ascertain by calculation the amount of alkaloids in the remainder of the liquid, and dilute this with enough menstruum to make each one hundred mils of the finished Fluidextract contain 0.4 Gm. of colchicine." *U. S.*

"Assay of Fluidextract of Colchicum Seed. —Introduce 15 mils of Fluidextract of Colchicum Seed into a 500 mil flask, add 10 mils of solution of lead subacetate, previously diluted with 35 mils of distilled water, shake the mixture thoroughly, then add 240 mils of distilled water, again agitate the mixture and proceed as directed under *Colchici Semen.*" *U. S.*

The use of glycerin in the former *U. S.* fluidex-traet was objectionable, as the fixed oil contained in the seeds was always thrown out of solution, and was usually found floating on the fluidextract, rendering the preparation unsightly. The present formula, *U. S. P. IX*, is an improvement, as the fixed oil is removed by the benzin treatment. *L. I. Morris (A. J. P., 1881, 7)* believes that it is unnecessary to grind the colchicum seeds, and that if the whole seeds are digested with diluted alcohol at 80° C. (176° F.) the colchicine is easily extracted.

Dose, two to eight minims (0.12-0.5 mil).

Off. Prep.—*Vinum Colchici Seminis*. N. F.

FLUIDEXTRACTUM ERIODICTYI. U. S.

FLUIDEXTRACT OF ERIODICTYON Fldext. Eriodict. [Fluidextract of Yerba Santa]

Extrait liquide d'Eriodictyon, *Fr.*; Flussiges Eriodictyonextrakt, *G*".

"Eriodictyon, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A (see page 483), using a mixture of four volumes of alcohol and one volume of water as the menstruum, and reserving the first eight hundred mils [or 27 fluidounces, 24 minims] of percolate." *U. S.*

For a process for Aromatic Fluidextract of Yerba Santa, see *U. S. D.*, 19th ed., p. 539.

This fluidextract has a dark brownish-green color, and has proven a valuable addition.

Dose, from fifteen minims to a fluidrachm (0.9-3.75 mils).

Off. Prep.—*Elixir Eriodictyi Aromaticum*, *N. F.*; *Syrupus Eriodictyi Aromaticus*, *N. F.*

FLUIDEXTRACTUM EUCALYPTI. U. S.

FLUIDEXTRACT OF EUCALYPTUS Fldext. Eucalypt.

Extrait liquide d'Eucalyptus, *Fr.*; Flussiges Eucalyptusextrakt, *G*.

"Eucalyptus, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains], Prepare a Fluidextract by Type Process A, using a mixture of three volumes of alcohol and one volume of water as the menstruum, and reserving the first eight hundred mils [or 27 fluidounces, 24 minims] of percolate" *U. S.*

This fluidextract well represents the drug, and is of a dark greenish-

brown color, having the peculiar odor and taste of eucalyptus very strongly developed, but in effectiveness it is much inferior to the volatile oil.

Dose, from ten to thirty minims (0.6-1.8 mils).

FLUIDEXTRACTUM FRANGULAE. U. S.

FLUIDEXTRACT OF FRANGULA Fldext. Frangul. [Fluidextract of Buckthorn Bark]

Extrait liquide d'Ecorce de Bourdaine, *Fr.*; Extractum Frangulae fluidum, *P. G.*; Faulbaum-Fluidextrakt, Flussigea Faulbaumriadenextrakt, *G.*

"Frangula, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, two hundred and fifty mils [or 8 fluidounces, 218 minims]. Prepare a Fluidextract by Type Process D. Evaporate the aqueous percolate to seven hundred and fifty mils [or 25 fluidounces, 173 minims] and, when cold, add the alcohol and, if necessary, sufficient water to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]." *U. S.*

This is a fluidextract which has been quite largely used in this country. It is intended to be a laxative, but it is frequently disappointing, as the drug is rarely to be obtained of uniformly good quality. The fluidextract is of a dark reddish-brown color. For a process for Sweet Fluidextract of Buckthorn, see *U. S. D.*, 19th ed., p. 540.

Dose, ten to -twenty minims (0.6-1.3 mils).

Off. Prep.—Elixir Catharticum Compositum, *N. F.*; Syrupus Sennae Compositus, *N. F.*

FLUIDEXTRACTUM GELSEMI. U. S.

FLUIDEXTRACT OF QELSEMIUM Fldext. Gelsem.

Extrait liquide de Jasmin jaune ou Gelsemium, *Fr.*; Flussiges Gelber Jasminextrakt, Flussiges Gelsemiumextrakt, *G.*

"Gelsemium, in No. 40 powder, one thousand grammes [or 35 ounces

av., 120 grains], Prepare a Fluidextract by Type Process, using a mixture of four volumes of alcohol and one volume of water as the menstruum." U. S.

In this fluidextract the former menstruum of alcohol has been replaced in the U. S. P. IX with alcohol, 4 volumes, and water, 1 volume. It is of a dark reddish-brown color.

Dose, from one to three minims (0.06-0.2 mil).

Off. Prep.—Elixir Sodii Salicylatis Compositum, N. F.

FLUIDEXTRACTUM GENTIANAE. U. S.

FLUIDEXTRACT OF GENTIAN Fldext. Gentian.

Extrait liquide de Gentiane, *Fr.*; Flussiges Enzianextrakt. *G.*

"Gentian, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using diluted alcohol as the menstruum." *U. S.*

This is a translucent, reddish-brown fluid, with the odor and taste of the root. It may be questionable whether it is needed, though it has the advantage that we may obtain from it the tonic effects of the drug with less alcohol than in an equivalent quantity of the tincture, and pharmaceutically it affords a convenient method of giving to mixtures the tonic properties of gentian when required.

Dose, from ten to thirty minims (0.6-1.8 mils).

Off. Prep.—Elixir Gentianae, *N. F.*; Elixir Gentianae et Ferri, *N. F.*; Elixir Gentianae et Ferri Phosphatis, *N. F.*; Elixir Gentianae Glycerinatum, *N. F.*

FLUIDEXTRACTUM GLYCYRRHIZAE. U. S. (Br.)

FLUIDEXTRACT OF GLYCYRRHIZAE Fldext. Glycyrrh.

Extractum Glycyrrhizae Liquidum, *Br.*; Liquid Extract of Liquorice; Fluidextract of Licorice or Liquorice; Extrait liquide de Reglisse, *Fr.*; Flussiges Sussholzwurzelextrakt, *G.*

"Glycyrrhiza, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, two hundred and fifty mils [or 8 fluid-ounces, 218 minims]; Ammonia Water, Chloroform Water, Water, each, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix three hundred mils [or 10 fluidounces, 69 minims] of ammonia water with twenty-seven hundred mils [or 91 fluid-ounces, 142 minims] of chloroform water and moisten the glycyrrhiza with a sufficient quantity of the mixture; pack it in a cylindrical percolator and add enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding more of the same menstruum until the glycyrrhiza is exhausted. Reserve the first five hundred mils [or 16 fluidounces, 435 minims] of the percolate and evaporate the remainder on a water bath to a soft extract; dissolve this in the reserve portion and add enough water to make the product measure seven hundred and fifty mils [or 25 fluidounces, 173 minims]. A few drops of ammonia water may be added if necessary to facilitate solution. Now gradually add the alcohol, allow the product to stand for seven days in a stoppered container, then decant the clear liquid, filter the remainder and wash the residue on the filter with enough of a mixture of one volume of alcohol and three volumes of water to make the Fluidextract measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]." *U.S.*

"Liquorice Root, in No. 20 powder, 1000 grammes; Chloroform Water, 5000 millilitres; Alcohol (90 per cent.), a sufficient quantity. Mix the Liquorice Root with one-half of the Chloroform Water; set aside for twenty-four hours; strain; press; to the pressed marc add the remainder of the Chloroform Water, and set aside for six hours; strain; press; mix the strained liquids; heat to 100° C. (212° F.); strain through flannel; evaporate until the liquid has acquired, when cold, a specific gravity of 1.200; add to this one-fourth of its volume of the Alcohol; let the mixture stand for twelve hours; filter." *Br.*

The process for this fluidextract was materially changed in the U. S. P. VIII. The former processes, while making stable fluidextracts of good appearance, were deficient in not providing for the removal of the acrid, oily constituent found in licorice root; the U. S. P. VIII process overcame

this difficulty by exhausting the coarsely powdered root with boiling water, concentrating the infusions, adding alcohol to precipitate inert constituents, and filtering; the filtrate was distilled to recover the excess of alcohol, and glycerin, ammonia water and alcohol added to bring the measure to the required standard. This process was essentially that recommended by A. R. L. Dohme. The U. S. P. IX process differs materially. Chloroform water is used to exhaust the licorice root with ammonia water to dissolve the glycyrrhizin, alcohol is added finally to preserve the fluidextract. The object of using chloroform water in the U. S. and British processes is to prevent decomposition in the aqueous liquids. The British formula for the liquid extract has several inconvenient manipulative features, such as the repeated macerations and expressions, evaporating to a certain specific gravity, etc. (See *Mont. Pharm. Journ.*, 1893, 147; *P. J.*, 1898, 188.) This preparation is now very largely used as an adjuvant, and for disguising the bitter taste of quinine, which should be added to the preparation of licorice just before the dose is taken. It is a very convenient form for using licorice, as the ammonia renders the glycyrrhizin soluble, thus materially adding to the power and sweetness of the fluid-extract, and it also greatly lessens the acidity. It is a very dark reddish-brown liquid, having the well known sweet taste of licorice, and froths when shaken with water. A syrup of licorice may be made by adding two parts of fluidextract to fourteen parts of simple syrup. (See also N. F., Part III.) An elixir containing licorice (*Elixir Adjuvans*) was made official in the U. S. P. VIII and introduced into the U. S. P. IX under the name of *Elixir of Glycyrrhiza*.

Used as a vehicle only.

Off. Prep.—Elixir Glycyrrhizae, *U. S.*; Mistura Sennae Composita, *Br.*; Syrupus Sarsaparillae Compositus, *U. S.*; Elixir Glycyrrhizae Aquosum, *N. F.*; Elixir Glycyrrhizae Aromaticum, *N. F.*; Elixir Taraxaci Compositum, *N. F.*; Syrupus Cimicifugae Compositum, *N. F.*

EXTRACTUM GOSSYPII RADICIS CORTICIS LIQUIDUM. Br.

LIQUID EXTRACT OF COTTON ROOT BARK

"Cotton Root Bark, in No. 30 powder, 1000 grammes; Glycerin, 250 millilitres; Alcohol (90 per cent.) sufficient to produce 1000 millilitres. Mix the Glycerin with seven hundred and fifty millilitres of the Alcohol;

moisten the Cotton Root Bark with this mixture and continue the percolation process, using as menstruum first the remainder of the mixture of Glycerin and Alcohol, and afterwards sufficient of the Alcohol to produce the required volume." *Br.*

The fluidextract of cotton root bark (U. S. P. 1890) was not retained in the U. S. P. VIII or IX, but the National Formulary IV introduced a fluidextract made from the recently-gathered air-dried bark of the root, using alcohol for the menstruum. (See Part III.) The British process requires the use of glycerin which may have a tendency to prevent gelatinization.

Uses.—There is reason to believe that cotton-root bark loses some of its activity in drying. For this reason the preparation of the N. F. IV is to be preferred to the *Br.* For therapeutic properties of cotton root, see *Gossypii Radicis Cortex*.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

FLUIDEXTRACTUM GRANATI. U. S.

FLUIDEXTRACT OF POMEGRANATE *Fl*dext. *Granat.*

Fluidextract of Pomegranate Root Bark; Extrait liquide d'Ecorce de Balaustier, Extrait liquide d'Ecorce de Grenadier, *Fr.*; Flussiges Granatwurzelnindenextrakt, *G.*

"Pomegranate, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains], Prepare a Fluidextract by Type Process B, using a mixture of one hundred mils [or 3 fluidounces, 183 minims] of glycerin, five hundred mils [or 16 fluidounces, 435 minims] of alcohol and four hundred mils [or 13 fluid-ounces, 252 minims] of water as Menstruum I, and diluted alcohol as Menstruum II." U. S.

This fluidextract was admitted to the U. S. Pharmacopoeia (8th Revision) for the first time; it well represents the virtues of pomegranate.

Dose, from one-half to one fluidrachm (1.8-3.75 mils).

FLUIDEXTRACTUM GRINDELIA. U. S. (Br.)

FLUIDEXTRACT OF GRINDELIA Fldext. Grindel.

Extractum Grindeliae Liquidum, *Br.*, Liquid Extract of Grindelia; Extrait liquide de Grindelia, *Fr.*; Flüssiges Grindelienextrakt, *G.*

"Grindelia, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using a mixture of three volumes of alcohol and one volume of water as the menstruum." *U. S.* "Grindelia, in No. 40 powder, 1000 grammes; Sodium Bicarbonate, 100 grammes; Distilled Water, 500 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Exhaust the Grindelia by percolation with the Alcohol. Recover the alcohol from the percolate by distillation, and dissolve the residue in the Distilled Water, to which the Sodium Bicarbonate has previously been added; after effervescence has ceased, add sufficient Distilled Water to produce seven hundred and fifty millilitres, and then sufficient of the Alcohol to produce the required volume." *Br.*

This is a fluidextract which well represents the drug; owing to the large quantity of resinous matter present, it does not mix well with aqueous liquids. The so-called "alkaline fluid extract of grindelia" may be made by evaporating one pint of official fluidextract until reduced to twelve fluidounces, making a solution of 180 grains of sodium bicarbonate in four fluidounces of water, adding- it slowly to the evaporated fluidextract, and filtering; the British liquid extract is made upon this principle. The fluidextract is a dark brown liquid having the peculiar odor of grindelia.

For medical properties and uses, see *Grindelia*.

Dose, from one-half to one fluidrachm (1.8-3.75 mils).

FLUIDEXTRACTUM GUARANAÆ. U. S.

FLUIDEXTRACT OF GUARANA Fldext. Guaran.

"One hundred mils of Fluidextract of Guarana yields not less than 3.6 Gm. nor more than 4.4 Gm. of caffeine." *U. S.*

Extrait liquide de Guarana, *Fr.*; Flüssiges Guaranaextrakt, *G.*

"Guarana, in No. 60 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using a mixture of three volumes of alcohol and one volume of water as the menstruum, and reserving the first eight hundred mils [or 27 fluidounces, 24 minims] of percolate. After dissolving the soft extract in the reserve liquid, assay a portion as directed below, and, from the result thus obtained, ascertain by calculation the amount of alkaloid in the remainder of the liquid and dilute this with enough menstruum to make each one hundred mils of the finished Fluidextract contain 4 Gm. of caffeine." U. S.

Assay.—Introduce 5 mils of Fluidextract of Guarana into a separator, add 1 mil of ammonia water, and shake out the alkaloid with chloroform until completely extracted, as shown by testing with iodine T.S. Evaporate the combined chloroform solutions to dryness and dissolve the residue in 20 mils of distilled water with the aid of heat. Allow this to cool, filter it into a separator and wash the container and filter with several small portions of distilled water, adding the rinsings to the liquid in the separator. Then shake out the alkaloid with chloroform until completely extracted, as shown by testing with iodine T.S., evaporate the combined chloroform solutions and dry the residue to constant weight at 80° C. (176° F.). The weight represents the alkaloid in 5 mils of Fluidextract of Guarana." U. S.

The menstruum for this fluidextract, U. S. P. IX (alcohol 3, water 1), is stronger than that of the U. S. P. VIII (diluted alcohol).

This fluidextract is of doubtful utility. The powdered drug itself is portable, not unpleasant to the taste, and is efficient when given suspended in water; nothing is gained by making it into a fluidextract. The fluidextract is of a deep reddish-brown color. (See *Proc. A. Ph. A.*, 1897, 423.)

Dose, one to two fluidrachms (3.75-7.5 mils).

Off. Prep.—Elixir Guarana¹, N. F.

EXTRACTUM HAMAMELIDIS LIQUIDUM. Br.

LIQUIDEXTRACT OF HAMAMELIS

Fluidextractum Hamamelis Foliorum, Fluidextract of Hamamelia Leaves; Fluidextract of Witch-hazel Leaves; Extrait liquide de Hamamelis, *Fr.*; Flussiges Hamamelisextrakt, *G.*; Extracto fluido de hamamelis, *Sp.*

"Hamamelis Leaves, dried, in No. 40 powder, 1000 grammes; Alcohol (45 per cent.), sufficient to produce 1000 millilitres. Exhaust the Hamamelis Leaves by percolation with the Alcohol. Reserve the first eight hundred and fifty millilitres of the percolate; recover the alcohol from the remainder by distillation; evaporate the residue to a soft extract; dissolve this in the reserved portion; add sufficient of the Alcohol to produce the required volume." *Br.*

This liquid extract well represents the virtues of witchhazel. The fluidextract of hamamelis leaves of the U. S. P. VIII was not retained in the U. S. P. IX, but will be found in the N. F. (See Part III.) It has a dark reddish-brown color.

Dose, ten to thirty minims (0.6-1.8 mils).

Off. Prep.—Unguentum Hamamelidis, Br.

FLUIDEXTRACTUM HYDRASTIS. U. S. (Br.)

FLUIDEXTRACT OF HYDRASTIS

Fldext. Hydrast. [Fluidextract of Golden Seal]

"One hundred mils of Fluidextract of Hydrastis yields not less than 1.8 Gm. nor more than 2.2 Gm. of the ether-soluble alkaloids of Hydrastis." U. S. "Liquid Extract of Hydrastis contains in 100 millilitres 2 grammes of hydrastine." *Br.*

Extractum Hydrastis Liquidum, Br.; Liquid Extract of Hydrastis; Extrait liquide de Hydrastis, *Fr.*; Extractum Hydrastis fluidum, *P. G.*; Hydrastis-Fluidextrakt; Flussiges Hydrastisextrakt, *G.*; Estratto di idraste liquido, *It.*; Extracto fluido de hidrastis, *Sp.*

"Hydrastis, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process B, using a mixture

of one hundred mils [or 3 fluidounces, 183 minims] of glycerin, six hundred mils [or 20 fluidounces, 138 minims] of alcohol and two hundred mils [or 6 fluidounces, 366 minims] of water as Menstruum I, and a mixture of two volumes of alcohol and one volume of water as Menstruum II. Reserve the first seven hundred and fifty mils [or 25 fluidounces, 173 minims] of percolate. After dissolving the soft extract in the reserve liquid, assay a portion as directed below, and, from the result thus obtained, ascertain by calculation the amount of alkaloids in the remainder of the liquid and dilute this with enough of Menstruum II to make each one hundred mils of the finished Fluidextract contain 2 Gm. of the ether-soluble alkaloids of hydrastis.

"Hydrastis Rhizome, in No. 60 powder, 1000 grammes; Alcohol (60 per cent.), a sufficient quantity. Exhaust the Hydrastis Rhizome with the Alcohol by the percolation process; reserve the first eight hundred and fifty millilitres of the percolate; recover the alcohol from the remainder by distillation; evaporate to a soft extract and dissolve in the reserved portion.

"**Assay.**—Proceed as directed under Fluidextractum Belladonna Radicis, modifying the process there given by using 5 mils of Fluidextract of Hydrastis instead of 10 mils of the fluidextract of belladonna root and using only ether as the immiscible, solvent throughout the assay. Dry the residue to constant weight at 100° C. (212° F.), instead of titrating it. The weight represents the amount of ether-soluble alkaloids in 5 mils of the Fluid-extract of Hydrastis." *U. S.*

"Determine the proportion of hydrastine in the liquid extract thus obtained by the following process: Transfer 10 millilitres of the liquid extract to a 100 millilitre graduated flask, add 20 millilitres of solution of potassium iodide diluted with 60 millilitres of water, and then sufficient water to produce 100 millilitres. Shake the mixture for several minutes and filter. Transfer 50 millilitres of the filtrate to a separator, render alkaline with solution of ammonia, add 30 millilitres of ether, and shake at intervals during several minutes. Allow the liquids to separate, draw off the aqueous solution into a beaker and the ethereal solution into a tared beaker. Return the aqueous solution to the separator and repeat the operation with two successive portions, each of 20 millilitres, of ether for one minute. Draw off and reject the aqueous layer; transfer the ethereal solutions to the tared beaker and evaporate at a gentle heat; dry the residue on a water-bath and weigh. The weight is that of the

hydrastine in 5 millilitres of the liquid extract examined. To the remainder of the liquid extract add sufficient of the menstruum to produce a Liquid Extract of Hydrastis containing 2 grammes of hydrastine in 100 millilitres. Examined by the foregoing process Liquid Extract of Hydrastis is found to contain in 100 millilitres 2 grammes of hydrastine. Limit of error 0.1 gramme in excess or defect. This Liquid Extract contains 2 grammes of hydrastine in 100 millilitres; 110 minims contain 2 grains." Br.

The fluidextract thoroughly represents the drug. It is of a deep brownish-yellow color.

Dose, from fifteen minims to one fluidrachm (0.9-3.75 mls).

Off. Prep.—Tinctura Hydrastis, *Br.*; Mistura Rhei Alkalina, *N. F.*

FLUIDEXTRACTUM HYOSCYAMI. U. S.

FLUIDEXTRACT OF HYOSCYAMUS Fldext. Hyosc. [Fluidextract of Henbane]

"One hundred mls of Fluidextract of Hyoscyamus yields not less than 0.055 Gm. nor more than 0.075 Gm. of the alkaloids of hyoscyamus." *U. S.*

Extrait liquide de Jusquiame, *Fr.*; Flussiges Bilsenkrautextrakt, *G.*

"Hyoscyamus, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A (see page 483), using a mixture of three volumes of alcohol and one volume of water as the menstruum. After dissolving the soft extract in the reserve liquid, assay a portion as directed below, and, from the result thus obtained, ascertain by calculation the amount of alkaloids in the remainder of the liquid and dilute this with enough menstruum to make each one hundred mls of the finished Fluidextract contain 0.065 Gm. of the alkaloids of hyoscyamus." *U. S.*

Assay.—Proceed as directed under *Fluid-extractum Belladonna Radicis*, modifying the process there given by using 25 mls of the Fluidextract of Hyoscyamus in place of 10 mls of fluidextract of belladonna root, and before titrating treating the residue twice with 5

mils of ether and evaporating to dryness each time.

"Each .mil of tenth-normal sulphuric acid V.S. consumed corresponds to 28.92 milligrammes of the total alkaloids of *hyoscyamus*." *U. S.*

The menstruum for this fluidextract was improved in the revision of the U. S. Pharmacopoeia IX by increasing the alcoholic strength to alcohol 3, water 1. It is of a very dark greenish-brown color. For the medicinal properties, see *Hyoscyamus*.

Dose, from three to ten minims (0.2-0.6 mil).

FLUIDEXTRACTUM IPECACUANHA. U. S. (Br.)

FLUIDEXTRACT OF IPECAC Fldext. Ipecac.

"One hundred mils of Fluidextract of Ipecac yields not less than 1.8 Gm. nor more than 2.2 Gm. of the ether-soluble alkaloids of ipecac." *U. S.*
"Liquid Extract of Ipecacuanha contains in 100 millilitres 2 grammes of the alkaloids of Ipecacuanha Root." "

Extractum Ipecacuanhae Liquidum, *Br.*; Liquid Extract of Ipecacuanha; Extrait liquide d'Ipecacuanha, *Fr.*; Flüssiges Ipecacuanhaextrakt, *G.*

"Ipecac, in No. 60 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process B, using a mixture of one hundred mils [or 3 fluidounces, 183 minims] of diluted hydrochloric acid, two hundred mils [or 6 fluid-ounces, 366 minims] of alcohol and two hundred mils [or 6 fluidounces, 366 minims] of water as Menstruum I, and a mixture of two volumes of alcohol and three volumes of water as Menstruum II. Reserve the first eight hundred mils [or 27 fluidounces, 24 minims] of percolate. After dissolving the soft extract in the reserve liquid, assay a portion as directed below, and, from the result thus obtained, ascertain by calculation the amount of alkaloids in the remainder of the liquid and dilute this with enough of Menstruum II to make each one hundred mils of the finished Fluidextract contain 2 Gm. of the ether-soluble alkaloids of ipecac." *U. S.*

"Ipecacuanha Root, in No. 120 powder, 1000 grammes; Alcohol (90 per cent.), a sufficient quantity. Pack the Ipecacuanha Root uniformly in a conical percolator, add two hundred millilitres of the Alcohol, and set

aside for twelve hours; then percolate with successive portions, each of two hundred millilitres, of the Alcohol, added at intervals of twelve hours, until the liquid begins to drop from the orifice of the percolator. Continue the percolation with more of the Alcohol until seven hundred and fifty millilitres of percolate have been collected. Reserve this portion. Then percolate until exhaustion is complete; recover the alcohol from this percolate by distillation, and dissolve the residual extract in the reserved portion." *Br.*

Assay of Fluidextract of Ipecac.—" From a pipette drop 10 mils of Fluidextract of Ipecac evenly over the surface of 10 Gm, of purified sawdust (see Part III), and evaporate it to dryness at a temperature not exceeding 80° C. (176° F.). Transfer the impregnated sawdust to a 250 mil flask and add 100 mils of ether. Rinse the dish in which the mixture was evaporated with 6 mils of ammonia water, previously diluted with an equal volume of water, used in several portions, and add the rinsings to the flask. Stopper the flask and shake in vigorously every few minutes, during two hours. Now add 15 mils of distilled water, again shake the flask well, and when the sawdust has subsided decant 50 mils of the ether solution, representing 5 mils of the Fluidextract. Completely extract the alkaloids from this solution by shaking out with weak sulphuric acid. Collect the acid washings in a separator; add ammonia water until the solution is decidedly alkaline to litmus, and completely extract the alkaloids by shaking out repeatedly with ether. Evaporate the combined ether washings to dryness, dissolve the alkaloid from the residue in exactly 10 mils of tenth-normal sulphuric acid V.S. and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S., cochineal T.S. being used as indicator (see Proximate Assays, Part III).

"Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 24 milligrammes of the ether-soluble alkaloids of ipecac." *U. S.*

"Determine the proportion of alkaloids in the liquid extract thus obtained by the following process: Introduce 5 millilitres of the liquid extract into a separator and add 4 millilitres of water, 1 millilitre of diluted sulphuric acid, and 10 millilitres of ether. Shake, and separate the ethereal solution. Repeat the shaking with 5 millilitres of ether and again separate. Wash the mixed ethereal solutions in a second separator with two successive portions, each of 5 millilitres, of water, and add the washings to the contents of the first separator. Shake this aqueous

liquid with 10 millilitres of chloroform and excess of solution of ammonia. Separate the chloroformic solution and filter it through a small filter-paper into a tared dish. Repeat the shaking with chloroform, separation, and filtration, twice, finally washing the filter-paper with a little chloroform. Evaporate the mixed chloroformic solutions to about 2 millilitres, add 5 millilitres of ether, evaporate, dry at a temperature not exceeding 80° ^ C. (176° F.) and weigh the residual alkaloids. To the remainder of the liquid extract add sufficient of the Alcohol to produce a Liquid Extract of Ipecacuanha containing in 100 millilitres 2 grammes of the alkaloids of Ipecacuanha Root. Examined by the foregoing process Liquid Extract of Ipecacuanha is found to contain in 100 millilitres 2 grammes of the alkaloids of Ipecacuanha Root. Limit of error 0.1 gramme in excess or defect. This Liquid Extract contains 2 grammes of the alkaloids of Ipecacuanha Root in 100 millilitres; 110 minims contains 2 grains." *Br.*

The menstruum for the U. S. fluidextract was altered in the U. S. P. IX by the addition of hydrochloric acid, which combines with the alkaloids and more thoroughly exhausts the ipecac. It was proved by J. U. Lloyd that when alcohol alone is used a portion of emetine escapes solution. On the other hand, it is known that when the menstruum is more aqueous large amounts of the pectinous principles are taken up, and it is very desirable to separate these in order to prevent their appearance as a flocculent precipitate in syrup of ipecac; but efficiency is to be sought for as the first desideratum, and hence a menstruum which will extract the activity and make a fluidextract that will not let fall a bulky precipitate of inert matter has been secured; usually this will not mix with syrup without slight precipitation, but the improved official process for syrup of ipecac should effectually separate any precipitate resulting from the presence of apotheme in the fluidextract. The British liquid extract (1914) is standardized; the excellent researches of Paul and Cownley on ipecac, and the assay work of Kremel, Keller, and others, undoubtedly prompted the introduction of the process for the liquid extract. (See *Ipecacuanha*.) It will probably be found, however, that the V. S. menstruum is preferable. An acetic extract of ipecac (dry) is used in Great Britain; it has been shown that the heating necessary to dry it is injurious to its emetic properties. (*P. J.*, 1895, 158.)

This fluidextract is a thin, dark reddish-brown, transparent liquid, of a bitterish, slightly acid taste, but without the nauseous flavor of the root. It is a convenient preparation for adding to expectorant and

diaphoretic mixtures, and is used officially in preparing the syrup of ipecac, and other preparations named below.

Dose, as emetic, fifteen to thirty minims (0.9-1.8 mils); as an expectorant, one to two minims (0.06-0.12 mil).

Off. Prep.—Syrupus Ipecacuanhae, *U. S.*; Tinctura Ipecacuanhae et Opii, *N. F.*; Vinum Ipecacuanhae, *Br., N. F.*; Mistura Rhei Composita, *N. F.*; Syrupus Asari Compositus, *N. F.*; Syrupus Cimicifugae Compositus, *N. F.*

EXTRACTUM KAVAE LIQUIDUM. Br.

LIQUID EXTRACT OF KAVA

"Kava Rhizome, in No. 20 powder, 1000 grammes; Alcohol (90 per cent.), a sufficient quantity; Alcohol (45 per cent.), a sufficient quantity. Mix the powdered Kava Rhizome with two thousand millilitres of the Alcohol (90 per cent.); set aside in a closed vessel for forty-eight hours; transfer to a percolator and percolate slowly, reserving the first seven hundred and fifty millilitres of the percolate. Continue the percolation, adding the Alcohol (45 per cent.) until the powder is exhausted; recover most of the alcohol from this percolate by distillation ; evaporate the residue at a temperature below 80° C. (176° F.) to a soft extract, and dissolve this in the reserved percolate; add sufficient of the Alcohol (90 per cent.) to produce one thousand millilitres of the Liquid Extract." *Br.*

This fluidextract was introduced into the British Pharm. (1914), and is also official in the *N. F. IV.* (See Part III.) It represents kava and may be given in the dose of thirty minims to one fluidrachm (1.8-3.75 mils).

FLUIDEXTRACTUM LOBELIAE. U. S.

FLUIDEXTRACT OF LOBELIA Fldext. Lobel.

Extrait liquide de Lobelie enflée, *Fr.*; Flussiges Lobelienkrautextrakt, Flussiges Lobelienextrakt, *G.*

"Lobelia, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process B, using a mixture of fifty mils [or 1 fluidounce, 331 minims] of acetic acid, five hundred

mils [or 16 fluidounces, 435 minims] of alcohol and four hundred and fifty mils [or 15 fluidounces, 104 minims] of water as Menstruum I, and diluted alcohol as Menstruum II." U. S.

This fluidextract differs from that of the U. S. P. VIII in that the menstruum is acetic acid 1, alcohol 10, water 9 parts. The acetic menstruum is well adapted for exhausting the drug.

This is a valuable fluidextract. It is of a dark olive color, having the acrid taste of lobelia in a very marked degree.

Dose, as an expectorant, from one to five minims (0.06-0.3 mil); as an emetic, from ten to twenty minims (0.6-1.3 mils).

FLUIDEXTRACTUM PILOCARPI. U. S.

FLUIDEXTRACT OF PILOCARPUS Fldext. Pilocarp. [Fluidextract of Jaborandi]

"One hundred mils of Fluidextract of Pilo-carpus yields not less than 0.55 Gm. nor more than 0.65 Gm. of the alkaloids of pilocarpus." *U.S.*

Extractum Jaborandi Liquidum, *Br.*, 1898: Liquid Extract of Jaborandi; Extrait liquide de Jaborandi, *Fr.*; Flussiges Jaborandiextrakt, *G.*

"Pilocarpus, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using a mixture of two volumes of alcohol and one volume of water as the menstruum, and reserving the first eight hundred mils [or 27 fluidounces, 24 minims] of percolate. After dissolving the soft extract in the reserve liquid, assay a portion as directed below, and from the result thus obtained, ascertain by calculation the amount of alkaloids in the remainder of the liquid and dilute this with enough menstruum to make each one hundred mils of the finished Fluidextract contain 0.6 Gm. of the alkaloids of pilocarpus."

"**Assay.**—From a pipette drop 15 mils of Fluidextract of Pilocarpus evenly over the surface of 15 Gm. of purified sawdust (see Part III), and evaporate it to dryness on a water bath. Transfer the mixture to a 250 mil flask, add 150 mils of chloroform, and proceed as directed under *Belladonnae Radix*, fifth line of the Assay, beginning with the word

'Stopper' modifying the process there given by increasing the amount of ammonia water to 6 mils, mixed with 5 mils of distilled water, which is to be used, in divided portions, to rinse the dish in which the mixture was evaporated, the rinsings being added to the mixture in the flask; the 100 mils of chloroform solution must be drawn off from the bottom of the flask.

"Each mil of tenth-normal sulphuric acid V.S. corresponds to 20.815 milligrammes of the alkaloids of pilocarpus." U. S.

This fluidextract represents Jaborandi leaves thoroughly. Of the liquid preparations of the drug, the infusion and tincture are both open to objection, the former on account of the bulkiness of the dose, and the latter because of the amount of alcohol it contains. Liquid abstract of jaborandi was deleted from the Br. Pharm. (1914).

Dose, from fifteen minims to half a fluidrachm (0.9-1.8 mils).

FLUIDEXTRACTUM PODOPHYLLI. U. S.

FLUIDEXTRACT OF PODOPHYLLUM Fldext. Podophyll.

Fluidextract of May Apple or Mandrake; Extrait liquide de Podophylle, *Fr.*; Flussiges Fussblattwurzelextrakt, Flussiges Podophyllumextrakt, *G.*

"Podophyllum, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using alcohol as the menstruum." *U. S.*

The menstruum of the U. S. P. VIII fluid-extract which was alcohol 4, water 1, was changed to alcohol in the U. S. P. IX. This is a fluidextract which well represents the root, but is of very little use, since Podophyllum is much better administered in other forms.

Dose, from five to fifteen minims (0.3-0.9 mil).

FLUIDEXTRACTUM RHEI. U. S.

FLUIDEXTRACT OF RHUBARB Fldext. Rhei

Extrait liquide de Rhubarbe, *Fr.*; Flussiges Rhabarberextrakt, *G.*

"Rhubarb, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using a mixture of four volumes of alcohol and one volume of water as the menstruum." *U. S.*

The present process affords a fluidextract which thoroughly represents the root, but when mixed with syrups arid. water, it loses its transparency. An alkali or an alkaline carbonate dissolves this precipitate, but the use of the fluidextract is limited. The British Pharm. (1898) "Liquor Rhei Concentratus " is made with alcohol (20 per cent.) as a menstruum and is one-half the strength of the U. S. fluidextract of rhubarb.

Dose, for an adult, as a purgative, twenty to thirty minims (1.3-1.8 mils); as a laxative, from five to ten minims (0.3-0.6 mil).

Off. Prep.—Syrupus Rhei, *U. S.*; Mistura Rhei Alkalina, *N. F.*; Mistura Rhei Composita, *N. F.*; Syrupus Sennae Compositus, *N. F.*; Vinum Rhei Compositum, *N. F.*

FLUIDEXTRACTUM ROSAE. U. S.

FLUIDEXTRACT OF ROSE Fldext. Rossae

Fluidextract of Red Rose; Extrait liquide de Rose rouge, *Fr.*; Flussiges Essigrosenblumenblatterextrakt, *G.*

"Red Rose, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process B, using a mixture of one hundred mils [or 3 fluidounces, 183 minims] of glycerin, five hundred mils [or 16 fluidounces, 435 minims] of alcohol and four hundred mils [or 13 fluid-ounces, 252 minims] of water as Menstruum I, and diluted alcohol as Menstruum II." *U. S.*

This fluidextract is a useful adjuvant and an excellent astringent. It is of a deep red color, with the agreeable flavor of rose. Wm. C. Alpers prefers repercolation for this fluid-extract, stating that even a moderate heat imparts an unpleasant odor to the finished product. (*Proc. A. Ph. A.*, 1897, 425.)

Dose, from one to two fluidrachms (3.75-7.5 mils).

Off. Prep.—Mel Rosse, U. S.; Syrupus Rosse, N. F.

FLUIDEXTRACTUM SABAL. U. S.

FLUIDEXTRACT OF SABAL Fldext. Sabal [Fluidextract of Saw Palmetto]

"Sabal, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using a mixture of four volumes of alcohol and one volume of water as the menstruum." *U. S.*

This fluidextract was introduced into the U. S. P. IX. It represents the virtues of saw palmetto berries.

Dose, fifteen minims (0.9 mil).

FLUIDEXTRACTUM SARSAPARILLA. U. S.

FLUIDEXTRACT OF SARSAPARILLA Fldext. Sarsap.

Extractum Sarsae Liquidum., Br. 1898; Liquid Extract of Sarsaparilla; Liquor Sarsae; Extrait liquide de Salsepareille, *Fr.*; Flussiges Sarsaparillaextrakt, *G.*

"Sarsaparilla, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using diluted alcohol as the menstruum." *U. S.*

The British Pharm. (1914) deleted Extractum Sarsae Liquidum. The process will be found in the 19th ed., U. S. Dispensatory, page 559.

The introduction of a simple fluidextract of Sarsaparilla into our Pharmacopoeias was judicious, as it enables the physician to associate this medicine with others at his pleasure, and in such proportions as he may deem expedient. He may rely upon the efficiency of the preparation, if made with sufficient care and skill and from good parcels of the root. The U. S. fluid-extract is a somewhat dense, scarcely translucent liquid, of a very dark reddish-brown color, and of a sweetish and a slightly acrid taste.

Dose, thirty to sixty minims (1.8-3.75 mils).

Off. Prep.—Syrupus Sarsaparillae Compositus, U. S.

FLUIDEXTRACTUM SARSAPARILLAE COMPOSITUM. U. S.

COMPOUND FLUIDEXTRACT OF SARSAPARILLA Fldext. Sarsap. Co.

Extrait liquide de Salsepareille compose, *Fr.*; Zusammen gesetztes flussiges Sarsaparillaextrakt, *G.*

"Sarsaparilla, in No. 20 powder, seven hundred and fifty grammes [or 26 ounces av., 199 grains]; Glycyrrhiza, in No. 20 powder, one hundred and twenty grammes [or 4 ounces av., 102 grains]; Sassafras, in No. 30 powder, one hundred grammes [or 3 ounces av., 231 grains] ; Mezereum, in No. 30 powder, thirty grammes [or 1 ounce av., 25 grains]. Mix the powders and prepare a Fluidextract by Type Process B, using a mixture of one hundred mils [or 3 fluidounces, 183 minims] of glycerin, five hundred mils [or 16 fluidounces, , 435 minims] of alcohol and four hundred mils [or 13 fluidounces, 252 minims] of water as Menstruum I, and diluted alcohol as Menstruum II." U. S.

The compound fluidextract is intended to represent, in a concentrated state, the compound decoction of sarsaparilla, having all its ingredients with the exception of the guaiacum wood, which probably adds little to the efficacy of the decoction. It was originally proposed by Wm. Hodgson, Jr. (*A. J. P.*, ii, 285), and the official process differs from his mainly in the omission of the guaiacum wood, the resin of which, separating during the evaporation, somewhat embarrassed the process, without adding to the virtues of the extract. The British Pharm. (1898) "Liquor Sarsae Compositus Concentratus " is of the same strength as the fluidextract of the U. S. Pharmacopoeia, and is made with a menstruum of distilled water with 225 mils of alcohol as a preservative in 1000 mils of finished solution.

Dose, from thirty minims to one fluidrachm (1.8-5.75 mils).

FLUIDEXTRACTUM SCILLAE. U. S.

FLUIDEXTRACT OF SQUILL *Fldext. Scill.*

"If assayed biologically the minimum lethal dose should not be greater than 0.0006 mil of Fluidextract, or the equivalent in Fluidextract of 0.000005 Gm. of ouabain, for each gramme of body weight of frog." *U. S.*

Extrait liquide de Scille, *Fr.*; Flussiges Meerzwiebeleextrakt, *G.*

"Squill, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains]; Diluted Alcohol, Alcohol, Water, each, a sufficient quantity, to make one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Mix two thousand mils [or 67 fluidounces, 301 minims] of alcohol with one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of water, moisten the squill thoroughly with sufficient of the mixture and allow it to macerate for two hours in a tightly-covered container. Then transfer it to a percolator, shake

it down evenly without packing, and pour on enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding more menstruum composed of two volumes of alcohol and one volume of water. When the percolate measures one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] close the lower orifice and macerate the drug twelve hours before continuing the percolation. Then collect a second one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms of percolate, again interrupt the percolation, macerate for twelve hours and then continue the percolation until the total percolate measures five thousand mils [or 169 fluid-ounces, 33 minims]. Recover the alcohol from the percolate at as low a temperature as possible and then concentrate the residue to a volume measuring eight hundred mils [or 27 fluidounces, 24 minims]. When the residue is cold, add slowly, with continuous agitation, two thousand mils [or 67 fluidounces, 301 minims] of alcohol and set the mixture aside in a tightly-stoppered container for twelve hours. Decant the supernatant liquid from the syrupy layer, filter the decanted liquid and wash the syrupy residue with two portions

of three hundred mils [or 10 fluidounces, 69 minims] each of a mixture of four volumes of alcohol and one volume of water, passing the washings through the filter Into the previously collected alcoholic liquid. Reduce the combined alcoholic liquids to eight hundred mils [or 27 fluidounces, 24 minims] by distillation and finally add enough diluted alcohol to make the finished Fluidextract measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]." U. S.

The U. S. P. has very properly returned to an alcoholic instead of an acetic acid menstruum for this preparation, as Houghton has shown that the fluidextract of the U. S. P. VIII did not represent the activity of squills, but it is doubtful whether the complicated process of the U. S. P. IX will be employed for such a rarely used fluidextract.

Dose, from one to three minims (0.06-0.2 mil).

Off. Prep.—Syrupus Scillae Compositus, *U. S.*, Mistura Pectoralis, Stokes, *N. F.*

FLUIDEXTRACTUM SENEGA. U. S.

FLUIDEXTRACT OF SENEGA Fldext. Seneg.

Extrait liquide de Polygale de Virginie, Extrait liquide de Seneca, *Fr.*; Flussiges Senegaextrakt, *G.*

"Senega, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]; Ammonia Water, Alcohol, Water, each, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix two thousand mils [or 67 fluidounces, 301 minims] of alcohol with one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of water, and, having moistened the powder with sufficient of this mixture, pack it in a cylindrical percolator and add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding menstruum, composed of a mixture of two volumes of alcohol and one volume of water, until the drug is exhausted. Reserve the first eight hundred mils [or 27 fluidounces, 24 minims] of the percolate and evaporate the

remainder to a soft extract; dissolve this in the reserved liquid and then gradually add ammonia water until the product is faintly alkaline and possesses a slight odor of ammonia. Finally add enough of the menstruum to make the Fluid-extract measure one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]." *U. S.*

Formerly, Fluidextract of Senega was very frequently the cause of annoyance to the pharmacist through gelatinization. This was due to the presence of pectinous bodies in the root. The addition of an alkali to the menstruum effectually prevents this, and in this respect the present preparation is a great improvement over the 1890 fluidextract. We prefer, however, solution of sodium hydroxide, as the alkaline liquid, to ammonia water, as the latter is rarely uniform in quality as found in commerce. This fluidextract is a blackish-brown, moderately thin liquid. For other processes, see *N. R.*, 1883, pp. 195, 196. The British Pharm. (1898) "Liquor Senegae Concentratus" was made half the strength of the U. S. fluidextract with a menstruum composed of 2 parts of 20 per cent. alcohol and 1 part of 45 per cent. alcohol.

Dose, five to twenty minims (0.3--1.3 mils).

Off. Prep.—Syrupus Scillae Compositus, *U. S.*; Syrupus Senega;, *U. S.*; Mistura Pectoralis, Stokes, *N. F.*; Syrupus Cimicifuga; Compositus, *N. F.*

FLUIDEXTRACTUM SENNAE. U. S.

FLUIDEXTRACT OF SENNA *Fldext. Senn.*

Extrait liquide de Sene, *Fr.*; Flussiges Sennaextrakt, *G.*

"Alexandria Senna, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains], Prepare a Fluidextract by Type Process A, using a mixture of one volume of alcohol and two volumes of water as the menstruum, and reserving the first eight hundred mils [or 27 fluidounces, 24 minims] of percolate." *U. S.*

The U. S. P. VIII process provided for the elimination of the griping principles by the previous percolation of the powdered senna with alcohol; diluted alcohol was then used to exhaust the drug of the purgative principles. This previous treatment of the senna was deleted from the U. S. P. IX process and the menstruum was made less alcoholic.

The fluid-extract is a dark, blackish, thick, and somewhat turbid liquid, with a strong flavor of senna. It is well adapted for exhibition with saline cathartics, such as Epsom salt or cream of tartar, which also obviate its griping. In this case not more than one-half of the full dose of the fluidextract should be given at once.

The British Pharm. (1898) "Liquor Senna Concentratus" was more like a concentrated infusion than a fluidextract, but had the same strength of the latter, the menstruum is distilled water; tincture of ginger and alcohol being added.

Dose, from one-half to two fluidrachms (1.8-7.5 mls), for an adult.

Off. Prep.—Syrupus Sarsaparillae Compositus, *U. S.*; Syrupus Sennae, *U. S.*; Elixir Cascara; Compositum, *N. F.*; Elixir Catharticum Compositum, *N. F.*; Syrupus Ficorum Compositus, *N. F.*; Syrupus Sennae Aromaticus, *N. F.*; Syrupus Sennae Compositus, *N. F.*

FLUIDEXTRACTUM SPIGELIA. U. S.

FLUIDEXTRACT OF SPIGELIA Fldext. Spigel. [Fluidextract of Pink Root]

Extrait liquide de Spigélie, *Fr.*; Flussiges Spigélienextrakt, *G.*

"Spigelia, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using diluted alcohol as the menstruum." *U. S.*

This preparation differs from that official prior to 1890 in having no glycerin in the menstruum; the *U. S. P.*, 1870, fluidextract contained 50 per cent. of glycerin. Diluted alcohol is an excellent menstruum.

The fluidextract of spigelia is a dark-brown translucent liquid, with the flavor of the root. The dose may be repeated morning and evening for three or four days, and then followed by a brisk cathartic. It is, however, most used in connection with the fluidextract of senna, the fluidextract of spigelia and senna formerly official being an excellent combination, which should not have been dropped from the Pharmacopoeia. The formula is as follows:

Extractum Spigeliae et Sennae Fluidum, U. S. 1870. *Fluid Extract of Spigelia and Senna*.— " Take of Fluid Extract of Spigelia ten fluid-ounces; Fluid Extract of Senna, six fluidounces; Oil of Anise, Oil of Caraway, each, twenty minims. Mix the Fluid Extracts, and dissolve the Oils in the mixture." U. S. 1870.

Dose, for an adult, from one to two fluidrachms (3.75-7.5 mils); for a child of two or three years, from ten to twenty minims (0.6-1.3 mils).

FLUIDEXTRACTUM STAPHISAGRIAE. U. S.

FLUIDEXTRACT OF STAPHISAGRIA Fldext. Staphisag. [Fluidextract of Stavesacre]

Fluidextract of Stavesacre Seed; Extrait liquide des Semences de Staphisaigre, *Fr.*; Flussiges Stephanskornereextrakt, *G.*

"Staphisagria, in No. 20 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using alcohol as the menstruum. The oil which separates in the freshly prepared Fluidextract may be removed by chilling and filtering the cold Fluidextract through a filter moistened with alcohol." *U. S.*

This fluidextract was first made official in the U. S. P. VIII. Mixed with two or three parts of alcohol and ether, it is used as an external application to destroy lice.

FLUIDEXTRACTUM STILLINGIAE. U. S.

FLUIDEXTRACT OF STILLINGIA Fldext. Stilling.

Extrait liquide de Stillingie, *Fr.*; Flussiges, Stillingiaextrakt, *G.*

"Stillingia, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using diluted alcohol as the menstruum." *U. S.*

The glycerin in the menstruum has been abandoned in this fluidextract, which is of a dark reddish-brown color.

Dose, from fifteen to forty-five minims (0.9— 2.8 mils).

Off. Prep.—Elixir Corydalis Compositum, *N. F.*

FLUIDEXTRACTUM SUMBUL. U. S.

FLUIDEXTRACT OF SUMBUL Fldext. Sumbul [Fluid-extract of Musk Root]

Extrait liquide de Sumbul, *Fr.*; Flussiges Sumbulwurzelextrakt oder Moschuswurzelextrakt, *G.*

"Sumbul, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using a mixture of four volumes of alcohol and one volume of water as the menstruum." *U. S.*

This fluidextract was made official for the first time in the U. S. P. VIII, superseding the tincture of sumbul, to which it is superior.

Dose, half a fluidrachm to one fluidrachm (1.8-3.75 mils).

FLUIDEXTRACTUM TARAXACI. U. S.

FLUIDEXTRACT OF TARAXACUM Fldext. Tarax. [Fluidextract of Dandelion]

Extractum Taraxaci Liquidum, *Br.* 1898; Liquid Extract of Taraxacum; Fluidextract of Dandelion; Extrait liquide de Pissenlit, *Fr.*; Flussiges Lowenzahnwurzelextrakt, *G.*

"Taraxacum, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains], Prepare a Fluidextract by Type Process B, using a mixture of one hundred mils [or 3 fluidounces, 183 minims] of glycerin, five hundred mils [or 16 fluidounces, 435 minims] of alcohol and four hundred mils [or 13 fluidounces, 252 minims] of water as Menstruum I, and diluted alcohol as Menstruum II." *U. S.*

The activity depends more upon the proper selection of the root than upon anything else.

The addition of solution of sodium hydroxide to the menstruum in the U.

S. P. VIII revision was dropped in the U. S. P. IX. The process of exhausting the drug is not difficult, and one of the best tests of this fluidextract is its bitter taste. It is a blackish, moderately thick liquid.

Dose, from one to three fluidrachms (3.75-11.25 mils).

Off. Prep.—Elixir Gentianae Glycerinatum, *N. F.*; Elixir Taraxaci Compositum, *N. F.*

FLUIDEXTRACTUM TRITICI. U. S. (Br.)

FLUIDEXTRACT OF TRITICUM Fldept. Tritic. [Fluidextract of Couch Grass]

Extractum Agropyri Liquidum, *Br.*; Liquid Extract of Couch Grass; Liquid Extract of Triticum; Fluidextract of Couch-grass Root; Extrait liquide de petit Chiendent, *Fr.*; Flussiges Queckenwurzelextrakt, *G.*

"Triticum, finely cut, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, two hundred mils [or 6 fluidounces, 366 minims]. Prepare a Fluidextract by Type Process D, evaporate the aqueous percolate to eight hundred mils [or 27 fluidounces, 24 minims] and when cold add the alcohol and, if necessary, sufficient water to make the product measure one thousand mils [or 33 fluidounces, 6½ fluidrachms]." U. S.

"Couch Grass, cut small, 1000 grammes; Distilled Water, boiling, 10,000 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Boil the Couch Grass with the Distilled Water for thirty minutes; strain; evaporate to seven hundred and fifty millilitres; cool, and add sufficient of the Alcohol to produce the required volume; filter." *Br.*

For therapeutic uses, see *Triticum* and *Agropyrum*.

In making this fluidextract in warm weather, it is advisable to commence evaporating the percolate before the drug is exhausted, or fermentation may set in; triticum contains fermentable sugars, and diluted aqueous solutions do not keep well.

This fluidextract represents whatever virtues triticum possesses. The German Pharmacopoeia formerly directed an *Extractum Graminis*, by

digesting 1 part of *Triticum* with 6 parts of hot water, for six hours, straining, evaporating to a syrup, mixing 1 part of this extract with 4 parts of cold distilled water, filtering, and evaporating to an extract. The fluidextract is preferable, as the excessive use of heat is avoided.

Dose, from three to six fluidrachms (11.25-22.5 mls).

FLUIDEXTRACTUM UVAE URSI. U. S.

FLUIDEXTRACT OF UVA URSI Fldext. Uvae Ursi

Extrait liquide de Busserole, *Fr.*; Flussiges Barentraubenblatterextrakt, *G.*

"Uva Ursi, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process B, using a mixture of one hundred mls [or 3 fluidounces, 183 minims] of glycerin, three hundred mls [or 10 fluidounces, 69 minims] of alcohol and five hundred mls [or 16 fluid-ounces, 435 minims] of water as Menstruum I, and a mixture of one volume of alcohol and two volumes of water as Menstruum II. Reserve the first eight hundred mls [or 27 fluid-ounces, 24 minims] of percolate." *U. S.*

This preparation is a dense, black liquid, of a sweet, bitterish, astringent, but not very disagreeable taste.

Dose, from thirty minims to a fluidrachm (1.8-3.75 mls).

FLUIDEXTRACTUM VERATRI VIRIDIS. U. S.

FLUIDEXTRACT OF VERATRUM VIRIDE Fldext. Verat. Vir. [Fluidextract of Green Hellebore]

Fluidextract of American Hellebore; Extrait liquide de Veratre americain, *Fr.*; Flussiges Grungermerextrakt, *G.*

"Veratrum Viride, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using alcohol as the menstruum." *U.S.*

This is the best preparation of veratrum and thoroughly represents the drug.

Dose, one to four minims (0.06-0.24 mil).

FLUIDEXTRACTUM VIBURNI PRUNIFOLII. U. S. (Br.)

FLUIDEXTRACT OF VIBURNUM PRUNIFOLIUM Fldext. Viburn. Prun. [Fluidextract of Black Haw]

Extractum Viburni Liquidum, Br.; Liquid Extract of Black Haw; Extrait liquide de Viburne, *Fr.*; Flussiges Viburnumextrakt, *G.*

"Viburnum Prunifolium, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using a mixture of two volumes of alcohol and one volume of water as the menstruum." U. S.

"Black Haw, in No. 60 powder, 1000 grammes; Alcohol (70 per cent.), sufficient to produce 1000 millilitres. Exhaust the Black Haw with the Alcohol by the percolation process. Reserve the first eight hundred and fifty millilitres of the percolate; recover the alcohol from the remainder by distillation; evaporate the residue to a soft extract; dissolve this in the reserved portion; add sufficient of the Alcohol to produce the required volume." *Br.*

This is a fluidextract which well represents the drug. It is of a dark reddish-brown color.

Dose, from one-half to one fluidrachm (1.8— 3.75 mils).

Off. Prep.—Elixir Viburni Prunifolii, *N. F.*

FLUIDEXTRACTUM XANTHOXYLI. U. S.

FLUIDEXTRACT OF XANTHOXYLUM Fldext. Xanthox. [Fluidextract of Prickly Ash]

Extrait liquide d'Ecorce de Clavaliere, *Fr.*; Flussiges Zahnwehrrindenextrakt, *G.*

"Xanthoxylum, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using a mixture of three volumes of alcohol and one volume of water as the menstruum." U. S.

This fluidextract thoroughly represents the virtues of the drug. (See Xanthoxylum.)

Dose, from one-half to one fluidrachm (1.8-3.75 mils).

Off. Prep.—Elixir Corydalis Compositum, *N.F.*

FLUIDEXTRACTUM ZINGIBERIS. U. S.

FLUIDEXTRACT OF GINGER Fldext. Zingib.

Extrait liquide de Gingembre, *Fr.*; Flussiges Ingwerextrakt, *G.*

"Jamaica Ginger, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]. Prepare a Fluidextract by Type Process A, using alcohol as the menstruum." U. S.

This fluidextract is a highly concentrated alcoholic solution of the active principles of ginger. It is transparent, and of a reddish color.

Dose, from five to twenty minims (0.3-1.3 mils).

Off Prep.—Syrupus Zingiberis, *U. S.*

FOENICULUM. U. S. (Br.)

FENNEL Foenic. [Fennel Seed]

"The dried, ripe fruit of cultivated varieties of *Foeniculum vulgare* Miller (Fam. *Umbelliferae*), without the presence or admixture of more than 4 per cent. of foreign matter." U. S." Fennel Fruit is the ripe fruit of *Foeniculum vulgare*, Mill., collected from cultivated plants, and dried." *Br.*

Foeniculi Fructus, *Br.*; Semen Foeniculi, Fennel Fruit (Seed), Sweet Fennel Fruit; Fenouil doux (Fruit), *Fr. Cod.*; Fruits (Semences) de Fenouil, *Fr.*; Fructus Foenicuii, *P. G.*; Fenchel, Fencbelsamen, *G.*; Finocchio, *It.*; Hinojo, *Sp.*

The plant producing fennel seed was attached by Linnaeus to the genus *Anethum*, but was separated from it by De Candolle, and placed, with three or four others, in a new genus styled *Foeniculum*, which has been

generally adopted by botanists. The *Anethum Foeniculum* of Linnaeus embraced two varieties, the common or wild fennel, and the sweet fennel, the latter being the plant usually cultivated in the gardens of Europe. These are considered by De Candolle as distinct species, and named respectively *Foeniculum vulgare* and *Foeniculum dulce*, but the correctness of the opinion of the great Swedish botanist is now generally admitted.

Foeniculum vulgare is a stout, glabrous biennial or perennial, aromatic herb, with leaves dissected into numerous filiform segments. The flowers are in large, flat, terminal umbels, with from thirteen to twenty rays, and destitute both of general and partial involucre. The corolla consists of five petals, which, as well as the stamens, are golden yellow. The fruit is ovate, and of a dark color, especially in the grooves. The plant is a native of Europe, growing wild upon sandy and chalky ground throughout the continent, and is also abundant in Asia, possibly extending as far as China. It is extensively cultivated in Europe as well as in this country. It has escaped from gardens and is somewhat naturalized in Maryland and Virginia. In India fennel is said to be obtained from *F. panmorium* DC., which is probably, however, only a variety of the official plant. Sicilian fennel is affirmed to be the fruit of *F. piperitum*.

F. dulce De Cand., *Sweet Fennel* bears a general resemblance to *F. vulgare*, but differs in having its stem somewhat compressed at the base, its radical leaves somewhat distichous, and the number of rays in the umbel only from 6 to 8. It is also a much smaller plant, being only about a foot high; its flowers appear earlier, and its young sweet shoots or turiones are eaten in Italy boiled or as a salad. According to Index Kewensis it is identical with *F. vulgare*.

Properties.—The roots of fennel were formerly employed in medicine, but are generally inferior in virtues to the fruit, which is now the only portion recognized by any of the pharmacopoeias. It is stated that manufacturers of the oil usually distil the whole plant.

The official description is as follows: "Mericarps usually separate, each being broadly elliptical, more or less curved, from 4 to 10 mm. in length and from 1 to 3.5 mm. in breadth, some having a slender stalk from 2 to 10 mm. in length; dorsal surface convex, yellowish-green to grayish-brown, with three prominent, longitudinal primary ribs and at the

summit a short, conical stylopodium; commissural surface with three narrow, light brown, longitudinal areas separated by two dark brown or brownish-black areas containing the vittae or oil-tubes; odor and taste aromatic and characteristic. Under the microscope, transverse sections of Fennel show a pentagonal mericarp, four of the edges being nearly equal and slightly concave, the other or commissural surface being much longer and more or less undulate; cells of the seed-coat closely united with those of the pericarp, giving the section two very distinct areas, the inner and larger portion (endosperm) more or less rounded-pentagonal and somewhat reniform, composed of polygonal cells, filled with aleurone grains containing rosette aggregates of calcium oxalate and a thin protoplasmic layer enclosing a fixed oil; the outer or pericarp layer distinguished by large elliptical vittae with thick, brown walls, occurring singly and alternating with the primary ribs, and two vittae on the dorsal surface, making usually six vittae in all, there sometimes being, however, one or two vittae additional; in the central portion of each of the ribs occurs a nearly circular, fibro-vascular bundle with a few tracheae and numerous thin-walled, strongly lignified sclerenchymatous fibers. The powder is yellowish-brown consisting of irregular angular fragments; tissues of endosperm, colorless, the cells filled with aleurone grains, each containing a rosette aggregate of calcium oxalate, about 0.002 mm. in diameter; fragments containing yellowish-brown vittae, from 0.1 to 0.2 mm. in width; sclerenchymatous fibers few, strongly lignified and with numerous, oblique, simple pores; parenchyma cells with more or less thick walls and simple pores and occasionally reticulately thickened; tracheae few and either spiral or annular; in mounts made with hydrated chloral T.S., numerous globules of a fixed oil separate. Fennel yields not more than 9 per cent. of ash." *U. S.*

Fennel seeds (half fruits) are officially described in the Br. Pharm. as follows:

"Small, oblong, straight or slightly curved, from three to ten millimetres long, and from two to four millimetres in diameter. Greenish or greenish-brown. Each of the two mericarps with five prominent principal ridges and six large vittae. Aromatic odor; taste strong, sweet and camphoraceous. Ash not more than 11 per cent." *Br.*

There are ten chief varieties of fennel known in commerce, the fruits differing very much in size and considerably in taste. They are as

follows: French (sweet); French (bitter); German; Puglis; Indian; Russian; Macedonian; Galician; Persian and Japanese. For histological differences of the different commercial varieties see monograph by Hartwich and Jama in *B. P. G.*, 1909, p. 306. Rosenthaler (*B. P. G.*, 1913, p. 570) has made a pharmacognostical study of a Chinese fennel.

Commercial fennel varies greatly in quality, this being either due to lack of care in harvesting or deliberate adulteration. It may contain sufficient sand, dirt, stem tissues, weed seeds, or other material beyond the 4 per cent. limit prescribed by the Pharmacopoeia that it amounts to adulteration. The fruits, especially the powder, may be deficient in volatile oil, inferring that they have been partly exhausted. Exhausted or otherwise inferior fennel is occasionally improved in appearance by the use of a factitious coloring. (See Spaeth, in *Ph. Zentralh.*, 1908, p. 545; and 1913, p. 736.)

Schimmel & Co.'s Semi-Annual Report for April, 1897, gives as additional varieties of fennel—Aleppo, oil amounting to 0.75 per cent.; Macedonian, 3.4 to 3.8 per cent.; Moravian, 3 per cent.; Milanese, 4.2 per cent.; Roumanian, 4.6 per cent.; Spanish, amount not stated; and Syrian (Damascus), 1.6 per cent. Of these, the Syrian may be the same as that called Persian by Umney, and the Roumanian the same as that called Russian. Several additional varieties are also mentioned by Umney (*P. J.*, 1897, lviii, p. 226), who states that the European varieties were almost entirely displaced by the East Indian seed and that the latter would probably be supplanted by the Japanese variety.

The odor of fennel seed is fragrant, its taste warm, sweet, and agreeably aromatic. It yields its virtues to hot water, but more freely to alcohol. The essential oil may be separated by distillation with water. (See *Oleum Foeniculi*.) From 960 parts of the seed Neumann obtained 20 parts of volatile and 120 of fixed oil.

Uses.—Fennel seed was used by the ancients. It is one of our most grateful aromatics, and in this country is much employed as a carminative, and as a corrigent of other less pleasant medicine, particularly senna and rhubarb. It is recommended for these purposes by the absence of any highly excitant property. An infusion may be prepared by introducing two or three drachms of the seeds into a pint of boiling water. In infants the infusion is frequently employed as an enema for the expulsion of flatus.

Dose, of the bruised or powdered seeds, twenty grains to half a drachm (1.3-2.0 Gm.).

Off. Prep.—Aqua Foeniculi, *U. S.* (from oil), *Br.*; Infusum Sennae Compositum, *U. S.*; Pulvis Glycyrrhizae Compositus, *Br.*; Pilulae Antiperiodicae, *N. F.*; Pilulas Antiperiodicae sine Aloes, *N. F.*; Species Laxativae, *N. F.*; Tinctura Antiperiodica, *N. F.*; Tinctura Antiperiodica sine Aloe, *N. F.*

FRANGULA. U. S.

FRANGULA Frang. [Buckthorn Bark]

"The dried bark of *Rhamnus Frangula* Linne (Fam. *Rhamnaceae*)." *U. S.*

Rhamni Frangulae Cortex, *Br.* (1885); Frangula Bark; Alder Buckthorn; Ecorce de Bourdaine, Bourgene, *Fr.*; Cortex Frangulae, *P. G.*; Faulbaumrinde, *G.*; Corteccia di frangola. *It.*

R. Frangula or Alder Buckthorn is an erect glabrous shrub from ten to fifteen feet high, without thorns, with broadly ovate obtuse leaves, the margins being entire or slightly sinuate, the under side sometimes slightly downy, and the rather numerous lateral veins diverging equally almost from the whole length of the midrib. Flowers all hermaphrodite, two or three together in each axil, with the calyx teeth, petals, and stamens in fives. Fruit dark purple, the size of a pea. This plant grows in hedges and bushy places throughout Europe and Russian Asia, except in the far north. It has become established on Long Island, northern New Jersey and in Ontario.

It is probable that most of the species of the genus *Rhamnus* have cathartic properties. An article upon *R. Purshiana* will be found elsewhere, as it is official in both of the Pharmacopoeias. (See Cascara Sagrada.) The *R. catharticus* Linn., or common buckthorn, grows in Europe along with the official species, and has become locally naturalized in the Eastern portions of the United States. Its bark is probably often sold for the official article. It is distinguished by its more spreading, thorny habit, and its dioecious flowers, which are thickly clustered in the axils and have their parts in fours. The leaves also are more acute, have their margins finely serrate and their lateral veins mostly proceeding from the proximal half of the midrib. The fruit is

purplish-black.

Properties.—This bark is officially described as "in quills varying in length, frequently flattened or crushed; from 0.5 to 1 mm. in thickness; outer surface grayish-brown or purplish-black, with numerous, prominent, lighter-colored, transverse lenticels and occasional patches of foliaceous lichens bearing small, blackish apothecia; inner surface smooth, dark brown with occasional purplish blotches, longitudinally striate, becoming red when moistened with solutions of the alkalies; fracture short, slightly fibrous in the inner layer; odor distinctive; taste slightly bitter. Under the microscope, transverse sections of *Frangula* show a distinctly undulate corky layer, composed of about 12 rows of reddish-brown cells; parenchyma cells of the primary cortex with numerous rosette aggregates of calcium oxalate, from 0.01 to 0.025 mm. in diameter; inner bark with bast-fibers in narrow, interrupted rows, the groups of fibers being separated radially by the medullary rays; bast-fibers with thick, strongly lignified, yellowish walls and narrow lumina and each group surrounded by a layer of crystal fibers, the prismatic crystals of calcium oxalate varying from 0.007 to 0.015 mm. in diameter, medullary rays one to two cells in width, occasionally three; cells of the parenchyma and medullary rays with numerous starch grains, 0.003 mm. in diameter. The powder is yellowish-brown; stone cells absent (distinguishing it from the powder of *Cascara Sagrada*). Add 0.1 Gm. of powdered *Frangula* to 10 mls of hot distilled water, shake the mixture occasionally until cold and filter; on the addition of a few drops of ammonia water, the filtrate is colored a deep red. Macerate 0.1 Gm. of powdered *Frangula* with 10 drops of alcohol, boil with 10 mls of distilled water and filter when cold. Shake this filtrate with 10 mls of ether; a yellow, ethereal solution separates, and 3 mls of this ethereal solution, when shaken with 3 mls of ammonia water, yields an alkaline solution, which, on being diluted with 20 mls of distilled water, still possesses a distinct cherry-red color. *Frangula* yields not more than 6 per cent. of ash." *U. S.*

As first pointed out by Schrenk (*Am. Drug.*, April, 1887), the bark of *Rhamnus Frangula* can be distinguished from that of *R. Purshiana* (*Cascara Sagrada*) by the absence of the irregular angular sclerenchymatous cells, which in *R. Purshiana* are wedged together in large compact groups, increasing in size and number towards the surface, and causing the short fracture of the outer bark.

Tschirch and Pool (*S. W. P.*, 1908, p. 665) have made a comparative pharmacognostical and chemical study of the barks of *R. Frangula* and *R. Purshiana*. Wurffel (*Zeit. Oest. Apoth. Ver.*, 1907, p. 211) and Mitlacher (*Bull. sc. pharmacol.*, 1911, p. 10) report the substitution of *Frangula* by the bark of an alder (*Alnus glutinosa* Medic). The latter may be detected by not being reddened with solutions of the alkalies. Mitlacher (*Ph. Post*, 1905, p. 751) and Moser (*A. J. P.*, 1909, p. 580) have found that the official *Frangula* is either admixed with or entirely substituted by the bark of *R. carniolica* A. Kerw. E'we (*Proc. A. Ph. A.*, 1914, p. 131) obtained a sample of *Frangula* which proved to be wild-cherry bark.

It is not certainly known which of the several bodies isolated from *frangula* bark is the purgative principle. The most important body, *frangulin*, the rhamnnoxanthin ($C_{20}H_{20}O_{10}$) of Bucner and Binswanger, may be obtained by Phipson's process by macerating the bark for three or four days in carbon disulphide, then permitting the liquid to evaporate, exhausting the residue with alcohol, which leaves the fatty matter behind, evaporating the alcoholic liquid to dryness, and recrystallizing from ether. As thus obtained it is in fine yellow crystals, melting at about $226^{\circ} C.$ ($438.8^{\circ} F.$), and subliming in golden-yellow needles. It is insoluble in water, soluble in 160 parts of warm 80 per cent. alcohol, nearly insoluble in cold alcohol, soluble in hot fixed oils, petroleum benzin, and oil of turpentine. It communicates its color to cotton, silk, and wool. Faust (*A. Pharm.*, clxxxvii, 8) first proved the glueosidal character of *frangulin* by boiling it in alcoholic solution with hydrochloric acid, obtaining glucose and *frangulinic acid*, $C_{14}H_8O_4$. This forms fine microscopic needles of reddish color, fusing at 248° to $250^{\circ} C.$ (478.4° - $482^{\circ} F.$). Liebermann and Waldheim (*Ber. d. Chem. Ges.*, 9, p. 1775) obtained in this decomposition instead of *frangulinic acid*, *emodin*, $C_{15}H_{10}O_5$, trioxymethylanthraquinone. *Frangulinic acid*, on the other hand, would be a dioxyanthraquinone and an isomer of alizarin. Schwabe, in 1888, also found that *emodin* and *rhamnmodulcite* were the decomposition products of *frangulin*, to which latter he gave the formula $C_{21}H_{20}O_9$, instead of that given above by Buchner. (Planchon et Collin, *Drogues Simples* (1896), vol. ii, 590.) E. Amweg has devised a method of separating the glucosides from *frangula*, *cas-cara* and *rhubarb* by extraction with solvents; he uses, 1, benzene; 2, a mixture of two parts of benzene, and one part of absolute alcohol, and 3, alcohol (60 per cent.) (*Ap. Ztg.*, 1897, 747.) Kubly isolated a crude acid

which, when purified, he termed *frangulic acid*; Amweg regards this acid as a decomposition product and calls it *pseudo-frangulin*, this when hydrolyzed becomes *pseudo-emodin*. The emetic action of the green bark is attributed to a hydrolytic ferment, which is destroyed by heating. (*P. J.*, 1898, 24.)

Tschirch and Bromberger state that the bark of *Rhamnus cathartica* was found to contain *rhamnosterin*, *rhamnofluorin*, *emodin*, *chrysophanol* and *d-glucose*. (*S. W. P.*, 1912, v. 50, pp. 193-197.)

Uses.—In its fresh state this drug is very irritant to the gastrointestinal mucous membrane, producing, when taken in sufficient quantity, violent catharsis, accompanied by vomiting and much pain. During drying it is said to lose much of its irritant power, and the dried bark is affirmed to resemble rhubarb in its action. The U. S. P. VIII required that the bark should be at least one year old, but this requirement does not appear in the U. S. P. IX. A *decoction* (an ounce to the pint) may be used in tablespoonful doses, or a dessertspoonful of an *elixir*, made by mixing four fluidounces of the fluidextract with twelve of elixir of orange, may be employed.

Dose, of frangula, fifteen to thirty grains (1-2 Gm.).

Off. Prep.—Fluidextractum Frangulae, *U. S.*; Elixir Catharticum Compositum (from Fluidextract), *N. F.*; Syrupus Sennae Compositus (from Fluidextract), *N. F.*

Frankenia. *Frankenia grandifolia* Cham. and Schlecht. Yerba Rezima. (Fam. *Frankeniaceae*).— This herb, which grows in California, Nevada, Arizona and Northern Mexico, contains about 6 per cent. of tannin and is employed as a topical remedy in *catarrhal affections*, especially of the nose and genito-urinary tract; also internally in doses of from ten to twenty minims (0.6 to 1.3 mils) of the fluidextract. For local application the fluidextract may be diluted with from two to five times its volume of water.

Frasera. *Radix Fraserae.* *Radix Colombo Americana; Racine de Colombo de Mariette (d' Amerique)*, Fr. *Frazerawumel, Amerikanische Colombowurzel*, G.—American Columbo is yielded by *Fraseracarolinensis* Walt. (Fam. *Gentianaceae*), a perennial herb which nourishes in rich dry soil from New York and Wisconsin southward. The period of flowering is from May to July; but the stems and flowers are produced only in the third year, the radical leaves being the only part of the plant which previously appears above ground. From this manner of growth, it is inferred that the roots, which were formerly included in the Secondary List U. S. P., should be

collected in the autumn of the second or the spring of the third year. Before being dried, they should be cut into transverse slices.

As formerly in the market, *fraseria* was in disc-like pieces resembling *calumba*, but are easily distinguishable by the greater uniformity of their internal structure, the absence of concentric and radiating lines, and their purer yellow color, without a greenish tinge. The root sliced longitudinally, so as to imitate gentian, has been offered in the market as American gentian. The taste of *fraseria* is bitterish and sweetish. Water and diluted alcohol extract its virtues, and the tincture precipitates upon the addition of water, but is not affected by tincture of galls. The hot infusion is not precipitated by solution of gelatin, and gives with iodine no signs of starch. These reactions afford additional means of distinguishing the root from *calumba*. It contains gum, pectin, glucose, wax, resin, fatty matter, yellow coloring matter, bitter extractive, and an acid which is probably peculiar. (*A. J. P.*, Jan., 1862, 23.)

Frasera is a feeble, simple bitter. Dose, of powder, one drachm (3.9 Gm.); of infusion (1 fl. oz. to 1 pint boiling water), two fluidounces (60 mls) a day. The fresh root is said to be emetic and cathartic.

Fucus. *N. F. IV. Bladderwrack. Sea-wrack. Kelp-ware. Black-twig. Cutweed. Quercus Marina. Fucus [Varech] vesiculeux, Fr. Blasentang, Seetang, Meeriche, G.* (Fam. *Fucaceae*.)— *Fucus* was retained in the National Formulary IV as " the dried thallus of *Fucus vesiculosus* Linne (Fam. *Fucaceae*)." This is a common seaweed growing on the rocks in the North Atlantic Ocean. " Sometimes a meter in length, but usually in

shorter pieces, from 1 to 4 cm. in width, dichotomously branched, brownish black, usually with a slight, whitish incrustation; flat, smooth, entire-margined, having a stout midrib throughout, along which are irregularly disposed pairs of air-vesicles which vary in diameter from 5 to 15 mm.; receptacles terminal, compressed, mostly ovate or elliptical and about 1 cm. in length, but varying from spherical and 5 mm. in diameter to linear-lanceolate and 5 cm. in length, forked, solitary, or in pairs. Odor strongly seaweed-like; taste saline and nauseous. *Fucus* yields not more than 20 per cent. of ash." *N. F.* The plant grows upon the shores of Europe and of this continent, attaching itself to the rocks by its expanded woody root. On the coasts of Scotland and France it is much used in the preparations of kelp. It is also employed as a manure, and is mixed with the fodder of cattle. It contains from 22 to 62 per cent. of mucilage and a peculiar cellulose, and about 0.1 per cent. of a volatile oil; the ash containing both iodine and bromine. Tollens and Kovoit state that 0.8 per cent. of a sugar named *fucose*, $C_6H_{12}O_6$, exists in dried seaweed. Votocek and Potmesil obtained from fucose an alcohol which they named fucitol. (*B. P. G.*, 1913, 3653.) Convoy has found in it 0.21 per cent. of iodine. (*P. J.*, x, 434.) These ingredients remain in its ashes, and in the charcoal resulting from its exposure to heat in close vessels. On the coast of France about a dozen species of seaweed have been used in making kelp. According to Eugene Marchand, *Fucus vesiculosus* is one of those poorest in iodine, the different species of *Laminaria* containing far larger amounts of iodine than this *Fucaceae*. (See *P. J.*, 1884, 1011.) *Laminaria digitata* (L.) Lamx. and *L. stenophylla* contain ten times as much iodine as the *Fuci*, and are practically now the only kelps

used in making iodine. (See *P. J.*, 1884, 1026.)

The charcoal derived from kelp was at one time used, under the name of *Aethiops vegetabilis* or *vegetable ethiops*, in the treatment of *goitre* and *scrofulous swellings*. The mucus contained in the vesicles was applied externally, with advantage, by Russell, as a resolvent in scrofulous tumors. Duehesne Duparc has obtained from it very good results in the treatment of morbid *obesity*. (*J. P. C.*, 1862, 65.) A. T. Carson affirms, however, that the *Fucus vesiculosus* is largely used in Ireland for fattening pigs, and it is doubtful whether its preparations are capable of reducing human obesity unless given in such doses as to interfere with digestion and injure the health. A possible explanation of the action of bladderwrack in obesity, if it exercise any, is found in the experiments of Hunt and Seidell (*J. P. Ex. T.*, 1910, ii, p. 15), who present evidence to show that the extract of this plant is a powerful stimulant to the thyroid gland. Dannecy prepares the extract from the plant, collected at the period of fructification and rapidly dried in the sun. The coarse powder he treats for three days, with four times its weight of alcohol of 86°, expresses at the end of this time, and subjects the residue twice successively to a similar treatment with alcohol of 54°. The tinctures are then mixed, the alcohol distilled off, and the remainder evaporated to the consistence of an extract. Of this extract, which is one-fifteenth of the plant, three pills, each containing 0.25 Gm. (3.75 grains), may be taken daily in the beginning, and increased gradually to twenty-four pills. (*J. P. C.*, 1862, 434.) From the tincture a syrup may be prepared. *Fluidextractum Fuci*, N. F. IV is made with a menstrum of three volumes of alcohol and one volume of water from fucus in No. 30 powder.

Other species of *Fucus* are in all probability possessed of similar properties. Many of them contain a gelatinous matter and a sweet principle analogous to mannite, and some are used as food in times of scarcity. The varieties are classified by Fristedt as follows:

The *Ceylon moss* is a delicate fucus (*Fucus amylaceus*) growing on the coast of Ceylon. It abounds in starch and vegetable jelly, and is used like carrageen or Irish moss. (*P. J.*, xiii, 355.) *Sphaerococcus Helminthochorton* (L.) Ag. (*Fucus Helminthochorton* L., *Gigartina Helminthochorton* Grev.) has some reputation in Europe as an anthelmintic and febrifuge. It is an ingredient in the mixture of marine plants sold in Europe under the name of *Corsican moss* or *helminthochorton*. This is used in decoction, from four to six drachms to the pint; dose, a wine-glassful three times a day. Large quantities of a seaweed, agar-agar, are gathered on the rocky coasts of the East India islands, and sent to China, where it is valued for making jellies and as a size for stiffening silks. (See *Agar*.)

Attention has been called by Sloan of Ayr, Scotland, to *Laminaria digitata* (L.) Lamx., (*L. Cloustoni* Edmonst.), commonly called *sea-girdles* or *tangles*, of Scotland, as supplying an admirable material for bougies. The stem is from two to twelve feet long and an inch or more in breadth, is of great strength and tenacity, with the property of drying readily, and, in doing so, of shrinking much, and acquiring an elastic firmness, with a consistence, if the desiccation be arrested at the proper point, somewhat softer than horn. In this state the plant may be kept for years, and is capable of absorbing moisture at any time and swelling to the original size, so that it

has been used for the making of dilating bougies and tents.

Fumaria. *Fumaria officinalis* L. *Fumitory. Beggary. Fumeterre, Fr. Erdrauch, Feldraute, G.* (Fam. *Fumariaceae*).—A small annual European plant, naturalized in this country, growing in waste places, and flowering from May to August. It was formerly considerably employed as a medicine, and is still used in Europe. The leaves are the official part. They are inodorous, have a bitter, saline taste, and are very succulent, yielding by expression a juice which has the sensible and medicinal properties of the plant. An extract, prepared by evaporating the expressed juice or a decoction of the leaves, throws out upon its surface a copious saline efflorescence. *Fumaric acid*, $C_4H_4O_4$, was early identified as present, and its isomerism with maleic acid, the acid obtained from malic acid by heat, was established later. The alkaloid fumarine, which was observed by Peschier, has been believed by some chemists to be identical with corydaline, but according to Reichwald (*P. J.*, xix, 990) its formula, $C_{21}H_{19}C_4N$, is different from that of corydaline, from which it further

differs in producing immediately an intense violet with concentrated sulphuric acid and an intense golden color with strong nitric acid. It occurs in colorless, tasteless crystals, freely soluble in chloroform, less so in benzene, still less so in alcohol and ether, sparingly soluble in water. He obtained it by treating the pulp of the leaves with concentrated acetic acid, with the aid of heat, filtering, evaporating the liquid, treating the extract with boiling alcohol, filtering the alcoholic solution, and, finally, decolorizing, and evaporating so that crystals might form. The acetate thus procured was decomposed by the alkalies and yielded the fumarine. (See Adermann, *A. J. P.*, 1890, 396.) Fumitory has been considered gently tonic, alterative, and, in large doses, laxative and diuretic. Hannon has found fumarine, in the dose of about one-third or one-fourth of a grain (0.021-0.016 Gm.) to be moderately excitant; in that of three grains (0.2 Gm.) to be at first irritant and afterwards sedative. (*Ann. Ther.*, 1854, 78.) Both in ancient and modern times fumitory has been esteemed a valuable remedy in visceral obstructions, particularly those of the liver, in *scorbutic affections*, and in various troublesome eruptive diseases. Cullen gave two fluidounces (60 mils) of the expressed juice twice a day. Others have prescribed it in much larger quantities. The leaves, either fresh or dried, may be used in decoction or extract, in almost indefinite dose. The inspissated juice has also been employed.

Fustic.—A yellow dye-wood, obtained from *Chlorophora tinctoria* (L.) Gaud. (*Maclura tinctoria* D. Don.), a tree of the Fam. *Moraceae*, growing in the West Indies and South America. It is not used in medicine or pharmacy. According to Bancroft, two different woods bear in England the name of fustic, one the product of the tree just mentioned, distinguished as old fustic, probably from the greater magnitude of the billeta in which it is imported; the other derived from the *Rhus cotinus* L., or *Venicesumach*, and called young fustic, or sometimes *Hungarian fustic*. The wood of *C. tinctoria* owes its coloring properties to two principles, which have been isolated by R. Wagner; one denominated *morin*, or *morindon*, $C_{15}H_{10}O_6$, and the other *moritannic acid*, $C_{13}H_8O_6$, from its resemblance to tannin. The former, when distilled with zinc dust, yields methylanthracene, whence the conclusion has been drawn that it is a *trioxymethylanthraquinone*, $C_{15}H_7O_2(OH)_3$. (See *Chem. Gaz.*, ix, 1, 21, and 241.)

From the fustic of *Rhus cotinus* L. (fam. *Anacardiaceae*), or Hungarian fustic, Chevreul extracted a yellow coloring matter, in small crystalline needles when pure, which he called *fisetin*. J. Schmidt (*Ber. d. Chem. Ges.*, 19, 1734-1749) has made a thorough study of fisetin, and prepared a number of derivatives of it. He states that it occurs in the wood as a tannic acid compound of the glucoaide of fisetin, which he calls *fustin*. This latter body crystallizes from hot water in fine silvery needles, easily soluble in alcohol and dilute alkalies, sparingly in ether. It melts at from 218°-219° C. (424.4°-426.2° F.) with decomposition. By warming with dilute H₂SO₄ it is split up into fisetin and a glucose (probably *isodulcite*). The *fisetin* has the formula C₁₅H₁₀O₆, and as it contains four hydroxyl groups, it is probably a *tetroxymethylanthraquinone*, C₁₅H₆O₂(OH)₄. It is obtained by recrystallization from dilute alcohol or acetic acid; it forms fine yellow needles or yellow prisms. It is very slightly soluble in hot water, easily soluble in alcohol and acetic ether, sparingly in ether and benzene.

The recent importations have been: 1914, 7121 tons, valued at \$100,501; and for 1915, 12,354 tons, valued at \$179,959.

It has long been known in the Southwest that the wood of the *Osage orange tree*, *Maclura, pomifera* (Raf.) Schneider, contains a dyestuff that would give a more or less fast yellow color. An examination of the wood from Texas by Kressmann showed that it not only contains *morin acid* and *morintannic acid*, the same as fustic wood, but also that the dyeing principles are present in amount to be commercially valuable. A comparative series of dyeing experiments made with fustic and Osage orange wood and extracts showed the latter to be of equal value with fustic in regard to depth of colors produced, the amount of extract, the character of the dyeing, and fastness to light, weather, washing, etc. (*Science*, 1914, 37.)

The Dispensatory of the United States of America Twentieth Edition (1918)

Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. Michael Moore]

Galangal. N. F. IV. *Galanga*. China Root. India Root. *Galanga*, Fr. East India Catarrh Root. *Rhizoma Galangae*, P. G. *Galgant*, G. —This is described in the National Formulary IV as "the dried rhizome of *Alpinia officinarum* Hance. (Fam. Zingiberaceae.)" Two varieties are described by authors, the *Galanga* major and *Galanga* minor, or large and small galangal. They are probably the roots of different plants. The large galangal is derived from *Alpinia Galanga* Willd. (*Maranta Galanga* L., *Galanga officinalis* Salisb.). According to H. F. Hance of Canton, the smaller galangal is the product of a distinct but closely allied plant, *Alpinia officinarum* Hance. (A. J. P., xliii, 408.) Both forms are brought from the East Indies. Galangal of the N. F. is described as "irregularly branched, from 2 to 10 cm. in length and from 1 to 2 cm. in thickness, the branches thinner toward the base; marked with the fine annuli of the leaf bases, which are from 3 to 10 mm. apart and of lighter color than the general surface; externally reddish- or rusty-brown; internally of a lighter orange-brown; cut ends of the branches circular, with recurved margin; fracture fibrous. Odor aromatic and agreeable; taste hot, spicy, resembling ginger. The powder is reddish-brown and, when examined under the microscope, exhibits numerous simple starch grains up to 0.06 mm. in diameter, the small grains few in number, the large grains narrow-ellipsoidal, broadened at one end, sometimes truncate, frequently curved, occasionally with a lateral development, lamellae mostly indistinct, point of origin of growth circular or a cleft in the larger end of the grain, sometimes absent; numerous yellowish oil cells and reddish resin cells; fragments of tracheae with reticulate thickenings or simple pores; thick-walled sclerenchymatous fibers with oblique pores. Galangal yields not more than 10 per cent. of ash." N. F. According to Morin, galangal contains a volatile oil, an acrid resin, *kaempferid*, $C_{16}H_{12}O_6$, *galangin*, $C_{15}H_{10}O_5$, *alpinin*, $C_{17}H_{12}O_6$, and galangol, with an unknown gummy substance and lignin. A. Vogel, Jr., found also starch and fixed oil. (*Ph. Cb.*, 1844, 158.) The active principles are the volatile oil and acrid resin. Galangal is a stimulant aromatic. It was known to the ancient Greeks and Arabians, and formerly entered into numerous compounds. (A. J. P., xliii.) Dose, from fifteen to thirty grains (1.0-2.0 Gm.) in substance, and twice as much in infusion.

Galbanum. Br. 1898. *Gummi - Resina Galbanum*. *Galbanum*, Fr. Cod. *Galbanum*, P. G. *Galban*, Mütterharz, G. *Galbano*, It., Sp.—"A gum-resin obtained from *Ferula galbaniflua*, Boiss. and Buhse, and probably from other species." Br.,

1898. This gum resin was not admitted to the British Pharmacopoeia, 1914. It was also formerly official in the U. S. Pharmacopoeia, but was dropped in the 1890 revision. There has been some confusion as to the plant yielding galbanum. It is fairly well established now through the studies of the German traveller, F. A. Buhse, that it is a species of *Ferula*. He stated that in 1848 he met with the galbanum plant on the declivities of the Demavend, near the southern coast of the Caspian. He saw the gum-resin exuding spontaneously from the plant, and was informed by the natives that the drug was collected from it. The plant is the *F. galbaniflua* Bossier and Buhse. Buhse also stated that the Persian galbanum is yielded by a second plant, which is doubtfully distant from *F. galbaniflua*, the *F. rubricaulis* Boissier. Schumann considers this identical with *F. galbaniflua*. Holmes is of the opinion (*P. J.*, 1891, 194) that "Levant" galbanum is yielded by *Ferula galbaniflua*, and its variety *β-Ancheri*; that solid "Persian" comes possibly from *F. Schair* Borscz, while the liquid "Persian," judging from the fruits found in it, derived from an undescribed species allied to *F. galbaniflua*. It would appear that all the varieties of galbanum of commerce come through Persia. Galbanum is said to be obtained by making incisions into the stem, or cutting it off a short distance above the root. A cream-colored juice exudes, which concretes upon exposure to the air. A portion of juice also exudes spontaneously from the joints, and hardens in the shape of tears.

Galbanum usually appears in the form of masses composed of whitish, reddish, or yellowish tears, from the size of a pin's head to that of a pea and larger, irregularly agglutinated by a darker colored yellowish-brown or greenish substance, more or less translucent, and generally mixed with pieces of stems, seeds, or other foreign matters. It is also found, though rarely, in our markets, in the state of distinct roundish tears, about as large as a pea, of a yellowish-white or pale brownish-yellow color, shining externally as if varnished, translucent, and often adhering together. Galbanum has in cool weather the consistence of firm wax, but softens in summer, and by the heat of the hand is rendered ductile and adhesive. At 180° C. (212° F.) it is sufficiently liquid to admit of straining, and it generally requires to be strained before it can be used. It is of a dark-brown or blackish color, and of a soft consistence. The absence of whitish grains, a deficiency in the characteristic odor and taste, and the intermixture of earthly impurities are signs of inferiority. According to Hirschsohm (*Ph. Z. R.*, 1893, 353), galbanum of commerce differs from that formerly found in the market; its consistence is now like that of white turpentine, although the odor is still that of Levant galbanum; the greatest difference is shown in the action of strong acids and solvents on it. (See *A. J. P.*, 1893, 384.)

The odor of galbanum is peculiar and disagreeable; its taste bitterish, warm, and acrid; its sp. gr. 1.212. Triturated with water, it forms an imperfect milky solution, which on standing deposits the greater portion of what was taken up. Wine and vinegar act upon it in a similar manner. Alcohol dissolves a considerable proportion, forming a yellow tincture, which has the odor and taste of galbanum, and becomes milky with water, but affords no precipitate. In diluted alcohol it is wholly soluble, with the exception of impurities, Ether dissolves the greater portion. "When moistened with alcohol, galbanum acquires a purple color on the addition of a little hydrochloric acid." U. S., 1880. According to Conrady, the composition of galbanum is as follows: ethereal oil, 9.5 per cent.; resin, soluble in alcohol, 63.5 per cent.; gum and impurities,

27 per cent. The purified resin was found by Conrady to contain about 20 per cent. of combined umbelliferone, about 0.23 per cent. of free *umbelliferone*, and about 50 per cent. of *galbaresino-tannol*. This latter represents a type of the class of resino-tannols, first established by Tschirch, was proved to have the alcohol character by forming the acetyl and benzoyl derivatives. Conrady also considers that the umbelliferone is combined with this galbaresino-tannol in the form of an ester. The volatile oil which is obtained from galbanum to the extent of about 10 per cent. he found to consist essentially of a hydrocarbon of the formula $C_{10}H_{16}$, with small amounts of a sesquiterpene, $C_{15}H_{24}$. The terpene has been identified as *d-pinene* by the terpin hydrate formation, while the sesquiterpene, according to Wallach, is *cadinene*, identified by the formation of its chlorhydrate fusing at 117° to 118° C. (242.6° to 244.4° F.). (Gildemeister and Hoffman, *Aetherische Oele*, p. 753.) When the oil is extracted by solvents it is free from acid reaction, but when distilled with steam it acquires an acid reaction, and notable quantities of iso-valeric acid are developed. These fatty acids are probably bound up as esters in the cold extracted oil. (*A. Pharm.*, ccxxxii (1894), 98.) The crude oil is dextrogyrate. The resin, constituting about 60 per cent., is very soft, and dissolves in ether or in alkaline liquids, even in milk of lime, but only partially in carbon disulphide. When heated with hydrochloric acid for some time, it yields umbelliferone, $C_9H_6O_3$, which may be dissolved from the acid liquid by means of ether or chloroform, and obtained on evaporation in colorless acicular crystals. The aqueous solution of umbelliferone exhibits, especially on addition of an alkali, a brilliant blue fluorescence, which is destroyed by an acid. If a small fragment of galbanum be immersed in water, a fluorescence will be produced by a drop of ammonia. Asafetida shows the same reaction, but ammoniac does not.

Galbanum submitted to dry distillation yields a thick oil of brilliant blue color. This oil on rectification yields a greenish portion, and then a superb' blue oil. Kachler (*Ber. d. Chem. Ges.*, 1871, p. 36) found a colorless oil, $C_{10}H_{16}$, and a blue oil, $C_{10}H_{16}O$, boiling at 289° C. (552.2° F.). The blue oil, according to Kachler, after purification, agrees with the blue oil of the flowers of *Matricaria Chamomilla*. By fusing galbanum resin with potassium hydroxide, Hiasiwetz and Barth (*Ann. Ch. Ph.*, 130, p. 354) obtained resorcinol, together with acetic and volatile fatty acids.

According to Ludewig, a gum-resin, designated as *Persian galbanum*, is received in Russia by the way of Astrakhan or Orenburg, and is the kind used in that country. It comes enclosed in skins, and is in masses of a reddish-brown color with whitish streaks, of a disagreeable odor, somewhat like that of asafetida, and of an unpleasant bitter, resinous taste. It is so soft as to melt with a slight elevation of temperature. It differs from common galbanum in its odor, in its color, which is never greenish, and in the absence of tears, and is probably derived from a different plant. It abounds in impurities. This variety of galbanum is probably the same as that obtained by Aitchison in Afghanistan, which on chemical examination yielded—volatile oil, 3.108 per cent.; resin (ether extractive, 61.2, alcohol extractive, 7.576), 68.776; water extractive (gum), 17.028; insoluble matter, 1056. (*P. J.*, Dec. 11, 1886.)

Galbanum was known to the ancients. It is stimulant, expectorant, and antispasmodic, and is considered as intermediate in power between ammoniac and

asafetida. It has chiefly been used in chronic affections of the bronchial mucous membrane, *amenorrhoea*, and chronic *rheumatism*. It is occasionally applied externally as a plaster to indolent *swellings*, with the view of promoting resolution or suppuration.

Compound pills of galbanum were official in the British Pharmacopoeia, 1898, under the name of *Pilula Galbani Composita*, the former name was *Pilula Asafoetida Composita* and the pills consisted of equal parts of galbanum, asafetida and myrrh, syrup of glucose being used as excipient.

Dose, from ten to twenty grains (0.65 to 1.3 Gm.), given in pill, or triturated with gum arabic, sugar and water, so as to form an emulsion.

Under the name of *Zolou root* there appears in the Bayrout markets the root of the *Ferula Hermonii* Boiss. This contains, according to Guiges (*P. J.*, 1906, p. 65) a resin which differs from Galbanum in that it gives with hydrochloric acid a green color, which disappears on heating. It is used by the people of that section as an aphrodisiac.

Galega. *N. F. IV. European Goat's Rue. Goat's Rue. Herba Rutas Caprarice. Rue de Chevre, Fr. Geisraute, Pestilenskraut, G.*—*Galega* was made official in National Formulary IV and thus defined: "The dried flowering tops of *Galega officinalis* Linne (Fam. Leguminosae)." This is a perennial leguminous herb, growing in the south of Europe, and sometimes cultivated in gardens. It is without odor unless bruised, when it emits a disagreeable odor. The *N. F.* describes it as follows: "Stem smooth, erect, branched, when entire from 15 to 45 cm. in length, commonly cut and broken; leaves oddly-pinnate with from six to eight pairs of leaflets; stipules lanceolate, sagitate on one side; leaflets bright green, smooth or slightly hairy, short petioled, lanceolate or ovate-lanceolate, obtuse, slightly mucronate, from 2 to 5 cm. in length and from 2 to 6 mm. in breadth; flowers small, white to violet, in axillary racemes. Odor indistinct, taste mucilaginous, slightly bitter and astringent; it colors the saliva yellowish-green. *Galega* yields not more than 12 per cent. of ash." *N. F.* It contains a bitter principle and tannin. In former times it was much employed in *malignant fevers*, the *plague*, the *bites of serpents*, *worms*, etc. In 1873 Gillet-Damitte, in a communication to the French Academy, stated that this plant when fed to cows would increase the secretion of milk from 35 to 50 per cent.; since which time Cerisoli, Goubeaux, Mas son d'Aury, Millbank, and Carron de la Carriere have affirmed that goat's rue is a powerful galactagogue. The best preparation appears to be an aqueous extract prepared from the fresh plant. This almost black extract has a pronounced odor, and may be given in doses of from eight to fifteen grains (0.5-1.0 Gm.), from three to five times a day.

Fluidextract of Galega is official in the National Formulary IV. It is made with a menstruum of diluted alcohol. Dose, sixty minims (3.75 mls). The root of the indigenous *Tephrosia virginiana*, (L.) Pers. (*Galega virginiana* L.) is said to be diaphoretic and powerfully anthelmintic. It is given in decoction.

Galium. *Galium Aparine* L. *Cleavers. Goose-grass. Grateron, Rieble, Fr. Klebkraut, G.*—This is an annual, succulent, rubiaceous plant, common to Europe and the United States, growing along the seashore and much in shaded ground inland. It is inodorous, and has a bitterish, herbaceous, somewhat acrid taste. Analyzed by Schwartz, it was found, besides chlorophyll, starch, and other principles common to all plants, to contain three distinct acids—viz., a variety of tannic acid, which he names *galitannic acid*, citric acid, and a peculiar acid, previously discovered by Schwartz and Eochleder, and named *ribichloric acid*, $C_{14}H_8O_9$. (*P. J.*, xii, 190.) The expressed juice is said to be aperient, diuretic, and antiscorbutic, and has been used in dropsy, congestion of the spleen, scrofula, scorbutic eruptions, and lepra. Orwin (*T. G.*, vol. i, 767) commends it highly in psoriasis. Three ounces (90 mils) may be given twice a. day.

Galium verum L. *Yellow Ladies' Bedstraw. Cheese Rennet. Caille-lait jaune, Fr. Meger-kraut, Liebfrauenstroh, G.*—This European Galium (fam. *Rubiaceae*) is inodorous, but has an astringent, acidulous, bitterish taste. The bruised plant is sometimes used to color cheese yellow, being introduced into milk before coagulation. It is also used for dyeing yellow. The roots of this and of most other species dye red, and the plant, eaten by animals,, colors the bones like madder. Schwartz found the same principles in it as in *G. Aparine*. It was formerly highly esteemed as a remedy in *epilepsy* and *hysteria*, and was applied externally in *cutaneous eruptions*, in the form either of the recently expressed juice or of a decoction from the fresh plant. Of the American species, *G. tinctorium* L. is closely allied in properties to *G. verum*. It is said to be useful in *cutaneous diseases*, and the root is employed by the Indians for staining their feathers and other ornaments red. *G. triflorum* Michx. contains coumarin, as pointed out by L. von Cotzhausen. (*A. J. P.*, 1876, 405.)

GALLA. U. S., Br.

NUTGALL Gall. [Aleppo Galls, Smyrna Galls]

"Excrescences on the young twigs of *Quercus infectoria* Olivier and other allied species of *Quercus* (Fam. *Fagaceae*), induced by the punctures on the leaf-buds and by the deposited ova of *Cynips tinctoria* Hartig (Order *Hymenopterae*). Not more than 5 per cent. of Galls float in water." *U. S.* " Galls are excrescences on *Quercus infectoria*, Olivier, resulting from the deposition of the eggs of *Cynips gallae tinctoriae*, Olivier." *Br.*

Galls, Syrian Galls; *Galla Halepensis*, s. *Turcica*, s. *Le-antica*, s. *Tinctoria*, s. *Quercina*; *Galle de Chene, d'Alep, Fr. Cod.*; *Noix de Galle, Fr.*; *Gallae, P. G.*; *Gallapfel, Gallen, G.*; *Noce di galla, It.*; *Agalla, Sp.*

Many plants, when pierced by certain insects, particularly those of the genus *Cynips*, are affected at the points of puncture with a morbid

action, resulting in excrescences, which, as they are derived from the juices of the plant, partake more or less of its chemical character. Most of the oaks are occasionally thus affected, and the resulting excrescences, having in a high degree the astringency of the plant, have been employed for various practical purposes. They are known by the name of galls, a term which, as well as their use in medicine, has been handed down from the ancients. *Quercus infectoria*, *Q. aegilops*, *Q. excelsa*, *Q. Ilex*, *Q. Cerris*, and *Q. Robur* have been particularized as affording this product; but it is now generally admitted, on the authority of Olivier, that the official galls are derived chiefly, if not exclusively, from *Q. infectoria*. Under the name of *Chinese galls*, a product has been brought from China, supposed to be caused by an insect allied to the aphis, as such an insect has been found in the interior of them. They are irregularly spindle-shaped, often more or less bent, with obtusely pointed protuberances, about two inches long by an inch in diameter at the central thickest part, of an ash color and a soft velvety feel, very light, hollow, with translucent walls about a line in thickness, of a slight odor recalling that of ipecac, and a bitter astringent taste. From an examination of fragments of leaves and petioles found among these galls, Schenck concluded that the tree on which they are found is a species of *Rhus*; but according to Decaisne, their true source is probably the *Distylium racemosum* of Zuccarini, a large tree of Japan, the leaves of which produce a velvety gall, resembling the one in question. (Guibourt, *Hist. Nat. des Drogues*, 1850, iii, 703.) Daniel Hanbury asserts that this opinion of Decaisne is erroneous (*P. J.*, Feb., 1862, p. 421), as in his examination of the packages imported from China and Japan he has found remains of different parts of a species of *Rhus*, but never any of a *Distylium*. Besides, the form of the galls of the *Distylium*, as figured by Siebold and Zuecarini, is entirely different. The species of *Rhus* which yields the commercial Chinese galls is the *R. semialata* Murray. The Chinese make great use of this product both in dyeing and as a medicine. L. A. Buchner, Jr., has found it to contain 65 per cent. of tannic acid identical with that of the official galls. (*Ph. Cb.*, July, 1851, p. 526.) It is recommended by Stenhouse for the manufacture of gallic acid, being preferable for this purpose to the official galls, in consequence of its less amount of coloring matter. (*P. J.*, Dec., 1862.) An inferior kind of galls is produced in great quantities in England, by the attack of the *Cynips kollari* of Hartig, upon the common English oak; but they have been ascertained to contain little tannic acid, and are of little value.

Quercus infectoria, or the so-called *dyer's oak*, is a small tree or shrub, with a crooked stem, seldom exceeding six feet in height. The leaves are petiolate, obtusely toothed, smooth and of a bright-green color on both sides. The acorn is elongated, smooth, two or three times longer than the cup, which is sessile, somewhat downy, and scaly. This species of *Quercus* grows, according to Olivier, throughout Asia Minor, from the Archipelago to the confines of Persia. M. Kinnier found it also in Armenia and Kurdistan; Hardwicke observed it growing in the neighborhood of Adwanie, and it probably pervades the middle latitudes of Asia.

The gall originates from the puncture of the *Cynips tinctoria* Hartig, a hymenopterous insect or fly, with a fawn-colored body, dark antennae, and the upper part of its abdomen shining brown. The insect pierces the shoots and young boughs, and deposits its egg in the wound. This irritates the part, and a small tumor quickly rises, which is the result of a morbid growth, exhibiting various cells under the microscope, but no proper vegetable fiber. The egg grows with the gall, and is soon converted into a larva, which feeds upon the vegetable matter around it, and thus form a cavity in the center of the excrescence. The insect at length becomes a fly, and escapes by eating its way out. The galls are in perfection when fully developed, before the egg has been hatched or the fly has escaped. Collected at this period, they are called, from their dark color, *blue, green, or black galls*, and are most highly esteemed. Those which are gathered later and have been injured by the insect are *white galls*. They are usually larger, less heavy and compact, and of a lighter color than the former.

The galls collected in Syria and Asia Minor are brought to this country chiefly from the ports of Smyrna and Trieste, or from London. As they are produced abundantly near Aleppo, it has been customary to designate them by the name of that town, though the designation, however correct it may formerly have been, is now wholly inapplicable, as they are obtained from many other places, and the product of different parts of Asiatic Turkey is not capable of being discriminated, at least in our markets. Great quantities of galls, very closely resembling those from the Mediterranean, have been brought to the United States from Calcutta. Royle states that they are taken to Bombay from Bussorah through the Persian Gulf. "We are, nevertheless, informed that galls are among the products of Moultan. Those of France and other southern countries of Europe have a smooth, shining reddish

surface, are little esteemed, on account of their small yield of tannin, and are seldom brought to the United States.

Properties.—Galls are "nearly globular, from 0.8 to 2.2 cm. in diameter; externally blackish-olive-green or blackish-gray, more or less tuberculated on the upper portion, the basal portion being nearly smooth and contracted into a short stalk; heavy, sinking in water, excepting the smaller galls; fracture short-horny; internally grayish or dark brown, consisting of a central portion slightly radiating and resinous, occasionally hollow and traversed by a narrow radial canal extending to the exterior as shown by the perforation in the whole gall; odor slight; taste strongly astringent. The powder consists of numerous fragments of thick-walled starch-bearing parenchyma; starch grains numerous; more or less free in the powder and varying in shape from spherical or ellipsoidal to polygonal, and from 0.005 to 0.03 mm. in diameter; stone-cells few, resembling those found in fruits and seeds, varying considerably in shape and size, and from 0.025 to 0.3 mm. in length; occasional fragments with spiral or reticulate tracheae; fragments mounted in dilute ferric chloride T.S. assume a deep blue or greenish-blue color. Macerate 0.5 Gm. of the powdered Nutgall with 2 mls of alcohol for a few minutes, add 500 mls of water, stir the mixture well for five minutes and filter. Take 1 mil of the light yellowish-brown solution, and dilute it with 10 mls of water; it shows a distinct blue or violet-blue color upon the addition of a drop of ferric chloride T.S." *U. S.*

"Hard, heavy, subglobular, from twelve to eighteen millimetres or more in diameter, tuberculated on the surface, the tubercles and intervening spaces being smooth; dark bluish-green or dark olive-green externally, yellowish or brownish-white within, with a small central cavity. Galls sink in water and exhibit no perforation. No odor; taste intensely astringent." *Br.*

The best are externally of a dark bluish or lead color, sometimes with a greenish tinge, internally whitish or brownish, hard, solid, brittle, with a flinty fracture, a striated texture, and a small spot or cavity in the centre, indicating the presence of the undeveloped or decayed insect. Their powder is of a light yellowish-gray. Those of inferior quality are of a lighter color, sometimes reddish or nearly white, of a loose texture, with a large cavity in the centre, communicating externally by a small hole through which the fly has escaped.

Kraemer (*Bot. Gaz.*, 1900, p. 275) made a microchemical study of American galls. These closely resemble the Aleppo variety and are formed on *Quercus coccinea* Muench and *Q. imbricaria*, Michx. by *Cynips aciculata*. Kraemer found the chemical constituents to vary with the development of the insects. At the chrysalis stage gallic acid is more abundant than when the winged insect is developed. Texas galls are formed on the live oak (*Q. vireus*), California oak balls are formed on *Q. lobata*.

Galls are formed on a number of trees and shrubs, including oaks, rhus, rhododendron, juniper, eucalyptus and sage. Hartwich {*Arch. d. Pharm.*, 1905, p. 584) illustrates these several varieties and discusses their composition. Richter gives minute descriptions of the origin, structural characteristics and microscopical appearance of galls in *Ph. Zentralh.*, 1912, p. 533. Feist and Haun have published (*A. Pharm.*, 1913, v. 251, p. 468) an article on the constitution of the tannin in Turkish and Chinese galls.

Galls have a bitter, very astringent taste, and when whole are inodorous or nearly so, but bruised or in powder they have a decided and peculiar though not very strong odor. The tannin of galls, usually known as *gallo-tannic acid*, appears to exist in the galls, in part at least, as a glucoside, but one very easily broken up by ferments like pectase into glucose and *di-gallic acid*, $C_{14}H_{10}O_9$, which is the material, therefore, extracted from the galls. This di-gallic acid may be considered as the anhydride of *gallic acid*, $C_7H_6O_5$, formed from two molecules of this latter by the elimination of one molecule of water. Commercial tannin yields from 0 to 22 per cent. of glucose, showing the presence of varying amounts of the unaltered glucoside. Galls yield, on an average, from 65 to 77 per cent. of tannin. All the soluble matter of galls is taken up by forty times their weight of boiling water, and the residue is tasteless. Alcohol dissolves seven parts in ten, ether five parts. A saturated decoction deposits upon cooling a copious pale-yellow precipitate. The infusion or tincture affords precipitates with sulphuric and hydrochloric acids, lime water, and ammonium and potassium carbonates, with solutions of lead acetate and subacetate, copper and iron sulphates, silver and mercuric nitrates, and potassio-anti-monyl tartrate; with solution of gelatin; and with the infusions of Peruvian bark, calumba, opium, and many other vegetables, especially those containing alkaloids, with most of which

tannic acid forms insoluble compounds. The infusion of galls reddens litmus paper, is rendered orange by nitric acid, milky by mercuric chloride, and has its color deepened by ammonia, but yields no precipitate with either of these reagents. Zinc sulphate was said by A. T. Thomson to slowly occasion a precipitate, but this result was not obtained by Duncan. Infusion of galls is rendered more permanent by the addition of 10 per cent. of glycerin.

A variety of galls was imported into Germany, which was said to be derived from Central Asia, especially from the provinces of Khokan, Khiva, and Bokhara, where they are used in dyeing. They are of various forms, some being long, others round, cylindrical, or angular, and sometimes they are grouped upon a single stalk, and covered with little elevations. They differ from all other galls by their color, being on one side yellow, and on the other of a fine red. Most of them present a little opening, and in the interior are eggs and larvss of a peculiar species of aphid. They have yielded, on analysis, 43.10- per cent. of tannin, 3.03 of a green wax, 16 of cellulose, and an undetermined quantity of fecula and volatile oil. (R. Palne, *J. P. C.*, April, 1873.)

From the so-called gall-wax of certain kinds of galls, M. Nierenstein obtained a nitrogenous constituent, $C_{13}H_{17}O_6N$, which is probably a laevorotatory galloleucin. (*Z. Phys. Ch.*, 92, 53.)

Uses.—Galls have a powerfully astringent action, but are no longer prescribed internally. *Aromatic Syrup of Galls* is sometimes prescribed. For a process, see U. S. Dispensatory, 19th ed., p. 574. Nutgalls may be used externally for the same purposes as tannic acid.

Dose, five to fifteen grains (0.3-0.9 Gm.).

Off. Prep.—Tinctura Gallse, *N. F.*; Unguentum Gallae, *U. S.*, *Br.*; Unguentum Gallae cum Opio, *Br.*; Elixir Rubi Compositum, *N, F.*

GAMBIR. U. S.

GAMBIR [Pale Catechu] [To replace Catechu, U. S. 1890]

"A dried extract prepared from decoctions of the leaves and twigs of *Ourouparia Gambir* (Hunter) Baillon (Fam. *Rubiaceae*)." *U. S.* (See *Catechu* and *Catechu Nigrum*.)

Catechu Pallidum, Terra Japonica, Gambier, Cutch; Gambir Cubique, *Fr.*; Catechu, *P. G.*; Katechu, Gambir-Catechu, *G.*; Catecu, *It., Sp.*

Ouroparia Gambir (Hunter) Baillon (*Uncaria Gambier* Roxb.) This is a climbing shrub with slender stems somewhat thickened at the nodes; leaves ovate or oblong, entire, rounded at the base but abruptly attenuated at the summit, opposite and stipulated, smooth on both sides. The flowers are small, crowded into a dense globular head on a hairy receptacle; the flower heads are borne on long axillary peduncles which bear in the middle a whorl of bracts. At the point where these bracts occur the peduncle breaks after the falling of the inflorescence and the remainder of the peduncle becomes elongated and curved into hooks by means of which the plant climbs. Corolla gamopetalous, trumpet-shaped, tube slender; fruit one inch long, pericarp dry, dehiscing vertically into two valves; seeds very numerous.

It is a native of Malacca, Sumatra, Cochin-China, and other parts of Eastern Asia, and is largely cultivated in the islands of Bintang, Singapore, and Prince of Wales. The gambir is prepared by lopping off the leaves, shoots, and twigs of the plant, chopping them into pieces, and throwing them into an iron pot filled with boiling water. When the leaves are exhausted and the liquid sufficiently thick, it is poured into small wooden tubs, and so soon as sufficiently cool, a half-closed hand is plunged into the semi-fluid mass and a piece of light wood shaped like an elongated dice box rapidly worked up and down in the hollow formed by the hand. The extract begins to thicken by a process which is compared to crystallization. The mass is finally turned out, and cut into cubes, which are put upon trays and smoke-dried. (See also *P. J.*, 1892, 1003.) This extract, which is known by the native Malays as pinang or siren was first brought to the attention of the profession by Campbell.

The amount of gambir exported from the Straits Settlements in 1910 amounted to 40,000,000 pounds, of which about 15,000,000 pounds was shipped to the United States.

Most of the commercial article is shipped from Singapore to London and Hamburg. The natives of Malay distinguish four different kinds: 1. *Gambir bulat* or *round Gambir*, which occurs in biscuit-like pieces and is mostly used for chewing. 2. *Gambir papan* or *table Gambir* which occurs in yellowish-brown thin tablets and is also used in chewing. 3.

Gambir paku (nail or finger Gambir) which occurs in long black sticks resembling licorice extract. 4. *Gambir dutoor* or *cube Gambir*. The latter is the form in which it is usually found in commerce. Gambir is also imported in large blocks, being used in this form for dyeing and tanning.

Properties.—Gambir is "usually in cubical or rectangular pieces from 20 to 30 mm. in diameter; externally pale grayish-brown to reddish-brown, more or less dull and porous; friable; internally of a light brown or dull earthy color; inodorous; taste bitterish and very astringent. Upon scraping a piece of Gambir and mounting the separated fragments in hydrated chloral T.S. and examining them under the microscope, numerous acicular crystals, from 0.01 to 0.03 mm. in length, separate at the edges of the fragments and gradually dissolve, leaving a few, thick-walled, non-glandular hairs which, when entire, may be 0.35 mm. in length; a few fragments of leaves may also be present showing either epidermal cells or small narrow trachea? with spiral or annular markings; a few starch grains either single or compound, of variable shapes and from 0.005 to 0.015 mm. in diameter; a number of bacteria may also be present. Macerate 1 Gm. of Gambir with 50 mils of water, and filter; the pale yellowish-brown solution obtained gives an intense, green color with dilute ferric chloride T.S.; but yields no precipitate with copper sulphate T.S. Not less than 65 per cent. of Gambir is soluble in water and not less than 60 per cent. is soluble in alcohol. Gambir yields not more than 9 per cent. of ash." U. S.

The microscopical appearance of gambir is very characteristic and Brumwell (*J. S. C. Ind.*, 1911, p. 475) illustrates the appearance of commercial specimens. Gambir is light and porous, so that it floats when thrown in water. It is partially soluble in cold water, and almost wholly so in boiling water, which deposits a portion upon cooling. Duhamel, Ecky, and Procter dissolved 87.5 per cent. of it in cold water by means of percolation. (*A. J. P.*, xvi, 166.) Nees von Esenbeck found it to consist of from 36 to 40 per cent. of *catechutannic acid*, a peculiar principle called *catechuin*, *catechin*, or *catechuic acid*, gum or gummy extractive, a deposit like cinchonic red, and 2.5 per cent. of lignin. *Catechin*, when perfectly pure, is snow-white, of a silky appearance, crystallizable in fine needles, melting at 217° C. (422.6° F.), unalterable in the air if dry, fusible by heat, very slightly soluble in cold water, with which it softens and swells up, soluble in boiling water, which deposits it on cooling, and soluble also in alcohol and ether. It very slightly reddens litmus paper,

and, though coloring solution of chloride of iron green, and producing with it a grayish-green precipitate, differs from tannic acid in not affecting a solution of gelatin. The very great discordance of different authors as to its formula seems to be explained by some experiments of Etti (*Ann. Ch. Ph.*, 186, p. 327), who showed that *catechin*, $C_{19}H_{18}O_8$, readily gives at $100^{\circ} C.$ ($212^{\circ} F.$), or even when kept for some time over sulphuric acid, an anhydride, $C_{38}H_{34}O_{15}$, and at $160^{\circ} C.$ ($320^{\circ} F.$) a second anhydride, $C_{38}H_{32}O_{14}$, which, mixed in varying proportions, explain the varying results. Gautier (*Bull. Soc. Chim.*, 30, 567) finds three different catechins separable by their different solubility in water, all of them crystallizable. These are: *a-catechin*, $C_{40}H_{38}O_{18} + 2H_2O$, melting at from 204° to $205^{\circ} C.$ (399.2° - $401^{\circ} F.$), and present in gambir to the amount of 12 per cent.; *b-catechin*, $C_{47}H_{38}O_{16} + H_2O$, melting at from 176° to $177^{\circ} C.$ (348.8° - $350.6^{\circ} F.$), and 2 per cent. present in gambir; and *c-catechin*, $C_{40}H_{38}O_{16} + H_2O$, melting at $163^{\circ} C.$ ($325.4^{\circ} F.$), and present in gambir to the amount of 6.5 per cent.

Perkin and Yoshitako (*P. J.*, 1902, p. 530) have made an elaborate investigation of gambir and acacia catechus. They find three catechins, designated respectively as (a), (b), and (c). *Catechin (b)*, $C_{15}H_{14}O_6 + 4H_2O$, occurs in air dried, colorless needles, melting at 175° to $177^{\circ} C.$ (347° - $350.6^{\circ} F.$), and gives on fusion with alkali, phloroglucinol, protocatechuic acid, and an acid resembling acetic acid. *Catechin (c)*, $C_{16}H_{14}O_6$, air dried, contains no water of crystallization and forms colorless prisms, melting at 235° to $237^{\circ} C.$ (455° - $458.6^{\circ} F.$). *Catechin (a)*, $C_{14}H_{14}O_6 + 3H_2O$ (or less probably $C_{14}H_{14}O_6 + 3H_2O$), air dried, forms colorless needles, melting at 204° to $205^{\circ} C.$ (399.2° - $401^{\circ} F.$).

Good gambir should occur in a hard compact mass, breaking up, "when the adhering mat is removed, into distinct cubes of a brownish-black color externally, and a deep mahogany-red with an occasional streak of yellow internally. It should not steam when the mat is opened. From this quality it grades down to a stuff which has been prepared by mixing the material obtained by reboiling the exhausted leaves with various mixtures. This lowest grade is not in cubes, steams when opened, frequently shows large patches of black or dirty blue color, and often has a sour fetid odor; its color varies from black to light-brown.

The varieties between the two extremes are very great; sometimes

gambir occurs in solid mass of fair quality; sometimes the cubes are of extraordinary size, and of a color varying from a dirty white to a very pale yellow. At the Edinburgh Forestry Exhibition in 1885 the Maharajah of Johore exhibited specimens labelled "gambir produced in Johore." The first quality, which was "*makan*" (for eating), was in regular cubes, externally cassia-brown color, internally pale cinnamon brown, and yielded 32 per cent. of tannic acid; the second quality was in badly formed cubes, externally brown and black, internally cinnamon, and yielded 30 per cent. of tannic acid; the third quality was in dull-brown, well-shaped cubes, internally pale brown, and yielded 19 per cent. of tannic acid. The oblong or *parallelepiped gambir* was of a uniform dull brown, very hard and strong, and yielded only 2 per cent. of tannic acid. MacEwan believes that the low percentage of tannin was due to the decoction not having been subjected to prolonged boiling, which favors the decomposition of catechin, with the formation of catechu-tannic acid. None of the finest varieties of gambir, such as are used by the natives for chewing, occur to any extent in American commerce. Prebble records his examination of a cube gambir of fine appearance which contained a large percentage of starch. (*P. J.*, 1893, 21.)

Enormous quantities of gambir are used both in Europe and America in tanning, calico printing, dyeing, as an ingredient in boiler compounds for preventing the hard scaly incrustation caused by certain kinds of water, and other art processes requiring tannic acid.

Vanderkleed and E'we call attention to the fact that the apparent alcohol soluble content of gambir may be unduly raised by the high moisture content of some of the commercial varieties, which they report as containing over 21 per cent. of moisture, all of which would be calculated in the alcohol soluble extractive by the ordinary methods in which no allowance is made for water. (*J. A. Ph. A.*, 1914, 1685.)

Uses.—Gambir is a serviceable remedy in those cases where astringents are indicated.

The complaints to which it is best adapted are *diarrhea* dependent on debility or relaxation of the intestinal mucous membrane, and passive *hemorrhages*, particularly from the uterus. A small piece held in the mouth and allowed slowly to dissolve is an excellent remedy in *relaxation of the uvula* and the *irritation of the fauces* and *troublesome*

cough which depend upon it. Applied to *spongy gums*, in the state of powder, it sometimes proves useful; and it has been recommended as a dentifrice in combination with powdered charcoal, Peruvian bark, myrrh, etc.

Dose, from ten grains to half a drachm (0.65— 2.0 Gm.), which should be frequently repeated, and is best given with sugar, gum arable, and water.

Off. Prep.—Tinctura Gambir Composita, *U. S. (Br.)*; Trochisci Gambir, *N. F.*; Pulvis Gambir Compositus, *N. F.*; Tinctura Pectoralis (from Compound Tincture), *N. F.*

Gardenia. *Gardeniagrandidiflora* Lour. (Fam. *Rubiaceae*.) —A Chinese tree, the fruit of which is employed in dyeing the yellow robes of the mandarins, and, according to Lorenz Mayor, contains *crocin*, which in powder is of a bright red color, and soluble in water and alcohol. According to the researches of Kayser (*Ber. d. Chem. Ges.*, 1884, 2228), its formula is $C_{44}H_{70}O_{28}$. When heated with diluted hydrochloric or sulphuric acid, it is decomposed into *crocetin*, $C_{34}H_{46}O_9$, and a dextrorotatory sugar called *crocose*. Alkalies bring about the same decomposition almost instantly. Concentrated sulphuric acid dissolves both the crocin and crocetin with deep blue color. The fruit of another species, *G. campanulata*, Roxb., growing in the forests of Chittagong, in - India, is said to be used by the natives as a cathartic and anthelmintic. (Lindley, *Flor. Med.*, 434.)

Garlic. *N. F. IV. Allium. English Garlic.*— The genus *Allium* includes a large number of species, of which nearly seventy are indigenous in this country. Many, and perhaps all, of these species contain volatile oil upon which their activity depends. The cultivated garlic, of which the bulbs are official in the *N. P.*, is *Allium, sativum* L., for which, according to Griffith, *A. canadense* L., has been substituted and found efficient.

Allium sativum, L., is a perennial plant with numerous bulbs which have a common membranous covering, from the base of which the fibers that constitute the proper root descend. The stem is simple, and rises about two feet. The leaves are long, flat, and grass-like, and sheathe the lower half of the stem. At the termination of the stem is a cluster of flowers and bulbs mingled together, and enclosed in a pointed spathe, which opens on one side and withers. The flowers are small and white, and make their appearance in July. This species of garlic grows wild in Sicily, Italy, and the south of France. The bulbs, or so-called cloves, are usually six or eight in number, oblong or wedge-shaped, and covered with dry membranous scales, with a pungent odor and a disagreeable and acrid taste.

The *N. F.* description is as follows: " The fresh bulb of *Allium sativum* Linne (Fam. *Liliaceae*). Bulb subglobular, from 4 to 6 cm. in diameter, compound, consisting of from eight to fifteen bulbels and surrounded by one or two dry, whitish,

membranaceous scales and attached to a flattened circular base from the lower portion of which arise numerous yellowish-white roots; bulbels more or less ovoid, in transverse section on three to four sided, the outer surface being convex, summit acute and narrowed into a thread-like fibrous portion, base truncate, each bulbel covered by one or two layers of whitish, membranaceous, scale-like leaves, beneath which is the light brown or pinkish, thin and coriaceous layer of epidermis, cohering but easily separable from the solid portion of the bulbel. Odor of broken or bruised bulbels powerfully alliaceous, taste intensely pungent and persistent. Under the microscope, transverse sections of the bulbel show, three distinct portions: (a) the large fleshy scale consisting chiefly of parenchyma enclosing scattered vascular bundles, epidermis in both ventral and dorsal surfaces consisting of small tabular cells; (b) the middle layer nearly circular in outline, about 0.75 mm. in diameter, the tissues resembling those of the outer fleshy scale, but the cells containing numerous yellowish-brown plastids; (c) an innermost bright green layer consisting of a single leaf folded lengthwise along the midrib so that the ventral surfaces lie close together."

The *oil of garlic* is of a dark brownish-yellow color, heavier than water, and decomposed at its boiling temperature. It may be purified by repeated distillation in a salt water bath, and is then lighter than water, of a pale yellow color, and not decomposed by boiling. Semmler obtained from garlic bulbs 0.09 per cent. of the volatile oil, sp. gr. at 14.5° C. (58° F.) 1.0525; it was yellow, having an intense odor and optically inactive. By fractional distillation he obtained four products, $C_6H_{12}S_2$, $C_6H_{10}S_2$, $C_6H_{10}S_3$, and $C_6H_{10}S_4$, which decomposed during distillation, and hence could only be obtained by distillation *in vacuo*. The oil, according to Semmler, is free from allyl sulphide, the latter having the sp. gr. 0.8991. (*A. Pharm.*, 1892, p. 434.) The impure oil has an exceedingly pungent odor and a strong acrid taste, and, when applied to the skin, produces much irritation and sometimes even blisters. The pure oil combines with silver nitrate, forming a precipitate soluble in heated alcohol and afterwards separating in crystals. Besides this oil, fresh garlic, according to Cadet de Gassicourt, contains, in 1406 parts, 520 of mucilage, 37 of albumen, 48 of fibrous matter, and 801 of water. Bouillon-Legrange mentions among its constituents sulphur, a saccharine matter, and a small quantity of starch. The fresh bulbs yield upon pressure nearly a fourth part of juice, which is highly viscid, and so tenacious as to require dilution with water before it can be easily filtered. When dried, it serves as a lute for porcelain. It has the medicinal properties of the bulbs. Water, alcohol, and vinegar extract the virtues of garlic. Protracted boiling renders it inert. According to Semmler (*A. Pharm.*, 1887, p. 927), *Allium ursinum* contains a volatile oil which consists mainly of *vinyl-sulphide*, C_4H_6S or $(C_2H_3)_2S$.

Medicinal Properties and Uses.—The use of garlic as a medicine and as a condiment can be traced to earliest antiquity. When taken internally, and even when applied externally, the oil is absorbed and imparts its odor to the breath, urine, perspiration, etc. The oil of garlic has some influence upon the human system as a general mild stimulant. Its chief value in medicine is for its local action upon the stomach and as a stimulant expectorant. The garlic itself is sometimes employed as a rubefacient which, by yielding its volatile oil to absorption, stimulates the nervous system, especially in the case of young children. The oil may often be given with advantage in

chronic bronchitis and in the advanced stages of *obstinate acute bronchitis*. It is especially valuable in the treatment of children when there is a distinct nervous element. In *catarrhal pneumonia* of young children the bruised garlic cloves are often applied as a poultice to the lungs, and similar applications were formerly used upon the feet for the *nervousrestlessness* or even the *convulsions* of young children. Garlic clove may be swallowed either whole or cut into pieces of a convenient size, but the syrup has replaced most other methods of administration. The *dose* in substance is from half a drachm to two drachms (2-7.7 Gm.) of the fresh bulb. That of the juice is half a fluidrachm (1.8 mils). A syrup is official in the N. F. (see Part III).

Garrya Fremontii Torr. *California Fever Bush. Skunk Bush.*—The leaves of this bush (fam. *Cornaceae*), indigenous to California and Oregon, have an intensely bitter taste, and are said to be largely used by Californians as a tonic and anti-periodic. D. W. Ross (*A. J. P.*, 1877) states that he found in them a new alkaloid, *garryine*. The dose of the fluidextract of the leaves is from ten to thirty minims (0.6-1.8 mils).

Gaultheria. *Wintergreen. Boxberry. Teaberry. Checker-berry. Feuilles de Gaultherie couchee (de Palowmier), The du Canada, The de Terrebonne, Fr. Canadischer Thee, Bergthee, G.*—*Gaultheria procumbens* L. (Fam. *Ericaceae*) is a small indigenous, shrubby, evergreen plant. The leaves, which were formerly official in the U. S. Pharmacopoeia, are short-petiolate, obovate or oval, about 4 cm. in length and 2 cm. in breadth, acute, revolute, obscurely serrate at the edges, coriaceous, shining, bright green above, paler beneath, of unequal size, and supported irregularly on short red petioles.

The plant extends from Newfoundland to Georgia, growing in large beds in mountainous tracts, or in dry barrens and sandy plains, beneath the shade of shrubs and trees, particularly of other evergreens, as the *Kalmiae* and *Rhododendra*. In different parts of the country it is variously called *checker-berry, tea-berry, aromatic wintergreen, and mountain-tea*. The flowers appear from July to August, and the fruit ripens at corresponding periods. To the very peculiar aromatic odor and taste which belong to the whole plant the leaves add a marked astringency. The aromatic and medicinal properties of wintergreen reside exclusively in an official volatile oil.

GELSEMIUM. U. S. (Br.)

GELSEMIUM Gelsem.

[Yellow Jasmine Root, Yellow Jessamine]

"The dried rhizome and roots of *Gelsemium sempervirens* (Linne) Aiton filius (Fam. *Loganiaceae*)." U. S. "Gelsemium Root is the dried rhizome and root of *Gelsemium nitidum*, Michaux." Br.

Gelsemii Radix, Br.; Gelsemium Root, Yellow Jasmine, Yellow Jessamine, Carolina or American Yellow Jessamine, Yellow or Evening Trumpet Flower; Gelsemium, *Fr. Cod.*; Jasmin sauvage, *Fr.*; Gelsemie, Giftjasmin, *G.*; Gelsemio, *Sp.*

The *yellow* or *Carolina Jessamine* (*Gelsemium sempervirens*) is one of the most beautiful climbing plants of our Southern States, ascending lofty trees, and forming festoons from one tree to another, and during its flowering season, in the early spring, scenting the atmosphere with its delicious odor. The stem is twining, smooth, and shining; the leaves perennial, opposite, nearly persistent, short, petiolate, lanceolate, entire, dark green above, and paler beneath;

the flowers in axillary clusters, large, of a deep-yellow color, and fragrant, with a very small, five-leaved calyx, and a funnel-shaped corolla, having a spreading, five-lobed, nearly equal border. The fruit is a flat, compressed capsule, divisible into two parts, two-locular, and furnished with flat seeds, which adhere to the margins of the valves. The plant grows in rich, moist soils along the sea-coast from Virginia to the south of Florida and Texas. The flowers are said to be poisonous. *Gelsemium elegans* Benth., of upper Burma, is an extremely poisonous creeper which contains gelsemine or an allied alkaloid.

This official plant must not be confounded with the true yellow jasmine of Madeira, often planted in the Southern States, which is the *Jasminum odoratissimum* L., which also has very fragrant yellow flowers.

Properties.—It is officially described as; "Rhizome cylindrical, usually in pieces from 3 to 20 cm. in length and from 3 to 30 mm. in diameter; externally light yellowish-brown, longitudinally wrinkled, with purplish-brown longitudinal lines and transverse fissures; the upper surface with a few stem-scars, the under and side portions with numerous roots and root-scars; fracture tough, splintery; internally light brown or pale yellow, bark thin, wood distinctly radiate, excentral, pith disintegrated; odor slight; taste bitter. Roots light brown; fracture one-half transverse, the other oblique or splintery. Under the microscope, sections of the rhizome of *Gelsemium* show a strong development of cork, the walls being grayish or yellowish-brown and more or less lignified; a cortex made up chiefly of parenchyma containing starch and having in the outer portion small scattered groups of stone cells or sclerenchymatous fibers, and in the inner portion in the region of the medullary ray prisms of calcium oxalate; woody portion made up of broad wedges consisting of large trachea? and fiber-tracheids separated by starch-bearing medullary rays, the innermost cells, or those nearer

the pith, being strongly lignified, while the outermost layers, or those nearer the cortex, are non-lignified and may contain prisms of calcium oxalate; an internal phloem or sieve, the cells forming distinct, more or less rounded groups, the latter being partly surrounded by a thin-walled starch-bearing pith. The powder is dark yellow, tracheae with bordered pores numerous, and conspicuous; spiral tracheae few; bast-fibers and fiber-tracheids long and narrow, strongly lignified; starch grains spherical, from 0.004 to 0.008 mm. in diameter; calcium oxalate in mono-clinic prisms from 0.015 to 0.03 mm. in length; occasional groups of stone cells or sclerenchymatous fibers, the walls being very thick, porous, and strongly lignified." U. S.

"In nearly cylindrical pieces about fifteen centimetres or more long, and usually from six to eighteen millimetres thick; occasionally with fibrous rootlets attached. Fracture splintery. In transverse section, a thin cortex, and a porous, yellowish, distinctly radiate wood with numerous, conspicuous, straight medullary rays. Rhizome usually with a brown or dark brownish-violet cork, often much fissured; nearly straight, and exhibiting silky fibres in the bast. Root yellowish-brown, finely wrinkled, and somewhat tortuous. Slightly aromatic odor; taste bitter." *Br.*

A microscopic character, said by Rothrock to be diagnostic, is the more or less complete division of the pith into four parts by plates of large thin-walled cells. (*A. J. P.*, 1884.) For elaborate study of structure of gelsemium, see *A. J. P.*, 1898, 398; *A. J. P.*, 1899, 422; *D. C.*, 1901, 244. Holm has contributed an article on the morphology of the overground portion of *Gelsemium sempervirens*. (*Merck's Rep.*, 1908, p. 86.) Tunmann (*Ph. Zentralh.*, 1907, p. 679) has made a pharmacognostic study of gelsemium and has proposed its identification through the microsublimation of aesculin. (See *Ap. Ztg.*, xxvi, p. 812.) Tutin (*P. J.*, Feb. 10, 1912) has shown that the sublimate obtained by Tunmann from gelsemium root must have consisted of scopoletin. Tutin further states that "The detection of scopoletin in gelsemium may prove to be a valuable means of distinguishing this drug from others of a similar appearance, such as that derived from *Gelsemium elegans* Benth., but it is doubtful whether the sublimation method is the most convenient one. If 0.5 gramme of ground gel-semium be heated in a test tube with chloroform, the mixture filtered, and the filtrate shaken with water to which a few drops of dilute ammonia have been added, the aqueous layer, on separation, will be found to show a distinct, blue fluorescence,

thus indicating the presence of scopoletin."

Sayre (*A. J. P.*, 1897, 8) found specimens of the root mixed with considerable proportions of the stem. Ingham (*A. J. P.*, 1897, 234) found that there was not much difference between the root and rhizome in alkaloidal value, but the stem does not appear to contain either gelsemine or gelsemic acid. (See also *A. J. P.*, 1897, 140.) Gelsemium yields its virtues to water, and readily to diluted alcohol. Analyzed by Henry Kollock, it was found to contain gum, starch, pectic acid, albumen, gallic acid, fixed oil, a fatty resin, a dry acrid resin, yellow coloring matter, volatile oil, extractive, lignin, a peculiar alkaloid called *gelsemine*, potassium, calcium, and magnesium salts, iron, and silica. The alkaloid, however, was not obtained sufficiently pure to admit of a full investigation of its properties. (*A. J. P.*, xxvii.) After Kollock's experiments, the alkaloid was obtained in a crystalline form, but still impure, by Maisch, from a tincture of the root, by a process of which a very brief abstract is given in *A. J. P.*, 1869, by C. L. Eberle, who in the same paper publishes the results of his own investigation. Eberle not only extracted gelsemine, but also satisfactorily established its alkaline properties, and proved that it was not contained in the wood of the root. Soon afterwards, the chemistry of yellow jasmine was more thoroughly investigated by Theo. G. Wormley. (*A. J. P.*, 1870.) He obtained pure gelsemine from the root and a peculiar acid, which he called *gelseminic* (gelsemic) *acid*.

Wormley obtained the acid by acidulating a concentrated aqueous solution of the drug and extracting with ether. (For details of his method, see *U. S. D.*, 19th ed., p. 578.) The acid, when pure, is colorless, inodorous, almost tasteless, and readily crystallizable, usually in groups or tufts of fine needles. The action of concentrated nitric acid upon gelsemic acid or any of its salts, produces a yellow, reddish, or red solution, which, if treated with ammonia in excess, becomes of a deep blood-red color, lasting for hours. The one-thousandth of a grain will exhibit these changes. Potassium, sodium, or ammonium hydroxide, added to the acid, cause it to become intensely yellow, and form with it highly fluorescent solutions. The acid is fusible, and, at a high heat, volatilizable without change. Robbins (*Deut. Chem. Ges.* 1876, 1182), stated that it was identical with *aesculin* (the glucoside of the horse-chestnut), and gave it the formula $C_{15}H_{16}O_9 + 1\frac{1}{2}H_2O$.

But Coblentz (*Proc. A. Ph. A.*, 1897, 225) showed that it differs from

aesculin in several particulars, and gave for its formula $C_{13}H_{11}O_5$, which melts at $206^{\circ} C.$ ($402.8^{\circ} F.$). E. Schmidt believes that Wormley's gelsemic acid is identical with scopoletin derived from scopolia root, and gives the name as *β -methylaesculetin*, $C_9H_5(CH_3)O_4$.

Gelsemine was obtained by Wormley, from the concentrated extract from which gelsemic acid has been separated by ether, by rendering it slightly alkaline, then shaking out repeatedly with chloroform. It is a brittle, transparent solid, crystallizing with difficulty from alcohol. Boiling water sparingly dissolves it. It softens at $38^{\circ} C.$ ($100.4^{\circ} F.$), and fuses at $45^{\circ} C.$ ($113^{\circ} F.$). The pure base gives no color reaction with strong nitric acid, and the mixture is scarcely changed in color by heating. Strong sulphuric acid has no apparent action upon it, but if to the mixture a little manganic oxide be added and then rubbed with a glass rod, a deep crimson-red is obtained, passing to green. This reaction is so delicate, that it can be demonstrated with a solution of 1 in 100,000. If this reaction be performed upon the pure alkaloid, the color may be sufficiently intense to cause it to be mistaken for strychnine, but if a parallel experiment be carried on with strychnine, the two alkaloids cannot be mistaken, for the strychnine gives an intense purple, passing to red. Gerrard analyzed the alkaloid with care, and gives the formula $C_{12}H_{14}NO_2$ as its correct composition. F. A. Thompson (*Ph. Era*, 1887, p. 3) announced the presence of a second alkaloid, which he called *gelseminine*. After obtaining a solution of the alkaloids as sulphates he agitates it with an alkali and ether; the ethereal solution is shaken with water acidulated with hydrochloric acid, and the alkaloids are converted into hydrochlorides; gelseminine hydrochloride being easily soluble, and gelsemine hydrochloride less soluble, the latter is deposited on standing, and may be obtained pure by repeated crystallizations. He asserts that gelseminine differs greatly in physical and chemical properties from gelsemine, but, as he did not succeed in obtaining it absolutely pure, did not give the differences.

Sayre (*J. A. Ph. A.*, 1912, p. 458; 1913, p. 436; 1914, p. 314, and 1915, p. 60) has made a series of investigations of the principles of gelsemium based partly upon the work of C. W. Moore (*J. Ch. Soc.*, 1910, p. 2223), who reported gelseminine to consist of two amorphous alkaloids. Sayre found two alkaloids differing in physiological activity and color reactions, the one of which he called gelseminine (the former name for the combination of the two), and the other *gelsemoidine*, which was

later changed to *sempervirine*. This latter alkaloid is similar in some of its properties to cinchonamine, particularly in the matter of the insolubility of its salts in water. Sayre also calls attention to the fact that the alkaloid commercially supplied under the name gelseminine is usually the crystalline alkaloid gelsemine. He states that the principles obtained by him show the following color reactions with sulphuric acid and manganic oxide: *Gelsemine*, at first crimson, then green, and finally yellow; *gelseminine*, at first brown, then pink, and finally yellow; *gelsemoidine*, at first purple and finally blue.

Uses.—According to the researches of Cushny (*A. E. P. P.*, 1892, xxxi, 49), gelseminine is so much more powerful than gelsemine that it is improbable that the latter alkaloid plays any part in the effect of the whole drug in mammals. Gelseminine is a depressant to the centers in the spinal cord and, in large doses, also paralyzes the peripheral motor nerves. Gelsemine acts, in the frog, much like strychnine, causing convulsions, by stimulating the spinal cord, which are followed by paralysis due to an effect on the motor nerves. In toxic quantities gelsemium lowers the blood pressure, probably by a direct action on the heart, but death is usually brought about through respiratory failure. When locally applied, or if given internally in poisonous dose, it causes dilatation of the pupil with loss of accommodation.

Formerly gelsemium was used as an arterial sedative and febrifuge in various sthenic fevers, but is probably useless for this purpose. Bartholow (*Pract.*, 1870, v, 200) has recommended it in spasmodic disorders, as *asthma* and *whooping cough*. It is, at present, rarely used except in the treatment of neuralgias, especially those involving the facial nerves. The mode of its action in these cases is obscure, but there is considerable clinical evidence of its utility.

The symptoms of gelsemium poisoning are: dizziness, dimness of vision, dilated pupil, general muscular debility, and universal prostration, reducing the frequency and force of the pulse, and the frequency of respiration. After very pronounced poisonous doses the symptoms which have just been enumerated are intensified: double or impaired vision, ptosis, dilated insensible pupils, falling of the lower jaw, loss of power of enunciation, and excessive muscular relaxation are associated with slow, labored breathing, which in some cases is interrupted by violent spells of dyspnea; consciousness is long unimpaired, but is apt to be lost before death, and in rare cases unconsciousness has been present, even

although recovery followed. Of the various symptoms of gelsemium poisoning the most characteristic are the dropping of the jaw and the ocular manifestations, combined with general muscular relaxation. The effects usually begin in half an hour, but sometimes almost immediately. According to Wormley, death has occurred at periods which vary from one to seven and a half hours. Twelve minims of the fluidextract are said to have proved fatal to a boy three years old, and thirty-five drops of a tincture of the bark have caused death in one hour and a half* In several instances a drachm of the fluidextract has, under treatment, been recovered from.

The treatment of poisoning by gelsemium should consist in evacuating the stomach, maintaining absolute rest in the horizontal position, keeping up the bodily temperature, if required, by external warmth, and administering spinal and arterial stimulants. We have very little experimental data as to the physiological antidotes to gelsemium. Our general knowledge indicates that ammonia, strychnine, and digitalis given hypodermically should be of service in the treatment of the poisoning.

Gelsemium should be administered in the form either of the tincture or of the fluidextract, the dose of the tincture being ten minims (0.6 mil), that of the fluidextract two minims (0.12 mil); to be repeated, if necessary, every 2, 4, or 6 hours, and gradually increased until the object is obtained, or some obvious effect is produced on the system.

Dose, of gelsemium, one to two grains (0.065-0.13 Gm.).

Off. Prep.—Extractum Gelsemii, *U. S.*; Fluid-extractum Gelsemii, *U. S.*; Tinctura Gelsemii, *U. S., Br.*; Elixir Sodii Salicylatis Compositum (from Fluidextract), *N. F.*

Genista. *Genista tinctoria* L. *Dyers' Broom. Dyers' Weed. Green Weed. Wood-Waxen. Genet des Teinturiers, Fr. Farberginster, G.* (Fam. *Leguminosae.*)—A low shrub, growing wild in Europe, and established on sterile hills and roadsides from Maine to New York, cultivated in greenhouses in this country on account of its profusion of yellow leguminous flowers. The flowering tops of the plant are employed to dye yellow, whence its name was derived. Both these and the seeds have been used in medicine. They are said to be purgative and even emetic, especially the seeds, which were formerly given as cathartic in the *dose*

of a drachm and a half (5.8 Gm.). By some authors they are said to be diuretic and to be useful in *dropsy*.

GENTIANA. U. S. (Br.)

GENTIAN Gentian. [Yellow Gentian Root]

"The dried rhizome and roots of *Gentiana lutea* Linne (Fam. *Gentianaceae*)." U. S. "Gentian Root is the dried rhizome and root of *Gentiana lutea*, Linn" Br.

Gentianae Radix, Br.; Gentian Root, Bitter Root, Fel Root; Radix Gentianae Rubrae (vel Luteae vel Majoris); Gentiane (Racine), *Fr. Cod*; Racine de Gentiane (de Gentiane jaune), Gentiane jaune, *Fr.*; Radix Gentianae, *P. G.*; Enzian, Enzianwurzel, Bitterwurzel, Rother Enzian, *G.*; Genziana, *It.*; Genciana (Raiz de), *Sp.*

Gentiana lutea or *Yellow Gentian* is among the most remarkable of the species which compose this genus, both for its beauty and great comparative size. From its thick, long, branching, perennial rhizome, an erect, round stem rises to the height of three or four feet, bearing opposite, sessile, ovate, acute, five-nerved leaves of a bright-green color, and somewhat glaucous. The lower leaves, which spring from the root, are narrowed at their base into the form of a petiole. The flowers are large and beautiful, of a yellow color, peduncled, and placed in whorls at the axils of the upper leaves. The calyx is monophyllous, membranous, yellowish, and semi-transparent, splitting when the flower opens, and reflected when it is fully expanded; the corolla is rotate, and deeply divided into five or six lanceolate, acute segments; the stamens are five or six, and shorter than the corolla. The plant grows among the Apennines, the Alps, the Pyrenees, and in other mountainous or elevated regions of Europe. It is stated by Bourquetot and Herissey that in order to develop the deep colored fracture preferred by many druggists the root is frequently submitted to fermentation by heaping it up into a mass which becomes heated. Gentian root which has thus been treated is said to yield 27 per cent. less extractive than does that which has been properly dried. Further, even in the best commercial dried root the *sucrose*, *gentianose* and *gentiopicrin* of the fresh root are present only in extremely small amounts. (*J. P. C.*, 6,16, 513.)

Several other species possess analogous virtues, and are used for similar purposes. The roots of *G. purpurea* L. and *G. punctata* L., inhabiting the

same regions as *G. lutea*, and of *G. pannonica* Scopoli, growing in Austria, are said to be often mingled with the official, from which they are scarcely distinguishable. In fact the German Pharmacopoeia permits the use of the rhizome and roots of these three species. The *G. macrophylla* of Pallas is used in Siberia.

G. quinquefolia L. (*G. quinqueflora* Lam.), growing throughout the Northern and Northwestern States, is said to be much used in domestic practice. In Europe the rhizome of the *G. asclepiadea* L. is often admixed with the official rhizome. According to Vogl, they can be detected by the abundance of lignified prosenchymatous elements and stone cells, the genuine powder containing scarcely any lignified elements other than large reticulated vessels. (*O. Z.*, 1903, 141.)

One indigenous species *G. Catesboei* (now *G. Elliottii* Chapm.), growing in the Southern States, formerly had a place in the secondary catalogue of the U. S. Pharmacopoeia, and is reputed to be but little inferior to the official species.

This plant, popularly called *blue gentian*, has a perennial, branching, somewhat fleshy root, and a simple, erect, rough stem, rising eight or ten inches in height, and bearing opposite leaves, which are ovate-lanceolate, acute, and rough on their margin. The flowers are of a palish-blue color, crowded, nearly sessile, and axillary or terminal. The divisions of the calyx are linear-lanceolate, and longer than the tube. The corolla is large, ventricose, plaited, and divided at its border into ten segments, of which the five outer are more or less acute, the five inner bifid and fringed. The number of stamens is five, and the stigmas are bifid. The capsule is oblong, acuminate, with two valves, and a single cell. *G. Elliottii* Chapm. grows in the grassy swamps from Virginia to Florida, where it flowers from September to December. It may be given in powder in the dose of from fifteen to thirty grains, or in the form of extract, infusion, wine or tincture.

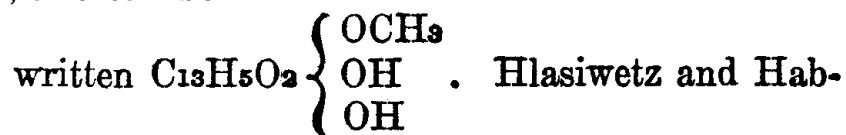
Powdered gentian is not infrequently adulterated with ground olive stones, ground peanut shells, and even quassia root. These are all readily detected by means of their lignified tissues, which may be seen through the use of the microscope. Gadd and Gadd assert (*P. J.*, 1905, xxi, p. 439) that adulterations of Gentian are most readily detected by means of the microscope, but that good evidence of quality is also furnished by the yield of extract, which should be about 40 per cent.

Properties.—As found in commerce, gentian is in pieces of various dimensions and shapes, usually of considerable length, consisting sometimes of longitudinal slices, sometimes of the rhizome and root cut transversely. They are twisted, wrinkled externally, sometimes marked with close transverse rings of a grayish-brown color on the outside, yellowish or reddish within, and of a soft, spongy texture. It is officially described as occurring " in nearly cylindrical, sometimes branching pieces, of variable length, from 5 to 35 mm. in thickness; externally yellowish-brown, the rhizome portion annulate, the roots longitudinally wrinkled; fracture short and uneven when dry, but tough and flexible when damp; internally yellowish-brown, the bark from 0.5 to 2 mm. in thickness, separated from the somewhat spongy, woody portion by a dark brown cambium zone; odor strong, characteristic; taste slightly sweetish, then strongly and persistently bitter. The powder is light brown or yellowish-brown, consisting chiefly of parenchymatous cells with fragments of scalariform or reticulate tracheae; starch grains few or none. Stone cells and sclerenchymatous fibers are absent. Gentian yields not more than 6 per cent. of ash." *U. S.*

"Parenchymatous tissue of rhizome and root abundant, containing small oil globules and minute crystals of calcium oxalate but not more than an occasional starch grain; vessels reticulated ; no sclerenchymatous cells or fibres. Characteristic odor; taste at first slightly sweet but afterwards bitter. When 5 grammes of the powdered root are macerated with 100 millilitres of water for twenty-four hours, shaken occasionally and filtered, 10 millilitres of the filtrate yield on evaporation in a flat-bottomed dish not less than 0.165 gramme of residue dried at 100° C. (212° F.). Ash not more than 6 per cent." *Br.*

Kromayer, in 1862, first obtained the bitter principle of gentian in a state of purity, and gave it the name of *gentiopicrin*, and the formula $C_{20}H_{31}O_{12}$. This principle has been found in many other species of the genus *Gentiana* and seems to be a characteristic principle of the genus. It is a glucoside, crystallizing in colorless needles, which readily dissolve in water. It is soluble in 95 per cent. alcohol, but: in absolute alcohol only when aided by heat; it does not dissolve in ether. A solution of sodium hydroxide forms with it a yellow solution. Under the influence of diluted acids, gentiopicrin is resolved into glucose and an amorphous yellowish-brown neutral substance named *gentiogenin*. Fresh gentian roots yield about one-tenth per cent. of gentiopicrin. Another constituent

is *gentianin* or *gentisin*, $C_{14}H_{10}O_5$. It forms tasteless, yellowish prisms, subliming with partial decomposition at a temperature over $300^\circ C$. ($572^\circ F$.) sparingly soluble in alcohol, and with alkalis yields intensely yellow, crystallizable compounds, easily decomposed by carbon dioxide. Von Kostanecki (*A. J. P.*, 1891, p. 192), by boiling gentisin with hydnic acid, succeeded in demethylating it, and so obtained gentisein, $C_{13}H_8O_3$, which crystallizes with $2H_2O$ in fine straw-colored needles; these become anhydrous at $100^\circ C$. ($212^\circ F$.). A triacetyl derivative was then formed from this gentisein. Gentisin is therefore the methyl ether of gentisein, and can be



ermann showed, in 1875, that when *gentianin* was melted with potassium hydroxide it yielded phloroglucin, $C_6H_3(OH)_3$, and dioxybenzoic acid, $C_6H_3(OH)_2COOH$. The latter was at first called *gentianic* or *gentisinic acid*. Maisch believed that tannin is absent from gentian root, and states that the dark olive-green coloration observed when ferric chloride is added to its preparations is due to gentisic acid. (*A. J. P.*, 1876.) Ville (*A. J. P.*, 1877) and Davies (*P. J.*, 1879) maintain that there is a small quantity of tannin in gentian root. Patch (*A. J. P.*, 1876) found that an alcoholic solution of an ethereal extract of gentian yielded a dark-green coloration with ferric salts, but if the alcoholic solution were diluted with water it yielded no precipitate with gelatin. Subsequently (*Proc. A. Ph. A.*, 1881) he showed that there was a principle associated with the resinous matter in gentian (but which was not isolated in a state of purity) that produced the reactions of a tannin, viz., a greenish-black color with ferric chloride, and precipitates with tartar emetic, cinchonidine sulphate, and gelatin. Louis Magnes found in the root, when perfectly dried at $100^\circ C$. ($212^\circ F$.), 15 per cent. of glucose. When gentian is macerated in cold water, it undergoes the vinous fermentation, in consequence of the presence of this saccharine principle. From the fermented infusion a spirituous liquor is obtained by distillation, which, though bitter, and having an unpleasant odor, is said to be relished by the Swiss and Tyrolese. A. Meyer (*Ph. Cb.*, May, 1882) obtained a sweet principle, which he called *gentianose*, $C_{16}H_{66}O_{31}$, by precipitation of the filtered juice with alcohol, treatment with ether, and crystallization from alcohol. It does not reduce Fehling's solution. Infusion of gentian is precipitated by tannic acid and the

soluble salts of lead, but is compatible with the salts of iron. Pectin, so frequently found in fleshy roots, exists in gentian. (Bourquelot and Herissey, *Repert de Pharm.*, 1898.) The yellow coloring matter of the root was investigated by E. V. Howell, who concludes that it is quereitrin. Tanret (*P. J.*, lxxvi, p. 87) found two glucosides, *gentiamarin* and *gentiin*. He also states (*B. G. T.*, 1905, p. 730) that in fresh roots the amount of gentiopicrin is about 1.5 per cent., but that it is destroyed in the process of drying so that dried roots contain only 0.1 per cent.

Uses.—Gentian has been known from the highest antiquity and is said to have derived its name from Gentius, a king of Illyria. Many of the complex preparations handed down from the Greeks and Arabians contain it among their ingredients. The ordinary preparations of gentian are, however, almost without physiological properties except their local effects on the mucous membrane of the alimentary tract. Moorhead (*J. P. Ex. T.*, 1915, vii) has given a scientific rationale for the ancient empirical belief in the bitters, by showing that gentian markedly increased the gastric secretions in cachectic dogs. As a stimulant to gastric digestion gentian is perhaps the most popular of all bitters in the treatment of *atonic dyspepsia*, *anorexia*, and similar complaints. In overdose it acts as a local irritant and may occasion nausea or vomiting. The porous property of the root causes it to expand with moisture and it has been employed as a substitute for the sponge tent to enlarge strictured passages. According to Tanret (*B. G. T.*, 1905, p. 730) gentiopicrin is highly poisonous to the plasmodium and in doses of twenty to thirty grains (1.3-2.0 Gm.) is a useful remedy in *malarial fevers*; it might be pointed out in this connection that it would require between four and five pounds of dried gentian root to produce one dose of gentiopicrin.

Dose, fifteen to thirty grains (1-2 Gm.).

Off. Prep.—Extractum Gentianae, *U. S.*, *Br.*;

Fluidextractum Gentianae, *U. S.*; Infusum Gentianae Compositum, *Br.*; Tinctura Gentianae Composita, *U. S.*, *Br.*; Elixir Gentianae (from Fluidextract), *N. F.*; Elixir Gentianae et Ferri (from Fluidextract), *N. F.*; Elixir Gentianae et Ferri Phosphatis (from Fluidextract), *N. F.*; Elixir Gentianae Glycerinatum (from Fluidextract), *N. F.*; Infusum Gentianae Compositum, *N. F.*; Pilulae Antiperiodicae (from Extract), *N. F.*; Pilulae Ferri, Quinae, Aloes et Nucis Vomicae (from Extract), *N. F.*; Pilulae

Antiperiodica sine Aloe (from Extract), *N. F.*; Tinctura Amara, *N. F.*;
Tinctura Antiperiodica, *N. F.*; Tinctura Antiperiodica sine Aloe, *N. F.*;
Tinctura Rhei et Gentianae, *N. F.*; Tinctura Zedoariae Amara, *N. F.*;
Vinum Aurantii Compositum, *N. F.*

Geranium. *N. F. IV (U. S. VIII). Cranesbill. Cranesbill Root. Spotted or Wild Cranesbill, or Storksbill. Alum Root. Racine de Bec-de-Orue tachete, Racine de Pied-de-Comeille, Fr. Fleck-storchschnabelwurzel, G.*—"The dried rhizome of *Geranium maculatum* Linne (Fam. *Geraniaceae*)."
N. F. *Geranium* was deleted from the U. S. Pharmacopoeia but is now official in the National Formulary IV. The stem is erect, round, dichotomously branched, from one to two feet high, of a grayish-green color, and thickly covered, in common with the petioles and peduncles, with reflexed hairs. The leaves are deeply divided into three, five, or seven lobes, which are variously incised at their extremities, hairy, and of a pale green color, mottled with still paler spots. Those which rise from the root are supported on foot-stalks eight or ten inches long; those of the stem are opposite, the lower petiolate, the upper nearly sessile, with lanceolate or linear stipules. The flowers are large, and usually of a rose-purple color. The peduncles spring from the forks of the stem, and severally support two flowers upon short pedicles. The calyx is composed of five oblong, ribbed, cuspidate leaves; the petals are five, obovate, and entire; the stamens ten, with oblong, deciduous anthers, the five alternate filaments being longer than the others, and having glands at their base; the ovary is ovate, supporting a straight style as long as the stamens, and surmounted by five stigmas. The fruit consists of five aggregate, one-seeded capsules, attached by a beak to the persistent style, curling up and scattering the seeds when ripe. The plant is indigenous, growing throughout the United States in moist woods, thickets, and hedges, and generally in low grounds. It flowers from May to July. The root should be collected in autumn.

Geranium is described as: "Rhizome cylindraceous, somewhat branched, bent, flattened and strongly tuberculated, from 2.5 to 10 cm. in length and from 3 to 15 mm. in diameter; surface marked with root scars and remnants of slender roots, longitudinally wrinkled; externally dark purple-brown; internally light purple-brown; fracture short, non-fibrous, the section shows a thin bark, a distinct cambium, irregular in outline, large central pith, wood indistinct, the fibro-vascular bundles few and at unequal distances. Odorless; taste strongly astringent. The powder is purplish-brown and, when examined under the microscope, exhibits tangentially elongated cork cells; parenchyma containing starch, scattered cells of pith and bark parenchyma containing tannin both in the content and walls of the cells' and colored bluish-black by ammonio-ferric alum T.S.; tracheae small, with scalariform markings; characteristic starch more or less abundant, grains smooth, mostly single, ovate, up to 0.035 mm. in length, hilum near the larger end, inner lamellae concentric with hilum, the outer excentric. Geranium yields not more than 8 per cent. of ash." *N. F.* Water and alcohol extract the virtues of geranium. According to Edward Staples, it contains tannic and gallic acids, mucilage, red coloring matter, resin, and a crystallizable vegetable principle. (*A. J. P.*, 1829, p. 171.) Tilden found, besides tannic and gallic acids, gum, pectin, sugar, starch, albumen, resin soluble in alcohol, oleoresin soluble in ether only, coloring matter, chlorophyll, lignin, and various salts. (*P. J.*,

1863, p. 22.) Tannic and gallic acids are probably the sole active ingredients. Henry Trimble and J. C. Peacock (*A. J. P.*, 1891, p. 265) collected the plant at periods of the year ranging from January to October, and determined the percentage of tannin as calculated for the perfectly dry drug to vary from 9.72 to 27.85 per cent. They also determined that it belonged to the class of tannins analogous to gallo-tannic acid, yielding pyrogallol on heating. They decomposed the tannin by the action of hydrochloric acid, obtaining gallic acid, glucose, and geranium red as products.

Geranium is one of our best indigenous astringents, and may be employed for all the purposes to which these medicines are applicable. The absence of unpleasant taste and of other offensive qualities renders it peculiarly serviceable in the case of infants and of persons of very delicate stomach. *Diarrhea, chronic dysentery, cholera infantum* in the later stages, and the various hemorrhages, are the forms of disease in which it is most commonly used and with greatest advantage. As an application to *indolent ulcers*, an injection in *gleet* and *leucorrhoea*, and a gargle in *relaxation of the uvula* and *aphthous ulcerations* of the throat, it answers the same purpose as kino, catechu, and other medicines of the same class. It is a popular domestic remedy in various parts of the United States, and is said to be employed by the Indians. It may be given in substance, decoction, tincture, or extract. (See *Fluidextractum Geranii*, *N. F. IV, Part III.*) *Dose*, fifteen to thirty grains (1-2 Gm.).

Geum. *Water Avens. Radix Caryophyllatae Aquaticae. Radix Benedictae Sylvestris. Racine de Benoite aquatique (de Benoitee des Ruisseaux), Fr. Sumpfnelkenwurzel, Wasser-Benedikten-Wurzel, G.*—Several species belonging to this genus have been medicinally employed, but three or four are deserving of particular notice—*Geum rivale* L., which once had a place in the U. S. Secondary List, *G. urbanum* L., formerly recognized by the Dublin College, *G. virginianum*, L., an indigenous species, the root of which has been recommended in dysentery by W. A. Gibson (*Med. Rec.*, 1868), and *G. canadense* Jacq. (*G. album* Gmel.), recommended by W. A. Spurgeon in gastric irritation and headache. (*A. J. P.*, 1883.)

The rhizome and roots of *Geum urbanum* L., of Europe and Asia, are used in medicine. The rhizome is from 3 to 7 cm. in length and about 8 mm. in thickness. It is more or less branching, having on the upper surface the remains of the short stems and petiole-bases and on the lower surface numerous fibrous roots. Externally it varies from a brownish to a brownish-yellow. The fracture is short and internally it is dark brown. When quite dry it is nearly inodorous, but in the recent state has an odor like that of cloves, whence it is sometimes called radix caryophyllatae. The taste is bitterish and astringent. It imparts its virtues to water and alcohol, which it tinges red. Buchner obtained a yellow, amorphous, neutral, bitter-tasting mass, which he calls geum-bitter. Distilled with water it yields 0.04 per cent. of a thick, greenish-yellow volatile oil, consisting chiefly of eugenol, a tasteless resin, gum, bassorin, and starch. It has been much used in Europe as a tonic and astringent, in chronic and passive *hemorrhages, chronic dysentery* and *diarrhea, leucorrhoea, intermittent fever*, etc. The dose is from thirty grains to a drachm (2.0-3.9 Gm.) of the powder three or four times a day, or an equivalent quantity in decoction.

Geum rivale L.—*Water or purple avens*, a plant growing in bogs and wet places in the northern United States, has a perennial, horizontal, jointed, scaly, tapering root, about 15 cm. long, of a reddish-brown color externally, white internally, and furnished with numerous descending yellowish fibers. The dried root is hard, brittle, easily pulverized, reddish or purplish, without odor, and of an astringent, bitterish taste. Boiling water extracts its virtues.

Water avens possesses similar therapeutic properties to avens, for which it is sometimes substituted, but is less esteemed. The dose of the powdered root is from twenty grains to a drachm (1.3-3.9 Gm.), to be repeated three times a day. Dose of the decoction (ounce to the pint), one or two fluidounces (30-60 mls). A weak decoction is sometimes used by invalids in New England as a substitute for tea and coffee.

Gillenia. *Bowman's Root. Indian Physic. American Ipecac. Racine de Gillenie, Fr. Gillenienwurzel, G.*—Under this name the U. S. P. formerly included in its Secondary List the roots of two species of *Gillenia*. (Fam. Rosaceae.)

Gillenia trifoliata (L.) Moench. is an herbaceous plant with a perennial rhizome, having many long, slender, roots. It grows throughout the United States, east of the Allegheny ridge, and, in Pennsylvania, may also be found abundantly west of these mountains. The root should be gathered in September. (See *A. J. P.*, 1898, 501.)

G. stipulata (Muhl.) Trel. is herbaceous and perennial, though much taller and more bushy than the preceding. It grows as far north as the State of New York, and extends as far west as Kansas. Its root is precisely similar to that of the Eastern species, and is reputed to possess the same properties.

The roots of *G. stipulata* resemble those of Ipecac, the bark being thinner and enclosing in the inner layers numerous reddish resin cells. The roots of *G. trifoliata* are smaller and indistinctly annulate, exhibiting few or no distinct fissures. For microscopic characters, see G. L. Curry. (*Am. Pract. and News*, May, 1892.) The bark, which is easily separable, has a bitter, not disagreeable taste; the wood is nearly insipid and comparatively inert, and should be rejected. The powder is of a light brownish color, and possesses a feeble odor, which is scarcely perceptible in the root. The bitterness is extracted by boiling water, which acquires a red color. The root yields its bitterness also to alcohol. By various experimenters it has been shown to contain gum, starch, gallotannic acid, fatty matter, wax, resin, coloring matter, albumen, and lignin, besides salts. (*A. J. P.*, xxvi, 490.) *Gillenin* of W. B. Stanhope was a whitish substance, very bitter, slightly odorous, permanent in the air, soluble in water, alcohol, ether, and the dilute acids, and neutral to test paper. Nitric acid rendered it blood-red, chromic acid green. Tanriic acid produced no effect. It gave white precipitates with potassium hydroxide, lead-aub-acetate, and tartar emetic. Half a grain (0.032 Gm.) of it produced nausea and retching. (*A. J. P.*, xxviii, 202.) G. L. Curry (*A. J. P.*, 1892, 513) has found two glucosides: the first, *gillein*, obtained from the ethereal extract, formed white feathery crystals, was colored red by sulphuric acid, yellow by nitric acid, and deepened the color of chromic acid; the second,

gilleenin, obtained from the aqueous infusion, was amorphous, of yellowish color, of faint taste at first but becoming very bitter, and giving no color reactions with the acids.

Gillenia is a mild and efficient emetic, and, like most substances belonging to the same class, occasionally acts upon the bowels. In very small doses it has been thought to be tonic, and has been used as a substitute for ipecacuanha, which it is said to resemble in its mode of operation. It was employed by the Indians, and became known as an emetic to the colonists at an early period. Linnaeus was aware of its reputed virtues. Dose of the powdered root, as an emetic, from twenty to thirty grains (1.3-2.0 Gm.).

Ginseng. *Panax quinquefolius* L., *Panax*. U. S. 1870. *Ginseng*, Fr., G., Sp. *Ginsen*, It.—American ginseng grows in rich, cool woods, especially along the mountains from Quebec and Ontario, south to Georgia. The root is the part employed. This is collected to the extent of about 100,000 pounds annually in the United States and shipped largely to Shanghai. It is also cultivated. (*A. J. P.*, 1891; *Ph. Era*, 1895, 359.) It is not used in America, but is exported to China. While supplied with ginseng exclusively from their own country, which furnished the root only in small quantities, the Chinese entertained the most extravagant notions of its virtues, considering it a remedy for all diseases, and as possessing almost miraculous powers in preserving health, invigorating the system, and prolonging life. It is said to have been worth its weight in gold at Pekin, and the first shipment from North America to Canton yielded enormous profits. John Henry Wilson (*P. J.*, July, 1888) states that there are in the Chinese market five ginsengs, four of them of Asiatic origin, derived from *Panax Ginseng* C. A. Meyer, the fifth, the American ginseng, from *Panax quinquefolium*. According to E. M. Holmes, *T'ang-shen*, which is used by the poor of China as a substitute for the costly ginseng, is a root of a new campanulaceous plant, *Codonopsis Tangshen*, and is exported from Hankow and Oo-chang to the extent of five hundred tons annually. (*P. J.*, xxi.) For an account of the Chinese methods of using ginseng, see *P. J.*, vi, 86.

On account of the growing scarcity of the American ginseng plant, experiments have been made by the State of Pennsylvania to determine whether it can be grown profitably, resulting in the conclusion that in five years an acre of ground would yield a profit of fifteen hundred dollars, without allowance for rental, but, according to Jackson (*P. J.*, lxx, p. 785), many precautions are necessary for success. The cultivated roots were larger than those of the wild plant. For an account of the ginseng cultivation in Corea, see *P. J.*, 1885, 732; and of its collection in the United States, see *D. C.*, 1884, 33. (For details of culture and preparation, see *Bulletin 62, Pennsylvania State Agricultural Experiment Station; Bulletin No. 16, Division of Botany, U. S. Department of Agriculture*; J. U. Lloyd's paper, *Proc. A. Ph. A.*, 1901, p. 90; *Ph. Era*, 1900, p. 581; 1903, p. 497; *P. J.*, 1904, p. 652.)

The root is fleshy, somewhat spindle-shaped, from 5 to 12 cm. long, and 1 to 2.5 cm. thick, and terminated by one or more stem scars. Frequently there are two portions, sometimes three or more, connected at their upper extremity, and bearing a supposed, though very remote, resemblance to the human figure, from which

circumstance it is said that the Chinese name ginseng originated. When dried, the root is yellowish-white and wrinkled externally, and within consists usually of a hard central portion, surrounded by a soft whitish bark. It has a feeble odor, and a sweet, slightly aromatic taste, somewhat analogous to that of licorice root. It contains a glucosidal principle, *panaquilon*, besides saponin, a bitter principle, a volatile oil, resin, sugar, mucilage and starch. S. S. Garrigues prepared *panaquilon*, to which he gave the formula $C_{12}H_{25}O_9$, by heating a cold infusion so as to separate the albumen, filter, concentrate to a syrupy consistence, precipitate by a concentrated solution of sodium sulphate, wash the precipitate thoroughly with the saline solution, and then treat it with alcohol, which dissolves the principle in question, and yields it on evaporation. To purify it, he dissolved it in water, treated the solution with animal charcoal, again evaporated, and dissolved the residue in absolute alcohol, which is finally distilled off. Panaquilon is an amorphous, yellow powder, soluble in water and alcohol, but not in ether, of a sweet bitterish taste, and has the characteristic property that, when treated with strong acids, it is converted into a white substance, insoluble in water, with the escape of carbon dioxide and water. Garrigues proposed for this white substance the name of *panacon*, $C_{11}H_{19}O_4$. (*A. J. P.*, xxvi, 511.) Davydow (*A. J. P.*, 1890, 338) investigated these principles discovered by Garrigues, but adds nothing new to our information concerning them. The root is sometimes submitted, before being dried, to a process of clarification, which renders it translucent and horny, and enhances its value as an article of export. The extraordinary medicinal virtues formerly ascribed to ginseng had no other existence than in the imagination of the Chinese. It is little more than a demulcent, and in this country is rarely employed as a medicine. Some persons, however, are in the habit of chewing it, having acquired a relish for its taste, and it is sold chiefly to supply the wants of these.

Glaucium. *Glaucium flavum* Crantz. 'Yellow Homed Poppy. Bruisewort. Pavot coma, Fr. Hornmohn, G. (Fam. Papaveraceae.)—An annual or biennial plant indigenous to Europe and sparingly naturalized in waste places from New England to Virginia. It contains a saffron-colored, milky juice, clasping leaves and solitary yellow flowers. Two alkaloids have been separated from this plant, sanguinarine and glaucine (Merck). Maepmann and Helt recommended the plant in the treatment of diabetes (*Med. Neuigkeiten d. Pharm-Post.*, 1899, 346.)

Glechoma. *Nepeta hederacea* (L.) Trevisan (*N. Glechona* Benth.). *Herba Hederæ Terrestris. Lierreterrestre*, Fr. *Gundermann, Gundelrebe, G. Ground-ivy. Gill-over-the-ground.*—A small perennial, labiate herb, indigenous in Europe and widely naturalized in the United States, and growing in damp, shady, grassy places, as in orchards and along fences and hedges. The herb was formerly official, and still enjoys some credit as a domestic remedy. It has a peculiar, disagreeable odor, and a bitterish, somewhat aromatic taste, and imparts its properties to boiling water. It is very prone to have galls developed on it, and to be infested with certain fungi. (*J. P. O.*, 1875, 127.) It is said to be gently stimulant and tonic, diuretic, and aperient; used in chronic *pulmonary* and *urinary catarrhs*. From a half drachm to a drachm (2-3.9 Gm.) was usually given in infusion as a dose.

Gleditschine.—*Gleditschia triacanthos* L., or *Honey Locust*, and *G. Macracantha*

Desf. (Fam. *Leguminosae*), and are small, thorny trees having pinnate leaves and forming elongated pods filled with a sweetish pulp. The trees grow in rich woods in the Eastern and Central United States and are common in cultivation. *G. Macracantha* is indigenous to China. These trees were chemically studied by B. F. Lautenbach (*P. M. T.*; 1878), who abstracted from them an alkaloid, which he found to produce in the frog stupor and loss of reflex activity, due to an action upon the spinal cord. To this alkaloid Lautenbach gave the name of *gleditschine*. In 1887 (*Med. Rec.*, 1887) Goodman, Seward, and Claiborne brought before the profession, as a local anesthetic, an alkaloid under the name of *stenocarpine* which was asserted to be obtained from the *Gleditschiatriacanthos*. In November, 1888, however, F. W. Thompson, of Detroit (*Med. Age*), and T. G. Novy (*Ph. Rund.*) and John Marshall of the University of Pennsylvania (*Phila. Med. News*), published analyses of this solution, showing that it contained 6 per cent. of cocaine, besides some atropine or other mydriatic alkaloid. (See also *A. J. P.*, 1887, 589.)

Globularia. *Globularia Alypum* Delile, *Wild Senna* of Europe. (Fam, *Globulariaceae*.)—This is a small shrub, growing on the European shores of the Mediterranean, the leaves of which have been occasionally used as a cathartic since the Middle Ages. Heckel and Schlagdenhauffen obtained from the leaves *globularin*, $C_{15}H_{20}O_8$, an amorphous glucoside which splits by treatment with mineral acids into glucose and *globularetin*, C_9H_6O . *Globularia vulgaris* L. was found to contain the same substances. (*J. P. C.*, 1883, 361.) It is asserted that globularin is a vasomotor constrictor which acts especially upon the renal arteries. Jaksch [*R. T.*, 1910, p. 596) has observed diminution of the quantity of urine in diabetes insipidus, also of diabetes mellitus after the administration of the glucoside. The dose of globularin is one-half to one grain (0.03-0.065 Gm.) daily. It does not diminish the excretion of sugar. Globularetin, a brownish-yellow powder, has also been used in medicine as a diuretic and purgative, although no definite information can be found regarding either its efficiency or its manner of use. *Dose*, of globularia, according to Planchon, one ounce (31 Gm.), in decoction.

Gloriosa. *Gloriosa superba* L.—The roots, stalk, and leaves of this climbing liliaceous plant growing in the forests of tropical Africa and extending as far East as the East Indies, are said to be an acrid narcotic poison, and not infrequently used for suicidal purposes in India. C. J. H. Warden found in them two resins, and a very poisonous bitter principle, *superbine*. (*P. J.*, xi, 496.)

GLYCERINUM TRAGACANTHAE. Br.

GLYCERIN OF TRAGACANTH

Glycere de Gomme Adragante, *Fr.*; Traganth-Glycerit, *G.*

" Tragacanth, in powder, 10 grammes; Glycerin, 30 millilitres; Distilled Water, 10 millilitres. Mix the Glycerin with the Tragacanth; add the Distilled Water; triturate until a homogeneous paste is produced." *Br.*

This preparation has been introduced into the British Pharmacopoeia mainly to serve as an excipient for pills.

GLYCERITA

GLYCERITES

Glycerinum, *Br.*; Glycerins; Glycerata, Glycerolata, Glycerole; *Glyceres*, *Fr. Cod.*; Glycerats, Glyceroles, *Fr.*; Glyocerit, Glycerolat, *G.*

These are solutions of medicinal substances in glycerin. In the thirteenth edition of the Dispensatory various reasons were adduced for preferring the name glycerates for these preparations, but, as the revisers of the U. S. Pharmacopoeia have adopted that of glycerites, these reasons are omitted. The U. S. name is certainly much better than the British name glycerin (*Glycerinum*) for this does not distinguish a class of preparations from the solvent used in making them.

Glycerin has valuable properties as a solvent and vehicle for medicinal substances. Such are its not unpleasant taste and bland character, its wide range of solvent power, which adapts it sometimes as a menstruum where neither water nor alcohol could be advantageously used, and enables it to retain in solution otherwise insoluble substances so frequently found in infusions and decoctions, and its preservative influence, which often protects against oxidation, and, by a destructive agency upon all of the lowest forms of vegetable and animal life, prevents the various fermentative processes so destructive to organic bodies. Another important property, as a vehicle for external remedies, is the permanence of its liquid character, so that it does not, like water and alcohol, dry up when applied to the skin, resembling in this respect, as well as in its demulcent quality, the fixed oils, without their tendency to rancidity. Hence it has of late come into extensive use in the preparation of medicinal solutions, which, under the name of *Glyceres* found admission into the French Codex of 1866, and are now recognized by both the United States and British Pharmacopoeias.

GLYCERITUM HYDRASTIS. U. S.

GLYCERITE OF HYDRASTIS Glycer. Hydragt. [Glycerite of Golden Seal]

"One hundred mils of Glycerite of Hydrastis yields not less than 1.12 Gm. nor more than 1.37 Gm. of the ether-soluble alkaloids of hydrastis." *U.S.*

Glycere d'Hydrastis du Canada, *Fr.*; Gelbwurzel-Glycerit, *G.*

"Hydrastis, in No. 60 powder, one thousand grammes [or 35 ounces av., 120 grains]; Glycerin, Alcohol, Water, each, a sufficient quantity, to make about one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Moisten the Hydrastis with three hundred and fifty mils [or 11 fluidounces, 401 minims] of Alcohol, pack it firmly in a cylindrical percolator; and add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding Alcohol, until the drug is exhausted. Remove nearly all of the Alcohol, by distillation or evaporation, pour the thick concentrated liquid into four hundred and fifty mils [or 15 fluid-ounces, 104 minims] of ice-cold Water, and set it aside, in a cold place, for twenty-four hours. Then filter and assay a portion of this filtrate by the process given below, and, from the result thus obtained, ascertain by calculation the amount of ether-soluble alkaloids in the remainder. of the liquid. Add to this enough cold water to make each one hundred mils of the product contain 2.5 Gm. of the ether-soluble alkaloids of hydrastis. Finally add an equal volume of glycerin, and mix." *U. S.*

"Assay.—Proceed as directed under *Fluid-extractum Belladonna Radicis*, first line of the Assay, modifying the process there given by using 5 mils of Glycerite of Hydrastis instead of 10 mils of fluidextract of belladonna root and using only ether as the immiscible solvent throughout the assay. Wash the final ether extractions with 10 mils of distilled water, draw off the water and discard it. Then filter the ether solution through a pledget of purified cotton, wash the cotton with ether, evaporate the filtrate and washings, and dry the residue at 100° C. (212° F.) to constant weight instead of titrating it. The weight represents the amount of ether-soluble alkaloids in 5 mils of the Glycerite of Hydrastis." *U. S.*

The process for this glycerite has been improved by adopting J. U. Lloyd's suggestion to concentrate the alcoholic tincture by distillation or

evaporation and pouring the thick liquid into ice-cold water, for the purpose of separating the oily and resinous matter which is useless. F. A. Sieker found that glycerite of hydrastis as made by the former U. S. process varies greatly in strength. (See *Proc. A. Ph. A.*, 1893, 691; also *Ph. Rund.*, 1895, 236, and *Proc. A. Ph. A.*, 1894, 668.) Its medicinal properties are those of hydrastis.

Dose, from one-half to one fluidrachm (1,8-3.75 mils).

GLYCYRRHIZA. U. S. (Br.)

GLYCYRRHIZA. Glycyrrh. (Licorice Root Licorice Liquorice Root)

"The dried rhizome and roots of *Glycyrrhiza glabra typica* Regel et Herder, known in commerce as Spanish Licorice, or of *Glycyrrhiza glabra glandulifera* Regel et Herder, known in commerce as Russian Licorice (Fam. *Leguminosae*). Preserve powdered and whole Glycyrrhiza in tightly-closed containers to which a few drops of chloroform or carbon tetrachloride are added from time to time to prevent attack by insects." *U. S.* "Liquorice Root is the peeled root and peeled subterranean stem of *Glycyrrhiza glabra*, Linn., and other species of *Glycyrrhiza*." Br.

Glycyrrhizae Radix, Br.; Radix *Glycyrrhiza* Hispanicae. Spanish Licorice Root; Reglisse, *Fr. Cod.*; Racine de Reglisse, Bois doux, Racine douce, Bois de Reglisse, *Fr.*; Radix *Liquiritiae*, *P. G.*; Spanisches Sussholz, Spanische Sussbolzwurzel, Sussholzwurzel, *G.*; Liquirizia, *It.*; Regalia (Raiz de), Orozus, Palo dulce, *Sp.*

Glycyrrhiza glabra has a perennial root, which is round, succulent, tough, and pliable, furnished with sparse fibers, rapid in its growth, and in a sandy soil penetrates deeply into the ground. The stems are herbaceous, erect, slightly branching, and usually four or five feet in height. The leaves are alternate, pinnate, consisting of several pairs of ovate, blunt, petiolate leaflets, with a single leaflet at the end, of a pale-green color, and clammy on their under surface. The flowers are violet or purple, formed like those of the pea, and arranged in axillary spikes supported on long peduncles. The calyx is tubular and persistent. The fruit is a compressed, smooth, acute, one-celled legume, containing from one to six small kidney-shaped seeds. There are two very distinct varieties of the plant yielding the root: in the typical form, or var. *typica*, the underground portion is spreading, producing slender rhizomes. This plant grows best on sandy soil near streams, usually not being found

more than fifty meters from a body of water. It is indigenous to southern Europe and southwestern Asia, and is cultivated in England, Germany and Austria and has been grown on an experimental scale in the United States. The second variety, var. *glandulifera*, has been sometimes designated as a distinct species, because the entire plant is pubescent or roughly glandular. The underground portions are not spreading and it produces a large fusiform root. This variety is indigenous to southeastern Europe and in western Asia. It is also cultivated to some extent in Russia. Asiatic licorice, known as "*Chuntschir*," is obtained from *G. uralensis* Fisch. The plant is found in Siberia, Turkestan and Mongolia, and it is claimed that the root is of better quality and is but little inferior to the best Russian licorice. (*Pharm. Journ. Russ.*, 1908, p. 1063; also *P. J.*, 1908, lxxxii, 164.)

It is probable that a portion of the root from Italy and Sicily is the product of *G. echinata*, which grows wild in Apulia. This species is also abundant in the south of Russia, where, according to Hayne, sufficient extract is prepared from it to supply the whole Russian empire. Large quantities of licorice root are now imported for the purpose of making the extract. The annual imports of licorice root in the United States is enormous. Between 75,000,000 and 100,000,000 pounds are annually imported from Turkey and about half of this quantity from Russia. The U. S. Department of Agriculture has had Spanish licorice under cultivation in South Carolina and the plant thrives in various localities in this country. It is said that the soil and climatic conditions in the Coachella Valley of California are ideal for the growing of the licorice plant. Ozmun describes the plantation of licorice in Turkey and the Levant and the manner of harvesting and handling this article. The licorice plant has been cultivated according to precedence of date in Spain, Italy, Greece, The Ottoman Empire, Russia, China, Turkestan and Persia. (See *Proc. A. Ph. A.*, 1905, p. 273, *A. J. P.*, 1907, p. 39; *Oil, Paint and Drug Sep.*, 1906, p. 37, and 1908, p. 22.)

A species of Glycyrrhiza, *G. lepidota* Pursh., grows abundantly about St. Louis, in the State of Missouri, and flourishes from Colorado to New Mexico, westward into Nevada and Northern California and northward to Washington. It is probably the same as the licorice plant mentioned by Mackenzie as growing on the northern coast of this continent. Nuttall states that its root possesses in no inconsiderable degree the taste of licorice, and M. L. McCullough found it to contain 6.39 per cent. of crude glycyrrhizin, in contrast with 7.18 per cent. in the official

species. (A. J. P., 1890.) Schneider reports that *G. lepidota glutinosa* Pursh., a native of California, is much like *G. glabra* and can no doubt be substituted for the true licorice. (*Pacific Pharm.*, II, p. 144.)

Properties.—The two varieties are described in the U. S. Pharmacopoeia as follows:

"*Spanish Licorice* (also known as Italian, Levant, Persia, Turkish, or Arabian Licorice)— Nearly cylindrical, upper portion more or less knotty; usually in pieces from 14 to 20 cm. or more in length and from 5 to 20 mm. in thickness, externally yellowish-brown or dark brown, longitudinally wrinkled, the thinner rhizomes often having prominent alternate buds, the thicker rhizomes having distinct corky patches; fracture coarsely fibrous; internally lemon-yellow, radiate; bark from 1 to 3 mm. in thickness; wood porous, in narrow wedges, rhizome with small pith; odor distinctive; taste sweetish and slightly acrid. Under the microscope, transverse sections of pieces of the older rhizome of Spanish Licorice show a periderm of numerous layers of yellowish-brown cork cells, a phellogen and one or more rows of cells of the phelloderm, the cells showing a tendency to collenchymatous thickenings and with occasional monoclinic prisms of calcium oxalate; a middle bark of starch-bearing parenchyma and whitish groups of bast-fibers surrounded with crystal-fibers; inner bark with a very characteristic radial arrangement of phloem and medullary rays, the phloem consisting of wedges of small groups of bast-fibers and parenchyma, separated by an almost continuous, obliterated sieve tissue, the cells of the latter being very irregular in outline and with thick, highly refracting walls; medullary rays from 1 to 8 cells wide; wood characterized by broad wedges consisting of large tracheae with yellowish walls, small compact groups of wood-fibers and starch-bearing parenchyma alternating with the broad medullary rays; pith composed of parenchyma, the cells being large, more or less polygonal in outline and containing numerous starch grains, or prisms of calcium oxalate. In sections of roots the pith is absent.

"*Russian Licorice.*—Nearly cylindrical, somewhat tapering, sometimes split longitudinally, from 15 to 30 cm. in length and from 1 to 5 cm. in diameter; when deprived of the outer corky layer, it is externally pale-yellow; fracture coarsely fibrous; internally lemon-yellow; wood radially cleft; odor distinct; taste sweetish. Under the microscope, transverse sections of the rhizome and roots of Russian Licorice somewhat resemble

those of Spanish Licorice, but the cork cells are absent.

Powdered Glycyrrhiza is pale brownish-yellow (Spanish Licorice) or pale yellow (Russian Licorice); starch grains numerous, mostly single and elliptical or oval, and from 0.002 to 0.02 mm. in diameter; tracheae mostly with bordered pores; wood- and bast-fibers numerous, strongly lignified, very long, much attenuated at the ends and about 0.01 mm. in width; crystal-fibers with monoclinic prisms of calcium oxalate, the latter from 0.01 to 0.02 mm. in diameter, occasional fragments of reddish-brown cork cells occur in Spanish Licorice, but are practically absent in the Russian Licorice. Add 10 Gm. of powdered Glycyrrhiza to 100 mils of distilled water, allow the mixture to macerate for fifteen minutes with occasional stirring; and then heat it for one-half hour on a water bath. Filter the mixture and add through the filter enough water to make the filtrate measure 100 mils; not less than 0.2 Gm. of residue remains on evaporating 10 mils of this filtrate and drying it at 100° C. (212° F.). Glycyrrhiza yields not more than 7 per cent. of ash." *U. S.*

" When 5 grammes are macerated with 50 millilitres of chloroform water for twenty-four hours, shaken occasionally and filtered, 10 millilitres of the filtrate evaporated in a flat-bottomed dish yield not less than 0.200 gramme of residue dried at 100° C. (212° P.). Ash not more than 6 per cent." *Br.*

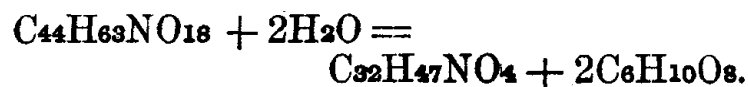
Formerly commerce was chiefly supplied with licorice root by Italy and Spain, but the amount coming from these sources is at present probably not more than 10 per cent. of the whole, the greater portion coming from Southern Russia, a large amount from Anatolia and Syria, and a little from Turkey and Persia. The Spanish variety has been most esteemed, but, according to H. N. Rittenhouse, the peeled Russian licorice is richer in glycyrrhizin and extractives than is any other variety, and is in fact the most valuable. Russian licorice is usually very large, quite sweet, but at the same time rather more bitter and acrid than is the Spanish variety. Licorice root is often worm eaten and more or less decayed; such root should be rejected, as should also the small fibrous roots often shipped from Spain. The best pieces are large, bright yellow internally, and have the layers and the bark distinct. Rusby has stated that he has seen ground licorice imported which apparently consisted of the peelings of Russian licorice. (*Ph. Era*, 1909, p. 634.)

A character said by Rothrock (A. J. P., 1884) to be diagnostic is the

occurrence of crystal fibers adjoining the wood and bast fibers. These are recognized in the official description of the powdered drug. In the Russian root the parenchymatous wood-cells are larger than in the Spanish. The powder is of a grayish-yellow color, when the root is pulverized without being deprived of its epidermis; of a pale sulphur-yellow, when the epidermis has been removed. Bobiquet found the following ingredients in licorice root: (1) a peculiar transparent yellow substance, called glycyrrhizin, of a sweet taste, scarcely soluble in cold water, very soluble in boiling water, with which it gelatinizes on cooling, thrown down from its aqueous solution by acids, readily soluble in cold alcohol, unsusceptible of the vinous fermentation, yielding no oxalic acid by the action of nitric acid, and therefore wholly distinct from sugar; (2) a crystallizable principle named agedo'ite by Robiquet, but subsequently proved to be identical with asparagin; (3) starch; (4) albumen; (5) a brown acrid resin; (6) a brown nitrogenous extractive matter; (7) lignin; (8) salts of calcium and magnesium, with phosphoric, sulphuric, and malic acids. Fluckiger states that a small amount of tannin is also always contained in the root, or rather its bark. The chief constituent, glycyrrhizin, $C_{44}H_{63}NO_{18}$, Gorup-Besanez (*Ann. Ch. Ph.*, 118) considered to be a glucoside, as on boiling with diluted acids it breaks up into *glycyrrhetin* and an uncrystallizable sugar capable of fermentation. Roussin (J. P. C., July, 1875) found that the sweet taste of the root was not owing to the free glucoside, but to its compound with ammonia.

Habermann (*Ann. Ch. Ph.*, 197) found that glycyrrhizin-ammonia was the acid ammonium salt of glycyrrhizic acid, a nitrogenous acid, and gave the formula $C_{44}H_{62}NO_{18}.NH_4$ for it. He succeeded in extracting from the commercial "ammoniacal glycyrrhizin," glycyrrhizic acid, which may be considered to be the active constituent of licorice. It was obtained by dissolving the crude glycyrrhizin in glacial acetic acid at a boiling temperature, rapidly filtering, again treating the crystalline parts of the filtrate in the same manner, and finally purifying by repeated crystallizations from 90 per cent. alcohol. Its properties are peculiar, and account to a great extent for the singular behavior of liquid licorice preparations. With water, in which the substance is but little soluble at ordinary temperature, it forms a transparent, faintly yellow jelly. On mixing 1 Gm. of the body with 100 mils of water, the mixture after a few hours becomes so jelly-like that the open vessel may be inverted without losing any substance. It is insoluble in ether, but slightly soluble in absolute alcohol (even boiling), more so in alcohol of 90 per cent., and especially so when hot. Its solubility increases with the

decrease of the percentage of alcohol. The apparent glucosidal character of glycyrrhizic acid Habermann explains by the fact that it breaks up on boiling with diluted sulphuric acid into *glycyrrhetin* and *parasaccharic acid*, according to the reaction:



(*Ann. Ch. Ph.*, cxcvii; *N. R.*, Sept., 1879.) By fusing glycyrrhizin with potassium hydroxide, Weselsky and Benedikt (*Ber. d. Chem. Ges.*, 1876) obtained *paraoxybenzoic acid*.

For methods of quantitatively determining glycyrrhizin, see *Ext. Glycyrrh.*, p. 452.

Uses.—Powdered licorice root is used for various pharmaceutical purposes as in the preparation of pills, either to give due consistence or to cover their surface and prevent them from cohering, and as a diluent of powdered extracts, etc. As a remedial agent it has been almost entirely replaced by the extract.

Off. Prep.—Extractum Glycyrrhizae, *U. S.*, *Br.*; Extractum Glycyrrhizae Purum, *U. S.*; Fluidextractum Glycyrrhizae, *U. S.* (*Br.*); Mistura Glycyrrhizae Compositus (from Extract), *U. S.*; Pulvis Glycyrrhizae Compositus, *U. S.*, *Br.*; Elixir Glycyrrhizae Aquosum (from Fluidextract), *N. F.*; Elixir Glycyrrhizae Aromaticum (from Fluidextract), *N. F.*; Fluidglyceratum Glycyrrhizae, *N. F.*; Mistura Ammonii Chloridi (from Pure Extract), *N. F.*; Syrupus Glycyrrhizae (from Fluidglycerate), *N. F.*

Gnaphalium. *Gnaphalium margaritaceum* L. (More correctly *Anaphalis margaritacea* (L.) Benth. and Hook.) *Cudweed. Life-everlasting. Pied de Chat, Immortelle*, Fr. *Katisenpfotchen, Immerschon*, G. (Fam. Compositea.)—An indigenous herbaceous perennial, which with *G. obtusifolium* L. (*G. polycephalum* Michx.), or *sweet-scented life-everlasting*, is sometimes used in the form of tea in intestinal and pulmonary catarrhs, and, externally, in the way of fomentation, in bruises, but it probably possesses little medicinal virtue. In Europe different species of *Gnaphalium* are occasionally employed for similar purposes.

Gomabrea.—This is an exudation from a Chilian tree, which has been offered in large quantities in France as a substitute for gum arabic, and is said to be of practical value.

GOSSYPII RADICIS CORTEX. Br.

COTTON ROOT BARK

"Cotton Root Bark is the dried root-bark of *Gossypium herbaceum*, Linn., and of other cultivated species of *Gossypium*." Br.

"The recently-gathered air-dried bark of the root of one or more of the cultivated varieties of *Gossypium herbaceum* Linne, *Gossypium Barbadosense* Linne, or *Gossypium arboreum* Linne (Fam. *Malvaceae*), without the presence of more than 5 per cent. of wood or other foreign matter." N. F.

Gossypil Cortex, N.F.; Ecorce de la Racine de Cottonnier Fr.; Baumwoll-Wurzelrinde, G.; Corteza de la raiz d'algodon, Sp.

In consequence of changes produced in the plants of this genus by cultivation, botanists have found great difficulty in determining which are distinct species and which are merely varieties. By some taxonomists more than fifty species of *Gossypium* are recognized. There are only 5 or 6 species which yield useful products and the bulk of the cotton is the product of two species: *G. herbaceum* L., which furnishes the Upland or short staple cotton, and *G. barbadense* L., the source of the Sea Island or long staple cotton. All of the species are of tropical origin. The Upland cotton has been cultivated in East India and Arabia since ancient times. The Sea Island cotton is indigenous to America and is of the type observed by Columbus.

Gossypium herbaceum is a biennial or triennial plant, with a branching stem from two to six feet high, and palmate hoary leaves, the lobes of which are somewhat lanceolate and acute. The flowers possess yellow petals, having a purple spot near the claw. The leaves of the involucre or outer calyx are serrate. The capsule opens when ripe, and displays a loose white tuft of long slender filaments, which surround the seeds and adhere firmly to the outer coating. The plant is a native of Asia, but is cultivated in most tropical countries. It requires a certain duration of warm weather to perfect its seeds, and, in the United States, does not mature north of Virginia.

The herbaceous part of the plant contains much mucilage, and has been used as a demulcent. The seeds yield by expression a fixed oil of the

semi-drying kind, which is employed for making soap and for other purposes. (See *Oleum Gossypii*.) The bark of the root has been supposed to possess medicinal virtues, and is recognized by the National Formulary IV. Another portion, for which the plant is cultivated, is the filamentous substance surrounding the seeds. This, when separated, constitutes the cotton of commerce, and when purified, is official as *Purified Cotton*. Cotton seeds have been employed in our Southern States with great asserted success in the treatment of intermittents, but are at present seldom, if ever used. (For details, see *U. S. D.*, 16th ed.) For an account of a microscopical and microchemical examination of cotton root bark by F. W. Morgan, see *A. J. P.*, 1898, p. 427. Farwell has made a histological study of the root and stem barks. (See *Merck's Rep.*, 1914, p. 133.) The drug of commerce frequently contains a considerable woody material. It is said it deteriorates with age and therefore only recently gathered bark should be used.

Properties.—Cotton Root Bark is described as: "In strips or quilled pieces; thin, tough and fibrous. Cork thin, pale brown, longitudinally striated; removed in places and then disclosing the orange-brown cortex. Inner surface whitish, silky and finely striated. Secondary bast readily separable into thin fibrous laminae. No odor, taste slightly acrid and astringent." *Br.*

The N. F. describes the bark as follows: "In flexible bands or quilled pieces, attaining a length of 30 cm. and a thickness of about 1 mm.; outer surface orange-brown, smooth, slightly wrinkled, with small circular lenticels, the outer corky layer frequently exfoliated and showing the more or less fissured and fibrous middle bark; inner surface light brown, longitudinally striate; fracture tough, fibrous, the inner bark readily separable into fibrous layers. Odor slight; taste very slightly acrid. Under the microscope, sections of Cotton Root Bark show an outer layer of cork composed of four to six layers of tabular, thin-walled, yellowish-brown, non-lignified cells; a thin primary cortex, consisting of starch-bearing parenchyma and an occasional large secretion reservoir with yellowish-brown contents; inner bark with large groups of bast fibers arranged in interrupted, concentric circles, separated radially by medullary rays and tangentially by the leptome or sieve tissue; bast fibers from 0.3 to 1 mm. in length and about 0.015 mm. in width, the walls being about 0.005 mm. in thickness, strongly lignified and with very few pores, the ends being acute and markedly attenuate; medullary rays one to six cells wide, the cells usually filled

with starch grains; the latter from 0.003 to 0.02 mm. in diameter; occasional cells containing rosette aggregates of calcium oxalate from 0.009 to 0.025 mm. in diameter. Cotton Root Bark yields not more than 7 per cent. of ash." *N. F.*

E. S. Wayne, of Cincinnati, found in it a peculiar acid resin, colorless and soluble in water, when pure, but absorbing oxygen on exposure, and then becoming red and insoluble in water. It is deposited from the fluidextract on standing. He suggests that this may be the active principle of the root; but the fact has not been determined. (*A. J. P.*, 1872.) William C. Staehle (*A. J. P.*, 1875) made an examination of this resin, and obtained results somewhat different from those of Wayne. Staehle's percolate was of a dark reddish-brown color, while Wayne's was pale amber. This is accounted for, however, by the presence of a principle which is colorless in the fresh bark, but of a dark red in bark which has been exposed to air and light. W. A. Taylor noticed that the change in color from pale amber to dark red took place in an alcoholic tincture. (*A. J. P.*, 1876.) Staehle found the resin soluble in 14 parts of alcohol, 15 parts of chloroform, 23 parts of ether, and 122 parts of benzene.

Power and Browning (*P. J.*, 1914, xciii, 420) found in an investigation of cotton root bark the following constituents: acetovanillone (in the steam distillate), a phenolic acid (probably two-thirds dihydroxybenzoic acid), salicylic acid, a new colorless phenolic substance, $C_9H_{10}O_3$, a new yellow phenolic substance, $C_{13}H_{18}O_6$, betaine, a fatty alcohol, $C_{20}H_{42}O$, a phytosterol, $C_{27}H_{46}O$, triacontane, ceryl alcohol, oleic and palmitic acids, and a sugar. Almost all of these constituents were separated from the resinous extractive which constituted between 10 and 11 per cent. of the air dried bark. No tannin was present and no alkaloids were detected.

Uses.—Cotton root bark was introduced into medicine by Bouchelle (*A. J. M. S.*, August, 1840), who stated that it was habitually resorted to by the slaves of the south as an abortifacient. His favorable opinion has been confirmed by various southern practitioners, and Scott (*T. G.*, 1911) has shown experimentally that cotton root bark increases the contractions and tonus of the uterus in the lower animals, although it is somewhat less powerful than ergot. It is used not only to strengthen the contractions in uterine inertia during *labor*, but also in the treatment of

metrorrhagias, especially when dependent on *fibroids*. Bellany, of Georgia, asserts that the root should be gathered as late as possible in the fall before frost. Bouchelle used a decoction made by boiling four ounces of the inner bark of the root in a quart of water down to a pint, of which he gave a wine glass full (60 mls) every twenty or thirty minutes. The U. S. P., 1890, recognized a fluidextract (see *U. S. Dispensatory*, 19th edition, p. 525); for the N. F. IV fluidextract, see Part III.

Dose, thirty to sixty grains (2.0-3.9 Gm.).

Off. Prep.—Decoctum Gossypii Radicis Corticis, *Br.*; Extractum Gossypii Radicis Corticis Liquidum, *Br.*; Fluidextractum Gossypii Corticis, *N. F.*

GRANATUM. U. S.

POMEGRANATE Granat. [Pomegranate Bark]

"The dried bark of the stems and roots of *Punica Granatum* Linne (Fam. *Punicaceae*), without the presence or admixture of more than 2 per cent. of wood or other foreign matter. Preserve it in tightly-closed containers."
U. S.

Granati Cortex, *Br.*, 1898; Pomegranate Bark; Grenadier, *Fr. Cod.*; Ecorce de la Racine de Grenadier (de Balaustier), Ecorce de Granade, *Fr.*; Cortex Granati, *P. G.*; Granatrinde, Granatwurzelnrinde, *G.*; Melogranato. Malicorio, Scorza del Melogranati, *It.*; Granada (Corteza de), *Sp.*

The *pomegranate* is a small tree, attaining in favorable situations the height of twenty feet, with a very unequal trunk, and numerous branches which sometimes bear thorns. The leaves are opposite, petiolate, entire, oblong or lance-shaped, pointed at each end, smooth, shining, and of a bright-green color. The flowers are large, of a rich scarlet color, and stand at the end of the young branches. The petals are roundish and wrinkled, and are inserted into the upper part of the tube of the calyx, which is red, thick, and fleshy. The fruit is a globular berry, about the size of an orange, crowned with the calyx, covered with a reddish-yellow, thick, coriaceous rind, and divided internally into many loculi, which contain an acidulous pulp, and numerous oblong, angular seeds.

This tree grows wild upon both shores of the Mediterranean, in Arabia,

Persia, Bengal, China, and Japan, has been introduced into the East and West Indies, and is cultivated in all civilized countries where the climate is sufficiently warm to allow the fruit to ripen. In higher latitudes, where it does not bear fruit, it is raised in gardens and hot houses for the beauty of its flowers, which become double and acquire increased splendor of coloring by cultivation. Doubts have been entertained as to its original country. The name of *Punicum Malum*, applied by the ancients to its fruit, implies that it was abundant at an early age in the vicinity of Carthage. The fruit, for which the plant is cultivated, varies much in size and flavor. It is said to attain greater perfection in the West Indies than in its native country. The edible pulp is red, succulent, pleasantly acid, and sweetish. The flowers were recognized by the Dublin College, and the seeds are official in France. See a paper by J. U. Lloyd in *West. Drug.*, 1897,202.

The pomegranate may be grown in the United States as far north as Virginia. It is cultivated to some extent in California, and the Gulf States as a garden and hedge plant. The seeds are utilized in the south in making cooling drinks. There are several varieties of the pomegranate. The typical having an acid pulp, and others having a sweet and sub-acid character. There is an East Indian variety which is seedless and is highly prized in India. There are several double-flowered varieties which do not bear fruit and are largely cultivated in the south and in greenhouses for ornamental purposes.

The *rind of the fruit* is seen in commerce in the form of irregular fragments, hard, dry, brittle, of a yellowish or reddish-brown color externally, paler within, without odor, and of an astringent, slightly bitter taste. It contains a large proportion of tannin, and in countries where the tree abounds, has been employed for tanning leather.

The flowers, sometimes called *balaustines*, are inodorous, have a bitterish, astringent taste, and impart a violet-red color to the saliva. They contain tannic and gallic acids, and were used by the ancients in dyeing.

Properties.—"The stem bark is mostly in somewhat flattened or transversely curved pieces, to some extent in quills, from 2 to 8 cm. in length; bark from 0.5 to 3.5 mm. in thickness; outer surface yellowish to grayish-brown, with grayish patches of foliaceous lichens with their brownish-black apothecia, longitudinally wrinkled, also marked with

small, broadly elliptical lenticels and with more or less abraded patches of cork; inner surface light yellow or yellowish-brown, finely striate; fracture short, smooth, inner bark yellowish-green; odor slight; taste astringent, somewhat bitter and nauseous. The root bark is in transversely curved pieces; externally brownish-yellow to dark brown with irregular patches of cork; internally dark yellow, the medullary rays extending nearly to the outer surface. The powder is yellowish-brown to dark brown; calcium oxalate crystals in rosette aggregates, monoclinic prisms or crystal fibers, the individual crystals from 0.01 to 0.018 mm. in diameter; starch grains numerous, spherical, ellipsoidal biconvex, polygonal or irregular, and single or compound, from 0.002 to 0.01 mm. in diameter; fragments of whitish cork with strongly lignified walls; stone cells mostly single, occasionally in small groups, the individual cells from 0.05 to 0.18 mm. in length, the walls being very thick and strongly lamellated; occasional fragments of wood with long wood-fibers from 0.015 to 0.02 mm. in width, the walls being slightly lignified and from 0.003 to 0.008 mm. in thickness and associated with tracheae possessing simple and bordered pores. Mix 1 Gm. of powdered Pomegranate with 100 mils of distilled water, macerate it with occasional agitation for about an hour and filter; a light yellow filtrate is obtained. Upon the addition of a drop of ferric chloride T.S. to 10 mils of this filtrate a bluish-black precipitate is produced. Upon the addition of from 40 to 50 mils of lime water to another portion of 10 mils of the filtrate, an orange-brown, flocculent precipitate is produced. Pomegranate yields not more than 16 per cent. of ash." *U.S.*

The roots of the pomegranate are hard, heavy, knotty, ligneous, and covered with a bark which is yellowish-gray or ash-gray on the outer surface, and yellow on the inner. The *root bark* occurs in quills or fragments similar to but differing from those of the stem as shown in the official characterization. "The transverse section exhibits numerous fine radial and tangential lines." *Br.* (1898). It has little or no odor, colors the saliva yellow when chewed, and leaves in the mouth an astringent taste without disagreeable bitterness. There is considerable question as to the relative value of the root and stem barks of granatum. The drug of commerce usually consists of a mixture of stem and root bark, the former commonly predominating. Granatum is sometimes substituted by the barks of other plants. The principal of these being *Berberis vulgaris*, which is bitter and not astringent; *Buxus sempervirens*, which is also bitter and free from tannin; and *Strychnos Nux Vomica* or false Angostura bark which has a dark inner surface

and a very bitter taste. None of these barks have the characteristic checkered appearance of the transverse surface of genuine *Granatum*.

The bark of the stem of the pomegranate is sold as root bark: for microscopic diagnosis, see *P. J.*, 1873. As the activity of the barks of different portions of the plant is important, represented by the alkaloids the analyses of Stoeder are of interest. His results are: stem and branch bark, in thin quills, 0.612 per cent.; average quills, 0.350 per cent.; thick quills, 0.498 per cent.; root bark from south of Europe, in thick quills, 1.010 per cent.; shaved root bark from Java, 1.326 per cent.; exfoliated bark from dry thick roots of unknown age, 1.240 per cent.; finely rasped wood from these roots, 0.218 per cent. According to the same authority (*Nederl. Tijd. Pharm.*, 1890), of the bark of three varieties of the wild pomegranate recognized and used by the natives of Java, the red-flowered "merah," yielded 2.43 per cent.; the white-flowered, "poetih," yielded 3.75 per cent.; the black-flowered, "hitam," yielded 1.71 per cent.

The infusion of granatum yields a deep-blue precipitate with salts of iron, and a yellowish-white precipitate with solution of gelatin. The inner surface of the bark, steeped in water and then rubbed on paper, produces a yellow stain, which by the contact of ferrous sulphate is rendered blue, and by that of nitric acid acquires a slight rose tint, which soon vanishes. These properties serve to distinguish this bark from those of the box root and barberry. When used, it should be separated from the ligneous portion of the root, as the latter is inert. The bark contains more than 22 per cent. of tannic acid, which Rembold (*Ann. Ch. Ph.*, 143, 285) found to consist for the most part of a peculiar variety, *punico-tannic acid*, $C_{20}H_{16}O_{13}$; when boiled with diluted sulphuric acid it is resolved into *ellagic acid*, $C_{14}H_8O_9$, and sugar. Punico-tannic acid is accompanied by common tannic acid, yielding by means of sulphuric acid, gallic acid, which appears sometimes to pre-exist in the bark. Henry Trimble, however (*A. J. P.*, 1897, 636), as the result of an ultimate analysis of the purified tannin and a study of its reactions, pronounced it to be identical with gallotannic acid. Pomegranate bark also yields a considerable quantity of *mannite*, which was formerly described under the names of *punicin* or *granatin*. The medicinal value of the root, however, is due, according to Tanret (*C. R. A. S.*, lxxxvi, 1270, and lxxxvii, 358), to an alkaloid *pelletierine*, $C_8H_{15}NO$, a dextrogyrate liquid boiling at $195^\circ C.$ ($383^\circ F.$), easily soluble in water, alcohol, and ether, and specially so in chloroform. It

has strong basic properties and precipitates many metallic salts: 1000 parts of dry bark yielded 4 parts of it.

Tanret (*C. R. A. S.*, lxxxviii, p. 716) announced that he had found three additional volatile bases in the bark, a liquid left-rotating one, a liquid optically inactive one, and a crystallizable inactive one, to which the names of *methylpelletierine*, $C_9H_{17}NO$, and *pseudopelletierine* (*granatonine*), $C_9H_{15}NO$, and *isopelletierine*, have been given. Carl J. Bender (*Ph. Centralh.*, 1885, p. 6) found three bases in pomegranate bark, one crystallizable and two amorphous. He objects to the name pelletierine, and substitutes *punicine*. Wm. F. Junkunz analyzed pomegranate bark, and believed that the alkaloid exists in the bark as a tannate. (*A. J. P.*, 1884.) The old idea that the bark loses activity when kept seems to be negated by the analysis of De Vrij. (*P. J.*, xxi.) Piccinni isolated a tertiary alkaloid, $C_{10}H_{18}NO$, from pomegranate root bark. (*P. J.*, 1900, 24-9.) Fluckiger stated that methyl pelletierine predominates in the bark of the root and pelletierine in the bark of the overground portions of the plant. For Leger's method of determining total alkaloids, see *P. J.*, 1904, 581. Assay processes for granatum are given in most of the foreign pharmacopoeias and these were critically reviewed by Dichgans (*Ph. Ztg.*, 1914, 852), who finds the one in the Swiss Pharmacopoeia to be the best.

Uses.—The rind of the pomegranate fruit was formerly recognized by the U. S. Pharmacopoeia. It is astringent, and in the form of decoction is sometimes employed in *diarrhea* and *colliquative sweats*, and, more frequently, as an injection in *leucorrhea*, and as a gargle in *sore throat* in the earlier stages, or after the inflammatory action has in some measure subsided. The powdered rind has also been recommended in *intermittent fever*. The flowers have the same medicinal properties and are used for the same purposes. The bark of the root was used by the ancients as a vermifuge, and is recommended in the writings of Avicenna, but was unknown in modern practice until brought into notice by F. Buchanan, who learned its powers in India. The Mahometan physicians of Hindostan consider it a specific against *taenia*. One of these practitioners, having relieved an English gentleman in 1804, was induced to disclose his secret, which was then made public. The French writers prefer the product of the wild pomegranate, growing on the borders of the Mediterranean, to that of the plant cultivated in gardens for ornamental purposes. The bark may

be administered in powder or decoction, but the latter form is usually preferred. The decoction is prepared by macerating two ounces of the bruised bark in two pints of water for twenty-four hours, and then boiling to a pint. Of this a wineglassful may be given every half hour, hour, or two hours, until the whole is taken. It often nauseates and vomits, and usually purges. Portions of the worm often come away soon after the last dose. It is recommended to give a dose of castor oil and to diet the patient strictly on the day preceding the administration of the remedy, and, if it should not operate on the bowels, to follow it by castor oil, or an enema. If not successful on the first trial, it should be repeated daily for three or four days, until the worm is discharged. It appears to have been used by the negroes of San Domingo before its introduction into Europe.

Pomegranate owes its anthelmintic powers to the alkaloids, pelletierine and isopelletierine, the mixture of which is official. The efficacy of these taenicides has been abundantly confirmed, and it appears to be established that the tannate is the most effective and the least dangerous form of the remedy,—probably because its insolubility prevents its rapid absorption and enables it to come in prolonged contact with the worm. The experiments of Dujardin-Beaumetz have shown that the alkaloids from pomegranate act upon the higher animals like curare, causing paralysis of the motor nerves without affecting sensation. The same authority asserts that hypodermic injections of six grains produce in man severe vertigo, muscular weakness, and great retinal congestion. Double vision has also been noted, and Galezowski has been led by it to prescribe pelletierine in paralysis of the third and sixth pairs of nerves; he affirms that he has succeeded in affording relief after the failure of potassium iodide and blisters. The proper dose of pelletierine tannate is variously given by authorities. It has been stated to be from one-half to three-quarters of a grain (0.032-0.048 Gm.) (*B. G. T.*, xcvi, xcvi), but others place it as high as eight grains (0.5 Gm.). Commercially, it occurs almost exclusively as a syrupy solution, put up, we believe, under the supervision of its discoverer, each bottle containing a single dose, it is stated, of about five grains (0.32 Gm.). We have seen pronounced temporary general palsy produced in a female adult by this dose. The dose of pomegranate rind and flowers in powder is from twenty to thirty grains (1.3-2.0 Gm.). *Decoctum Granati Corticis* was formerly official in the British Pharm. (1898). The decoction may be prepared in the proportion of four ounces of the bark to twenty fluidounces of water, and given, in the dose of half a fluidounce (15

mils). The remedy should always be given after a twelve hours fast, and be followed in two hours by a brisk cathartic. The seeds are demulcent.

Dose, twenty to thirty grains (1.3-2.0 Gm.).

Off. Prep.—Fluidextractum Granati, *U. S.*

Gratiola. *Gratiola officinalis* L. *Hedge-hyssop.*, *Gratiolle*, Fr. *Gnadenkraut*, *Gottesguadenkraut*, Gr. (Fam. *Scrophulariaceae*).—This is a perennial herb, indigenous in the south of Europe, in meadows and other moist grounds. The whole herb is used. It is nearly inodorous, but has a bitter nauseous taste. The indigenous *G. virginiana* L. closely resembles the European plant and indeed was regarded by Michaux as identical with it. Both water and alcohol extract its active properties. F. G. Walz found in it the following constituents: 1, *gratiolin*; 2, *gratiosolin*; 3, *gratioloic acid*; 4, *gratiola fat*; and 5, a brown resin. For chemistry, see *P. J.*, lxi, 295, and lxx, 385. The *gratiolin* is decomposed on prolonged boiling with diluted H₂SO₄ into *gratioletin*, *gratiolaretin*, and sugar; the *gratiosolin* is similarly decomposed by dilute acids or alkalis into *gratiosoletin* and sugar; the *gratioloic acid* is obtained in the form of pearly white scales of a fatty odor. *Hedge-hyssop* is a drastic cathartic and emetic, possessing also diuretic properties, and has been used in Europe for the relief of *dropsy*, *jaundice*, *worms*, *chronic hepatic affections*, and *scrofula*. The dose of the powdered herb is from fifteen to thirty grains (1.0-2.0 Gm.); of the infusion (half an ounce to the pint of boiling water), half a fluidounce (15 mils).

Ground Nuts. *Peanuts. Earth nuts. Goober-nuts.*—The fruit of *Arachis hypogaea* L., a leguminous, annual plant, indigenous probably in Africa and South America and abundantly cultivated in our Southern States, China, etc. Recent government statistics show that about 16,000,000 bushels are produced annually in the United States, and about 29,000,000 bushels imported. There has, however, been a great increase in the domestic production in the last year or two, and the American crop will probably be much larger in the near future.

A remarkable property of the plant is that its fruit ripens under the surface of the ground, into which the pods penetrate after flowering, until the young fruit is completely buried under the soil in the progress of their growth. The kernels or seeds contain about 45 per cent. of a fixed oil. (See *Oleum Arachis*, Part I.)

GRINDELIA. U. S., Br.

GRINDELIA Grindel.

" The dried leaves and flowering tops of *Grindelia camporum* Greene, or *Grindelia cuneifolia* Nuttall, or *Grindelia squarrosa* (Pursh.) Dunal (Fam. *Compositae*), without the presence or admixture of more than 10 per cent. of stems or other foreign matter." *U. S.* "Grindelia consists of

the dried leaves and flowering tops of *Grindelia camporum*, Greene." *Br.*

California Gum-plant; *Grindelia*, *Fr.*; *Grindelie*, *G.*

The genus *Grindelia* includes some twenty-five species, six or eight of which are found in South America and the remainder occurring in the United States west of the Mississippi. They are coarse perennial or biennial herbs, being occasionally shrub-like. Most, if not all, of the species produce a resinous exudation on the stem and leaves and especially on the flower-heads. The leaves are alternate, sessile or clasping and spinulose-dentate. The flowers occur in large terminal heads composed of both discoid and radiate yellow flowers. The ray flowers are pistillate and the involucre is more or less hemispherical, the bracts being imbricated, in several series, being usually subulate-tipped. The drug of the market appears to be derived in large part from *G. camporum* Greene, which is the common "*gum plant*" of California. It occurs abundantly in the inner coast ranges, where it has been collected in quantity in Lake and Napa Counties. It is also common in the foot hills of the Sierra Nevada and is almost the only plant found on the plains in certain regions of the Sacramento Valley. The leaves are oblong or spatulate, sessile or clasping, coarsely serrate and of a pale-green color. The flower-heads are yellow and the involucre consists of several rows of lanceolate acuminate recurved bracts. The achenes are distinctive in this species and are usually biauriculate or more rarely unidentate at the summit.

G. cuneifolia closely resembles *G. camporum*. The leaves are cuneate oblong or linear oblong and either sessile or amplexicaul. It is a marsh plant and is not as glutinous as *G. camporum*. The leaves of this species, in addition to their being cuneiform in shape, are darker green and not so thick as in *G. camporum*. The achenes are compressed and closely resemble those of *G. camporum*.

G. squarrosa is a common plant on the prairies and dry banks of the West. It has been reported as occurring from the Saskatchewan to Minnesota, Texas and California. It is a glabrous, erect, branching herb having linear-oblong or spatulate leaves, which are more or less clasping at the base and sharply spinulose-dentate. It is especially characterized by the bracts of the involucre being linear-lanceolate, subulate tipped and spreading or squarrose at the summit, giving the species its name. The achenes are truncate, those of the outer flowers

being usually thicker. The pappus consists of two or three awns.

It was formerly supposed that the drug of commerce was derived from *G. robusta*. The studies of Perredes (*Proc. A. Ph. A.*, 1906, 370) showed this not to be the case. *G. robusta* is apparently not a very common plant and is distinguished by having cordate-oblong, amplexicaul, coarsely serrate leaves. The involucre is squarrose and leafy at the base. The pappus consists of two awns. At one time both *G. cuneifolia* and *G. camporum* were considered merely as varieties of *G. robusta*.

According to Joseph Beauvais (*A. J. P.*, Feb., 1889), the resin of the leaf of *G. robusta* is contained in epidermal glands, and also in rather large resin-ducts situated in an interior collenchymatous layer.

Properties.—The official description of grin-delta is as follows: " Stems with attached branches terminated with resinous flower-buds; stems cylindrical, not exceeding 2 mm. in diameter; light yellow or rose-colored, with alternate leaf-scars, occasionally with basal portions of leaves, sometimes more or less irregularly flexuous and coated with resin, especially at the nodes; leaves usually separate and more or less broken and varying in shape when entire from oblong and lanceolate, to oblanceolate-spatulate and cuneate-spatulate, from 1 to 7 cm. in length, mostly sessile or amplexicaul and more or less sharply serrate or evenly spinosely-toothed, pale yellow to yellowish-green, very resinous, somewhat coriaceous and brittle; bracts of flowering branches almost entire and usually more or less spreading; heads more or less resinous, viscid, many-flowered, either conical-urceolate or depressed-urceolate, involucre from 5 to 20 mm. in breadth, composed of numerous imbricated bracts with more or less recurved tips; ray flowers yellow, ligulate and pistillate; disk florets yellow, tubular and perfect; pappus of two or three mostly unequal linear awns about the length of the disk florets; disk achenes more or less ovoid or oblong; more or less compressed or triquetrous, and either biauriculate or broadly unidentate or with a broad truncate corky, thickened summit; odor balsamic; taste aromatic and bitter, resinous. The powder is yellowish-brown; consisting of numerous fibrous fragments made up of tissues of the stem, the most prominent being the tracheae with annular and spiral thickenings or marked with simple or bordered pores, associated with numerous, narrow, strongly lignified wood-fibers; pith cells more or less tabular and containing a layer of protoplasm in which are embedded numerous spheroidal granules; fragments of epidermis of leaves very characteristic

and. showing more or less polygonal areas containing large chloroplastids, and the large, colorless, basal cells of the multicellular glandular hairs; -pollen grains spherical, about 0.035 mm. in diameter, spinose, and in section showing three pores." *U. S.*

"Stems slender, yellow, smooth. Leaves three to five centimetres long, oblong or spatulate, sessile or amplexicaul, pale green, rigid, brittle, smooth, glabrous; surface minutely dotted; margin coarsely serrate. Flower-heads yellow, hard, resinous, with several rows of lanceolate-acuminate, recurved bracts. Fruits biauriculate or unidentate at the summit, with a pappus consisting of two thick, stiff bristles. All parts more or less resinous. Slightly aromatic odor, taste aromatic and bitter." *Br.*

As it occurs in commerce, *Grindelia* is in the form of the whole dried herb; the stems are about eighteen inches in length, light brownish, very frequently stripped of their leaves, but with some of the floral heads adherent. The brittle leaves are much broken, and, with separate floral heads, are mixed with the stem. The taste is warm, peculiar, and very persistent. Tunmann (*Ph. Zentralh.*, 1908, p. 457) has made an excellent pharmacognostical study of *G. robusta*. Wohn (*Merck's Rep.*, 1910, p. 310) presents the results of a morphological study of *G. squarrosa*. Farwell (*D. C.*, 1907, p. 460) reports having received one of the California "tar weeds," *Hemizouella minima* Gray, for *Grindelia*. The plant is very diminutive in size, but the inflorescence is very glutinous. Perredes (*P. J.*, 1909, xxix, pp. 596 and 604) gives the results of some experiments in the cultivation of *G. camporum*. The activity of the drug probably resides in the resinous exudation. C. J. Rademaker obtained from it an oil, the odor of which closely resembled that of oil of turpentine, resin, and a crystalline body having an alkaline reaction. (N. R., 1876, p. 205.) W. H. dark and John L. Fischer (*A. J. P.*, 1888, p. 433) failed to verify all of Rademaker's results, but obtained an alkaline principle to which the name of *Grindeline* was given. A. Schneegans (*A. J. P.*, 1892, 369) found in *Grindelia robusta*, *saponin*, which, he states, is composed of two glucosides; he also found indications of an alkaloid, but believes that its presence is not yet certainly proved. See also *M. R.*, 1898, 394. *Grindelia robusta* is said to contain 0.28 per cent. of a dark-brown essential oil, having a specific gravity of 0.9582 at 15° C. (59° F.), and the optical rotation in alcoholic solution of -8° 08'. It is soluble in ether, amy alcohol, and chloroform. (*Ph. Ztg.*, 48, 574.)

Uses.—Grindelia is possessed of only feeble physiologic powers, but according to Buffington, when given to the lower animals in very large doses produces narcosis, with dilated pupils, slowing of the action of the heart from stimulation of the inhibitory nerves, and elevation of the blood pressure from stimulation of the vasomotor center. Dobroklowsky has found that it had a primary stimulating and later depressant effect on the isolated frog's heart. He further states that it acts chiefly upon the motor nerves and muscles, but Buffington asserts that it paralyzes first the sensory nerve-trunks, than the sensory side of the spinal cord, and afterwards involves the motor nerve-trunks and cord. Grindelia is used almost solely in the treatment of *bronchial catarrhs*, especially when there is a tendency to *asthma*. Its action is probably simply that of a stimulating expectorant, but some believe it exerts also an antispasmodic influence. It is frequently used in conjunction with stramonium leaves in the preparation of "Asthma powders" or cigarettes. It has been employed with asserted success in *whooping cough*. Its active principles appear to be excreted from the kidneys; hence, after large doses, there are sometimes evidences of renal irritation, and in *chronic catarrh of the bladder* good has been effected by its stimulant influence upon the mucous membrane of the viscus. As a local application, grindelia has been employed with asserted advantage in *burns, vaginitis, genito-urinary catarrh*, etc., applied either in the form of a poultice or in solution. It has considerable use also as a local application in the treatment of *rhus poisoning*. The fluidextract, diluted with water, is employed.

Dose, thirty to forty grains (2.0-2.6 Gm.).

Off. Prep.—Fluidextractum Grindeliae, *U. S. (Br.)*.

Guaco.—This name is given in Central and South America and the West Indies to various plants belonging to the genera *Willughboea* (better known under the newer name, *Mikania*) and *Aristolochia*; but it is in its application to the different species of the former genus that the drug is known in medicine. The species most used is *W. amara* (Willd.) O. Kze. (*Mikania amara* Willd.), and *M. Quaco*, genus *Eupatorium*, Humb. and Bonpl. Plants closely allied to the *M. Houstonis* (Willd.) O. Kze.—as *M. gonotada* (DC.) O. Kze. (of the Fam. Composites); *Aristolochia fragrantissima* Ruiz., *A. grandiflora* Sw., *A. pentanara* Jacq. (of the Fam. Aristolochiaceae); *Comocladia integrifolia* Jacq. (Fam. Anacardiaceae)—are also known locally as guaco. *M. amara* is described as having twining stems, with round, sulcate, and hairy branches; ovate subactt-minate, remotely dentate leaves, somewhat narrowed at the base, rough above and hairy beneath, and flowers in opposite axillary corymbs. The plant is a native of tropical America, and has been introduced into the West Indian Islands from

the continent. The leaves are the part used. The result of a long and close investigation into the natural history of guaco by Guibourt is, that the guaco from this source, instead of possessing, as has been asserted, a strong, penetrating, and nauseous odor, is in fact inodorous, and destitute of all active properties, and that the strongly aromatic plants which have been employed under the name of guaco all belong to the genus *Aristolochia*, especially *A. cymbifera* Mart. and Zucc., growing in Brazil, after this *A. maxima* (DC.), and in less degree *A. maxima* Jacq. (*A. geminiflora* H.B.K.). (*J. P. C.*, 1867, 99.)

Although the guacos of South America seem to be entirely distinct drugs they appear to be indiscriminately used by the natives for the cure of the *bites of poisonous serpents*. The medicine is also used in South America as a febrifuge and anthelmintic, and has been considered antisyphilitic. A few years ago it attracted on the continent of Europe considerable attention on account of its alleged power in *epidemic cholera* and *chronic diarrhea*. The *Aristolochia cymbifera* Mart. and Zucc. has been the subject of a careful study by L. Butte. (*Annales de la Polyclin, de Paris*, Sept., 1890.) The root of this plant as it occurs in commerce is cylindrical, from three to four centimeters in diameter, much broken up into long rootlets, yellowish, with a strong odor, especially in the bark. The plant itself is a vine, growing in great abundance in the province of Tabasco in Mexico. Butte was not able to find in it either an alkaloid or a glucoside, but he found a blackish resin which may be the active principle of the plant, though this does not seem probable, since Butte found the alcohol extract much less active than the aqueous extract, which would hardly be the case if the resin were really the active principle. In the physiological experiments made with the aqueous extract it was found that massive doses produced cries and excitement, followed after a time by sleep, with muscular relaxation and symptoms of gastro-intestinal irritation. There was also depression of the nerve center, both sensory and motor. If the dose were sufficient death was produced by an arrest of the respiration. The heart continued to beat after the cessation of respiration; nevertheless there was depression of the arterial pressure, apparently due to the action of the drug upon the heart. After death marked signs of irritation of the gastro-intestinal tract and kidneys were found. Butte believes that guaco has valuable therapeutic properties in the treatment of skin affections, especially *eczema* and *pruriginousmaladies*, in which he used it both locally and internally. He gives the *dose* of the aqueous extract of guaco as three grains (0.2 Gm.) three times a day. In the external application the following formula was used. Guaco (bruised), 30 parts; sodium bicarbonate, 5 parts; water, 1000 parts; boil for a quarter of an hour, allow to macerate one hour, decant, and use the liquid as a lotion. Guaco is said to be largely used in South America as an antirheumatic and E. W. Pritchard (*P. J.*, 1861) affirms that in the *gouty paroxysms* it is especially effective given in the *dose* of a fluidrachm (3.75 mils) of the tincture every four hours, and applied locally.

GUAIACI LIGNUM. Br.

GUAIACUM WOOD

"Guaiacum Wood is the heart-wood of *Guaiacum officinale*, Linn., or of

Guaiacum sanctum, Linn." Br. " The heart-wood of *Guaiacum officinale* Linne or of *Guaiacum sanctum* Linne (Fam. *Zygophyllaceae*)" N. F.

Lignum Sanctum (vel Benedictum); Lignum Vita; Gayac, *Fr. Cod.*; Bois de Gayac, *Fr.*; Lignum Guajaci, *P. G.*; Gua-jakholz, Franzosenholz, Pockholz, *G.*; Guajaco, Legno guajaco, *It.*; Guayaco (Lefio de), *Sp.*

Guaiacum officinale is a large tree, of a very slow growth. When of full size it is from forty to sixty feet high, with a trunk four or five feet in circumference. The branches are knotted, and covered with an ash-colored striated bark. That of the stem is of a dark-gray color, variegated with greenish or purplish spots. The leaves are opposite, and abruptly pinnate, consisting of two, three, and sometimes four pairs of leaflets, which are obovate, veined, smooth, shining, dark green, from an inch to an inch and a half long, and almost sessile. The flowers are of a rich blue color, stand on long peduncles, and grow to the number of eight or ten at the axils of the upper leaves. The seeds are solitary, hard, and of an oblong shape.

G. sanctum L. is distinguished from *G. officinale* by its five-celled fruit and its oblong or obliquely obovate or sometimes rhomboid-ovate leaflets, six to eight to each leaf. It grows in Cuba, the Bahama Islands and Florida. Its wood is smaller than that of *G. officinale*, and is said by Fee to be paler and less dense.

The commercial supplies are shipped from the Bahama Islands and Florida to London, Hamburg and Havre.

G. officinale grows throughout tropical America, particularly in the Lesser and Greater Antilles, also in Brazil, Venezuela and Colombia. The commercial drug is exported from Port au Prince, Puerto Plata and St. Domingo, also Savanilla (Colombia) and Puerto Cabello (Venezuela). *G. arboreum* of De Candolle has been said to furnish some of the guaiacum wood of commerce.

As imported, guaiac wood is in the shape of logs or billets, covered with thick gray bark, which presents on its inner surface, and upon its edges, when broken, numerous shining crystalline particles. These were supposed by Guibourt to be benzoic acid, by others a resinous exudation from the vessels of the plant; but Otto Berg has determined that they are crystals of calcium sulphate. The billets are used by turners for the fabrication of various instruments and utensils, for which the wood is

well adapted by its extreme hardness and density. It is sometimes kept by pharmacists in the state of shavings or raspings, which they obtain from the turners. It is commonly called *lignum vitae*, a name which obviously originated from its durable properties.

Properties.—Guaiacum wood is hard and heavy. The color of the sapwood is yellow, that of the older and central layers greenish-brown, that of the shavings a mixture of the two. It is said that when the wood is brought into a state of minute division its color is rendered green by exposure to the air, and bluish-green by the action of nitric acid fumes, and the latter change may be considered as a test of its genuineness. (Duncan.) An easier test is a solution of corrosive sublimate, which, added to the shavings and slightly heated, causes a bluish-green color in the genuine wood. Guaiacum wood is almost without odor unless rubbed or heated, when it becomes odorous. When burned, it emits an agreeable odor. It is bitterish and slightly pungent, but requires to be chewed for some time before the taste is developed.

"Dark greenish-brown, dense, hard; heavier than water. In transverse section, abundant sclerenchymatous fibres, scattered, isolated vessels, and medullary rays one cell wide. Odor, on warming, somewhat aromatic; taste slightly acrid. An alcoholic tincture prepared from the Wood assumes a blue color on the addition of diluted *T. Sol. of ferric chloride.*" *Br.*

The N. F. IV describes it as follows: "Usually in the form of shavings, chips or raspings of a greenish-brown color, heavier than water, entirely free from adhering bark and containing only a few chips or shavings of a whitish color (*sap wood*). Almost odorless except when heated; taste bitter and acrid when chewed for some time. The powder, when examined under the microscope, exhibits numerous fragments of more or less lignified, thick-walled wood fibers, up to 0.028 mm. in width, some with simple, oblique pores; tracheae from 0.09 to 0.16 mm. in width, some filled with resin; numerous small masses of resin; wood parenchyma and medullary ray cells up to 0.02 mm. in width, with lignified, porous walls and usually containing resin; occasionally tangential views of the medullary rays show an elliptical group of from three to six cells; the resin masses and resinous tissue become bluish-green on the addition of iodine T.S. Place powdered Guaiac Wood in a solution of sodium chloride (1 in 3); the blackish-brown part only will sink and this does not exceed in amount the portion which floats. Shake

10 mils of alcohol with 0.5 Gm. of ground Guaiac Wood for a few seconds and filter the mixture; the filtrate yields a deep blue color with one drop of a solution of ferric chloride (1 in 10). Guaiac Wood yields to alcohol not less than 15 per cent. of extractive. Guaiac Wood yields not more than 3 per cent. of ash." *N. F.*

Guaiac wood contains, according to Trommsdorf, 26 per cent. of resin, and 0.8 of bitter pungent extractive, upon both of which, probably, though chiefly on the former, its medicinal virtues depend. (See *Guaiacum*.) Paetzold (*Schim Rep.*, 1902, 43) states that the bark of the guaiac tree yields 1 per cent. of a volatile oil, having an exquisite odor. The wood yields its virtues but slightly to water. One pound of the wood afforded to Geiger two ounces of extract.

Uses.—Guaiacum wood possesses no therapeutic powers which are not contained in its resin and the latter is always to be preferred.

Dose, thirty to sixty grains (2.0-3.9 Gm.).

Off. Prep.—Decoctum Sarsaparillae Compositum, *N. F.*

GUAIACUM. U. S. (Br.)

GUAIAC Quaiac. [Guaiaci Resina, Pharm. 1890, Guaiac Resin]

"The resin of the wood of *Guaiacum officinale* Linne, or of *Guaiacum sanctum* Linne (Fam. *Zygophyllaceae*)." *U. S.* "Guaiacum Resin is the resin obtained from the stem of *Guaiacum officinale*, Linn., or of *Guaiacum sanctum*, Linn." *Br.*

Guaiaci Resina, *Br.*, Guaiacum Resin; Resine de Gayac. *Fr. Cod.*; Resina Guajaci, *P. G.*; Guajak, Guajakharz, *G.*; Resina de guajaco, *It.*; Resina de guayaco, *Sp.*

For a description of *Guaiacum officinale*, see *Guaiaci Lignum*.

Guaiac resin was introduced into the London Pharmacopoeia in 1677. It exists in the tree as a physiological product filling up the tissues of the wood. It is obtained in several different modes. The most simple is by spontaneous exudation, or by incisions made into the trunk. Another method is by sawing the wood into billets about three feet long, boring them longitudinally with an auger, then placing one end of the billet on

the fire, and receiving in a calabash the melted guaiac, which flows out through the hole at the opposite extremity. But the plan probably most frequently pursued is to boil the wood, in the state of chips or sawdust, in a solution of common salt, and skim off the substance which arises to the surface. Guaiac is chiefly produced in the eastern portion of the Island of Haiti, being exported from Port au

Prince and Gonaives. (*Ap.-Ztg.*, xxv, p. 556.) It is estimated that in 1912 about 6000 pounds of guaiac resin were exported to the United States. It is usually in large irregular pieces of various sizes, in which small fragments of bark, sand, and other impurities are mixed with the genuine guaiac, so as to give to the mass a diversified appearance. Sometimes it is found in small roundish homogeneous portions, separate or agglutinated; sometimes in homogeneous masses, prepared by melting and straining the drug in its impure state. It is probable that the guaiac obtained from the billets in the manner above described is of uniform consistence.

Properties.—The masses are irregular or somewhat globular, of a glassy luster and resinous fracture. They are of a deep greenish-brown or dark-olive color on their external surface, and internally wherever the air can penetrate. The predominant hue of those parts not exposed to the air is reddish-brown or hyacinthine, diversified, however, with shades of various colors. The odor is feeble but fragrant, and is rendered stronger by heat. The taste, which is at first scarcely perceptible, becomes acrid after a short period, and a permanent sense of warmth and pungency is left in the mouth and fauces. Guaiac is brittle, and when broken presents a shining glass-like surface, conchoidal or splintery, with smaller fragments more or less translucent. It is readily pulverized, and the powder, at first of a light-gray color, becomes green on exposure to the light. Its sp. gr. varies from 1.2 to 1.23. It softens in the mouth, and melts with a moderate heat. Water dissolves a small proportion of guaiac, not exceeding nine parts in 100, forming an infusion of a greenish-brown color and sweetish taste, which upon evaporation yields a brown substance soluble in hot water and alcohol, but scarcely so in ether. Alcohol takes up the whole, with the exception of impurities. The official requirements are as follows : " In irregular fragments or in large, nearly homogeneous masses, occasionally in more or less rounded or ovoid tears, enclosing fragments of vegetable tissues; externally brown, becoming greenish-gray-brown on exposure, the fractured surface having a glassy luster, the thin pieces being

translucent and varying in color from reddish to yellowish-brown; odor balsamic; taste slightly acrid. Guaiac melts between 85° and 90° C. (185° and 194° F.). It is readily soluble in alcohol, ether, chloroform, creosote, and in solutions of the alkalis or in hydrated chloral T.S. It is sparingly soluble in carbon disulphide or benzene and not more than 15 per cent. is insoluble in alcohol; the alcoholic solution, on the addition of an excess of chlorine water or tincture of ferric chloride, becomes blue, changing quickly to green, the color being best seen when the solutions are diluted with an equal volume of water. Macerate the crushed or powdered Guaiac with 4 or 5 times its weight of purified petroleum benzin for three hours and then filter; the filtrate is colorless, and does not give a green color on the addition of an equal volume of cupric acetate T.S. (*rosin*). The powder is grayish, becoming green on exposure to the air. Guaiac yields not more than 4 per cent. of ash." *U. S.*

"In masses, or sometimes in large more or less rounded tears. Brittle; fracture vitreous; thin splinters transparent, from yellowish-green to reddish-brown. Powdered Resin greyish, but becoming green on exposure to light and air. Odor, on warming, somewhat aromatic; taste slightly acrid. A solution in alcohol (90 per cent.) is colored blue by diluted T. Sol. of ferric chloride. 1 gramme of the powdered Resin, shaken for five minutes with 5 millilitres of petroleum spirit, yields a colorless filtrate which does not become green when shaken with an equal volume of diluted solution of copper acetate (absence of colophony). Not more than 10 per cent. insoluble in alcohol (90 per cent.). Ash not more than 4 per cent." *Br.*

The tincture is of a deep-brown color, is decomposed by water, and affords blue, green, and brown precipitates with the mineral acids. It is colored blue by nitric acid, by chlorine, and by tincture of ferric chloride, and usually by spirit of nitrous ether, and is similarly changed when treated successively by diluted hydrocyanic acid and solution of copper sulphate. Either in substance or tincture, guaiac gives a blue color to gluten and substances containing it, to mucilage of gum arabic, to milk, and to various freshly cut roots, as to the potato, carrot, and horseradish. This is on account of the fact that oxidizing enzymes or oxidases are present in all of these substances and guaiac resin is one of the most delicate reagents for detecting this class of enzymes. It is soluble also in ether, alkaline solutions, and sulphuric acid. The solution in sulphuric acid is of a rich claret color, deposits, when diluted with water, a lilac precipitate, and, when heated, yields charcoal. Exposed to

air and light, guaiac absorbs oxygen and becomes green, and the change takes place rapidly in the sunshine. Schaer states that a good natural guaiac resin is preferable to a resin purified by alcoholic treatment as a reagent, but a solution of resin extracted by chloroform from the wood is the most sensitive of all. Tincture of guaiac has been used for the detection of blood stains, which it does by the blue color produced by it, when in contact with the red coloring matter of blood, in connection with some ozonized substance, especially hydrogen dioxide. R. M. Bertolet (*Am. J. M. S.*, Jan., 1874) has used it to distinguish between the blood of man and other mammals, in which the corpuscles are non-nucleated, from that of other classes, as birds, fishes, and reptiles, which have nucleated corpuscles.

Lucker (*Proc. A. Ph. A.*, 1894, 953), finds in guaiac three acids,—viz., *guaiacic*, $C_{20}H_{24}O_4$, occurring in crystals melting at 86 C. (186.8° F.); *guaiaconic*, $Q_{20}H_{24}O_5$, an amorphous body melting at from 81° to 83° C. (177.8°-181.40 F.); and *guaiacinic*, $C_{21}H_{22}O_7$. He considers all three of them to be probably condensation products from tiglic aldehyde with creosol and gua-iacol. Dobner has also determined that these three acids form a series of hydroxyl-containing acids which may be represented by the formulas: $C_{20}H_{23}O_3(OH)$, $C_{20}H_{22}O_3(OH)_2$ and $C_{21}H_{19}O_4(OH)_3$. (Tschirch, *Harze und Hambehalter*, 1900, p. 300.) Guaiac yellow, the coloring matter of guaiac resin, was first observed by Pelle-tier. It crystallizes in pale yellow quadratic octahedra having a bitter taste, but is not a gluco-side. Guaiac resin also yields interesting products on dry distillation. First, according to Hiasiwetz, is obtained *guaiacene*, C_5H_8O , at 118° C. (244.4° F.), next *guaiacol*, $C_6H_4 \left\{ \begin{array}{l} OCH_3 \\ OH \end{array} \right.$,

being the methyl ether of pyrocatechin, at 205° to 210° C. (401°-410° F.), and with it *kreosol*, $C_6H_3(CH_3)_2OH$, and finally *pyroguaiacin*, $C_{38}H_{44}O_6$ (according to Wiesner, $C_{18}H_{18}O_3$), in pearly scales, melting at 180° C. (356° F.). According to Lieben and Zeisel (*Ber. d. Chem. Ges.*, xiv, p. 932), guaiacene is the aldehyde of tiglic acid, $C_5H_8O_2$, and can be made synthetically from a mixture of acetaldehyde and propionaldehyde. When distilled with zinc dust there is obtained *creosol* (50 per cent. in the case of resin purified by alcohol) and 30 per cent. of a mixture of *toluene*, *meta*- and *paraxylene*, with a little *pseudocumene* and *guaion*, $C_{12}H_{12}$.

Saponin has been found by E. Paetzold in the bark, the wood, and the natural resin of guaiacum. (*Bull. des Sciences Pharm.*, iii, 407.) According to the experiments of W. Frieboes (*In. Dis.*, Rostock, 1903), this saponin (1 to 1000) forms a frothing solution which is persistent, is an excellent emulsifier, has the power to maintain in solution large proportions of sparingly soluble substances and is innocuous and non-irritant.

The mineral acids are incompatible with the solutions of guaiac.

Adulterations.—This drug is sometimes adulterated with the rosin of the pine. The fraud may be detected by the terebinthinate odor exhaled when the sophisticated guaiac is thrown upon burning coals, as well as by its partial solubility in hot oil of turpentine. This liquid dissolves rosin, but leaves pure guaiac untouched. Amber was said to be another adulterant at one time. Nitric acid affords an excellent test of guaiac. If paper moistened with the tincture be exposed to the fumes of this acid, it speedily becomes blue. Purgotti proposed guaiac resin as a test for copper. (See *A. J. P.*, June, 1880.)

Uses.—Guaiac, like many other resinous substances, is stimulant and alterative. If given to a patient when covered warm in bed, and accompanied with hot drinks, may assist in exciting perspiration, and hence it has been ranked among the diaphoretics. In large doses it purges, and it has been especially commended as a laxative in chronic rheumatism, and it is thought by some practitioners to be possessed of emmenagogue powers. It has been given in chronic rheumatism, gouty affections, secondary syphilis, scrofulous diseases, and cutaneous eruptions, but is of doubtful service. The medicine is given in substance or tincture. The dose of the powder is from ten to thirty grains (0.65-2.0 Gm.), which may be exhibited in pill or bolus, in the shape of an emulsion formed with gum arable, sugar, and water, or as a syrup. An objection to the form of powder is that it quickly aggregates. Guaiac is sometimes administered in combination with alkalies, with which it readily unites. The ammoniated tincture of guaiac is a preparation of this kind. Several European Pharmacopoeias direct a *soap of guaiac*, under the name of *sapo guaiacinus*, to be prepared by diluting solution of potassium hydroxide with twice its weight of water, boiling lightly, then adding guaiac gradually, with continued agitation, so long as it continues to be dissolved, and finally filtering, which was followed by

evaporating to the pilular consistence.

T. C. Craig (A. J. P., July, 1880) recommends a *Syrup of Guaiac* made as follows: Powd. Guaiac Resin, 640 grains; Caustic Potassa, 58 grains; White Sugar, 1 lb. (av.); Water, q. s. Dissolve the Potassa in 8 fluidounces of water; moisten the Guaiac with this solution; pack it in a percolator, and gradually pour on the remainder of the solution; when this ceases dropping, add sufficient water to make the percolate measure 8 fluidounces; add the sugar, and dissolve.

Dose, from ten to thirty grains (0.65-2.0 Gm.).

Off. Prep.—Mistura Guaiaci, *Br.*; Pilula Hydrargyri Subchloridi Composita, *Br.*; Tinctura Guaiaci, *U. S.*; Tinctura Guaiaci Ammoniata, *U. S.*, *Br.*; Trochiscus Guaiaci Resinse, *Br.*; Gargarisma Guaiaci Compositum, *N. F.*; Glyceritum Guaiaci, *N. F.*; Mistura Guaiaci (from Tincture), *N. F.*; Pilulas Antimonii Compositae, *N. F.*; Tinctura Guaiaci Composita, *N. F.*

GUARANA. U. S.

GUARANA

"A dried paste consisting chiefly of the crushed seeds of *Paullinia Cupana* Kunth (Fam. *Sapindaceae*), yielding not less than 4 per cent. of caffeine." U. S.

Paullinia, Brazilian Cocoa, Guarana Bread; Guarana, *Fr. Cod.*; Pasta Guarante; Guarana, *G., It.*; Paulinia, Guarana, *Sp.*

There are described of the genus *Paullinia* 121 species, all of them confined in their geographical range to tropical and subtropical South America, except one, which has strayed to Eastern and Western Africa, and two others which are found in Mexico and in the gardens of the Sandwich Islands. The name of the genus was given in honor of Christ. Fred. Paullini, a German medico-botanical writer, who died in 1712.

The *Paullinia Cupana* Kunth is a climbing shrub with alternate compound impari-pinnate leaves, which is native to the Northwestern provinces of Brazil. The flowers are of yellowish color, growing in spicate panicles. The leaves are long petioled, the leaflets being 5 to 6 inches

long by 2 or 3 inches wide, and sinuate dentate on the margins. The fruit is ovoid or pyriform and about the size of a grape, and contains 1 to 3 seeds which resemble small horse chestnuts.

It is probable that in the preparation of guarana the seeds of the allied species *P. sorbilis* Martins, are used interchangeably with those of the official species.

The seeds, which look like small horse-chestnuts, are lenticular and almost thorny, and invested with a flesh-colored arillus, which is easily separable when dry. *Guarana* is made exclusively by the Guaranis, a tribe of South America Indians, and probably varies in the details of its preparation, as it certainly does in appearance and quality. The drug appears to be produced almost exclusively from plants cultivated in the region of the lower Madeira and southward. After the seeds are shelled and thoroughly washed they are roasted for about six hours, and their external papery shells are then removed by placing them in sacks and beating them with clubs; or, after the seeds have been broken in a mortar, the coarse powder is mixed with a little water, and then kneaded into a paste, which is shaped into cylindrical or globular masses. The latter are dried, sometimes in the sun, or more usually by the heat of a slow fire so arranged as to avoid smoke. When finished, the masses are of a reddish-brown color, rugose on the surface, very hard, with an irregular fracture, and of a marbled appearance when broken, due to the fragments of the seeds and their black testa embedded in the mass.

Guarana occurs in a number of molded forms, and an excellent collection of these can be found in the Philadelphia Commercial Museum. Stockman (*P. J.*, liii; *P. J.*, lxxxix, p. 685) describes and illustrates some of these interesting forms.

Properties.—It is officially described as follows: "Usually in cylindrical sticks, about 3 to 5 cm. in diameter, externally dark reddish-brown; hard and heavy; fracture uneven, often fissured in the center; internally pale reddish-brown, showing more or less coarse fragments of seeds and occasionally their blackish-brown integuments; odor slight; taste slightly astringent and bitter. The powder is light pinkish-brown ; consisting mostly of irregular masses of parenchyma containing more or less .altered starch grains; unaltered starch grains occasional, varying from spherical and polygonal to ellipsoidal and broadly ovoid, 0.01 to 0.025

mm. in diameter; occasional fragments with narrow, elongated sclerenchymatous cells; the walls being thick, yellowish and non-lignified. Place on a slide a drop of hydrochloric acid, add about 0.001 Gm. of powdered Guarana, then add a drop of gold chloride T.S. and allow the mixture to stand for a few minutes; beginning at the edge of the mount, crystals of caffeine and gold chloride separate in the form of orthorhombic plates and needles, the latter usually occurring in spheroidal aggregates and finally forming branching groups.

"Assay.—Introduce 6 Gm. of Guarana, in No. 60 powder, into a flask and add 120 mils of chloroform and 6 mils of ammonia water. Stopper the flask, shake it frequently for half an hour, then let it stand four hours. Again shake the flask vigorously and when the drug has settled, filter the liquid rapidly through a pledget of purified cotton and collect 100 mils of the filtrate, representing 5 Gm. of Guarana. Evaporate the clear filtrate to dryness and dissolve the residue in weak sulphuric acid with the aid of a gentle heat. When the liquid has cooled, filter it into a separator and wash the container and filter with several small portions of distilled water. Now add ammonia water until the liquid is distinctly alkaline to litmus and shake out the caffeine with chloroform until completely extracted, as shown by testing with iodine T.S. in place of the usual mercuric potassium iodide T.S. Evaporate the united chloroform solutions and dry the residue to constant weight at 80° C. (17610 P.). The weight is the amount of caffeine from 5 Gm. of Guarana (see Proximate Assays, Part III)." *U. S.*

Guarana is of a somewhat astringent and bitterish taste, and in this, as well as in its odor, bears some resemblance to chocolate, though not oleaginous. It swells up and softens in water, which partially dissolves it. It is also partly soluble in alcohol. Martius found in it a orys-tallizable principle, which he named guaranine, but which was later proved by Berthemot and Dechastelus to be identical with caffeine. Alexander Bennett, in an elaborate series of physiological experiments, 'confirmed this identity Caffeine may be obtained by microsublimation and Rosenthaler (*B. P. G.*, xxi, p. 532) describes the crystals obtained from guarana by means of pyroanalysis. According to Berthemot and Dechastelus, the caffeine exists in the seeds united with tannic acid, with which it appears to form two compounds, one crystallizable and soluble in water, the other of a resinoid appearance and insoluble. Besides these ingredients the seeds contain free tannic acid, gum, albumen, starch, and a greenish fixed oil. (*J. P. C.*, xxvi, 514.)

M. I. Wilbert (*J. A. Ph. A.*, 1914, 1286) reported a compilation of analyses of guarana comprising 41 samples in which the caffeine content varied from 3.72 to 5.16 per cent.

Rochefontaine and Gusset prepared caffeine by mixing one part of calcined magnesia with five parts of powdered guarana, moistening with water, and, after standing twenty-four hours, exhausting the mass with boiling chloroform, evaporating the chloroform, treating the residue with boiling water, filtering, and evaporating over sulphuric acid. (*A. J. P.*, 1886, p. 248.) F. V. Greene (United States Navy) prefers a process for obtaining caffeine from guarana similar to one proposed by Wayne for its extraction from tea and coffee. See *U. S. D.*, 19th ed., p. 606.

F. V. Greene has shown that the tannic acid from guarana has different properties from that

found in other plants, and proposes to call it *paullinitannic acid*. (*A. J. P.*, 1877, 390.) Fournier has found in guarana, besides caffeine tannate, the following principles: gum, starch, an acrid green fixed oil, a concrete volatile oil, an aromatic liquid volatile oil soluble in water with a little alcohol, another liquid volatile oil scarcely soluble in water, a peculiar principle not precisely determined, and tannic acid. (*J. P. C.*, April, 1861, 291.) E. R. Squibb examined commercial guarana, and obtained 4.38 per cent. of alkaloid from good specimens. On account of the uncertainty of the composition of guarana, he recommended physicians to prescribe fluidextract of green coffee in its place. (See *Ephem.*, 1884, 612.)

Uses.—The effects of guarana upon the system are chiefly those of its alkaloid, although it contains enough tannin to have an appreciable influence. It is habitually employed by the Indian's, either mixed with articles of diet, as with cassava or chocolate, or in the form of drink, prepared by scraping it, and suspending the powder in sweetened water, precisely as other nations use teas, coffees, etc. It is also considered by the Indians useful in the prevention, and cure of bowel complaints. Gavrelle, who was at one time physician to Dom Pedro, in Brazil, and there became acquainted with the virtues of this medicine, called the attention of the profession to it some years since in France. It is now used in medicine almost exclusively to give relief during the

paroxysm of *migraine*, and in atonic *chronic diarrhea*, taken three or four times a day.

Dose, of the powder, twenty to sixty grains (1.3-3.9 Gm.); of the fluidextract, twenty to sixty minims (1.3-3.75 mils).

Off. Prep.—Fluidextractum Guaranae, U. S.; Elixir Guaranae (from Fluidextract), *N. F.*

Gum Cebil.—This gum is a product of the Brazilian leguminous tree *Piptadenia Cebil* Griseb. It occurs in reddish-yellow tears, or in dark-colored angular masses, and forms a reddish-yellow, odorless, viscous mucilage of acid reaction. It is said to contain 80.78 per cent. of arabin.

Gum, Cedar.—This, the product from *Cedrela Toona* Roxb. (*C. australis* F. Muell.), or Red Cedar of Queensland (Fam. *Meliaceae*), is a very pale yellow or brownish gum, occurring in tears about 2.5 cm. long, having an astringent taste, swelling and, finally, almost dissolving in water. It contains about 68 per cent. of arabin, and 6 per cent. of metarabin, but no resin. (*P. J.*, vol. xx, 1890.)

Gum, Grass-tree. Yellow Resin. Botany Bay Gum. Resina Acaroides. Yellow Acaroid Resin. Earth Shellac.—An Australian product, occurring as an exudation upon the stems of *Xanthorrhoea hastilis* R. Br. (Fam. *Liliaceae*.) It is of a resinous character, usually is found in the markets in the state of small fragments or coarse powder, resulting from the breaking up of the larger brittle masses in which it first occurs. It is of a deep reddish-yellow color in mass, but greenish-yellow in powder. It does not dissolve in the mouth when chewed, nor adhere to the teeth, but has a slightly astringent and aromatic flavor. It melts with heat, and at a higher temperature takes fire in the air, burning with a smoky flame, and emitting a fragrant odor not unlike that of balsam of Tolu. It yields picric acid largely under the action of nitric acid. The natives and early settlers employed it as a medicine in diarrhea. It is said to be used extensively, instead of shellac, as a resinous glaze for confectionery and also in cabinet work, but to be distinctly inferior. For much interesting information concerning it and other resinous products of the genus *Xanthorrhoea*, see paper by J. H. Maiden, *P. J.*, 1891, xxi. It is obtainable in inexhaustible quantities as the plants producing it are abundant throughout almost the whole of Australia. (*A. J. P.*, 1866, 465.) Three hundred tons of the resin of *X. hastilis* have been exported in one year, and at one time the price rose to £65 per ton for the best quality, but for ordinary quality it is from £7 to £10. (*A. J. P.*, 1885, 405.) (See article on *Xanthorrhoea Resins*.)

Gum Hogg. Hog-Gum. Kuteera Gum.—Under the name of *gum-hogg* a peculiar gum is much used in marbling paper. A full discussion of it may be found in the 14th edition of the U. S. D., but, as it appears to be only a variety of Bassora gum, and rarely found in commerce, we omit any further account of it.

Gum, Indian. Ghatti Gum.—Under the name of *Gummi Indicum* the Br. recognizes

the gummy exudation from the wood of *Anogeissus latifolia*. The forests of India produce large quantities of other gums, a number of which have found their way into commerce and are used to a considerable extent as substitutes for gum arable and gum. tragacanth. Indian gum occurs in yellowish-white tears having a vitreous fracture. It is entirely soluble in water, forming a thick mucilage.

Of the other "so-called" Indian gums, that yielded by *Prosopis spicigera* L. (Fam. *Leguminosae*) occurs in small, angular, yellowish fragments, or sometimes in large ovoid tears 5 cm. long, of an amber color, frosted externally with fissures. It forms with water a dark-colored tasteless mucilage and resembles in its behavior to reagents the *Mezquitegum*. The gum of *Feronia elephantum* Corr. (Fam. *Rutaceae*) is in small, irregular tears varying from reddish-brown to pale yellow and forms a thick, tasteless, colorless mucilage which resembles gum arable, but is precipitated by neutralized lead acetate and gelatinized by ferric chloride, although unaffected by borax. The most important of the Indian gums is that which is recognized in the Br. Pharmacopoeia, and which in its solubility and relation to reagents closely resembles gum arabic. This is the product of *Anogeissus Latifolia* above referred to. It has double the viscosity of gum arable and forms with water a colorless mucilage having a faint characteristic odor. It is well suited for pharmaceutical use, and is said to be specially valuable in the making of emulsions. It is insoluble in 90 per cent. alcohol. For further description of the properties of this gum see *Gummi Indicum*.

The Br. Pharmacopoeia allows of the substitution of Indian gum in official preparations in place of gum acacia, with the statement that one part of it should be substituted for two of the acacia. The *mucilage of Indian gum* (*Mucilago Gummi Indici*, Br., 1914) is made with two avoirdupois ounces of gum to six fluidounces of distilled water. See also *Gum Sterculia*.

Gum Kauri.—This is an amber-like substance, varying from a soft cream-white to an amber color, dug in large quantities from the soil of Australia and New Zealand. It is a resinous exudation from the Kauri Spruce, *Agathis australis* Salisb. (*Dammaris australis* Lamb.), of the Fam. *Coniferae*, but, as it first exudes and is found on the surface of the ground, it is not esteemed. According to Tschirch and Niederstadt, it contains kaurinic acid, $C_{10}H_{16}O_2$, 1.5 per cent.; α - and β -kaurolic acids, $C_{12}H_{20}O_2$, 48 to 50 per cent.; kaurinolic acid, $C_{17}H_{34}O_2$, and kauronolic acid, $C_{12}H_{24}O_2$, together, 20 to 22 per cent. All these resin acids are soluble in solution of sodium hydroxide. *Baume Caledonien* consists of a solution of *kauri gum* in an equal weight of 90 per cent. alcohol. It has been used with alleged great success in the treatment of *wounds* and *ulcers*, of *eczema* and other skin affections, and as a substitute for collodion and the soluble sodium silicate. When applied to a well cleansed and dried wound it leaves a slight deposit of resin as a varnish, which is not affected by friction or contact with water.

The commercial product known as *Manila copal*, according to Tschirch and Koch, is derived from *Agathis Dammara* Rich. (*Dammara orientalis* Lamb.), a conifer. It consists chiefly of free amorphous resin acids, namely, α - and β -*mancophalolic acid*, $C_{10}H_{18}O_2$ (about eighty per cent.), and contains besides about 12

per cent. of a resin, $C_{20}H_{32}O_2$, and about five per cent. of essential oil. The latter, when fresh, forms a liquid as clear as water, very mobile, having a pleasant odor, and the sp. gr. 0.840; it boils at from 165° to 170° C. (329°-338° F.), and mixes in all proportions with alcohol, ether, chloroform and fatty oils. See also the article on Copal.

Gum Mango.—This gum, which is obtained from the mango tree, *Mangifera indica* L. (Fam. *Anacardiaceae*), occurs in the Indian bazars in amber-colored or reddish-yellow lumps, almost transparent, with a brilliant conchoidal fracture, 39.4 per cent. of which is soluble in water. (See *J. P. C.*, xix, 584.)

Gum Mesquite. *Mesquite Gum. Gum Mezquite.*—This is the product of *Prosopis juliflora* C., and perhaps other species of the same genus. Mesquite is a small, thorny, acacia-like tree or shrub belonging to the Fam. *Leguminosae*, and growing in New Mexico, Texas, and other neighboring regions, where it covers vast extents of country. The fruit is a long, compressed pod, filled with a sweet pulp, which is said to contain 30 per cent. of grape sugar, and to be used by the Indians as a food. A gum exudes from the stem and branches, It occurs in irregular, roundish pieces, of various sizes and usually of a dark amber-brown color, though sometimes, especially when gathered from young trees, it is nearly colorless. Procter found it to resemble gum arable in its solubilities, but to differ essentially in not being precipitated by lead subacetate, and in its strong solution not being coagulated by borax. (*A. J. P.*, xxvii, 224.) Campbell Morfit found in it a very little bassorin (0.206 per cent.), which did not exist in the specimens examined by Procter. (*Am. J. Sci.*, March, 1855, 264.) See also *A. J. P.*, 1855, 542, for a brief description of the gum and its character.

The saccharine pods of *Prosopis odorata* Torr. and Frem. (*P. pubescens* Benth.) are largely employed as food by the Indians, and those of all the species form valuable fodder for cattle.

Gum Sassa. *Sassa Gum.*—This name has been applied by Guibourt to a gum, occasionally brought into commerce from the East. It is produced by a tree growing in Abyssinia, *Albizzia Fastigiata* Oliv. (Fam. *Leguminosae*). According to Guibourt's description, it is in mammillary masses, or in convoluted pieces resembling an ammonite, of a reddish color and somewhat shining surface, and more transparent than tragacanth. Its taste is like that of tragacanth, but slightly acrid. When introduced into water it becomes white, softens, and swells to four or five times its original bulk; but it preserves its shape, neither, like tragacanth, forming a mucilage, nor, like Bassora gum, separating into distinct flocculi. It is rendered blue by iodine.

Gum Sonora. *Sonora Gum.*—According to Krewson, the exudation from *Covillea tridentata* (DC.) Vaill. (*Larrea mexicana* Moric.) contains 17.27 per cent. of resin, and 11.71 per cent. of mucilage and allied substances. (For details, see *P. J.*, xvi, 128; also *A. J. P.*, May, 1898.) *Covillea tridentata* is also known in Southwestern United States and Mexico as "Creosote bush," because of the odor of the oleoresin which covers the herbage.

Gum Sterculia. *Sterculia Gum. Indian Gum Tragacanth.. Indian Gum.*—A number of trees belonging to the genus *Sterculia* in India, particularly *Sterculia avens* and *Cochlospermum gossypium*, Africa, and Australia yield gums in considerable quantity, most of which resemble in their appearance tragacanth, some of which have remarkable adhesive properties and in some of which the adhesive power is lacking but the swelling power when moistened with water is enormous. These gums have been much used of recent years, frequently under the unqualified name of tragacanth. They are employed frequently as a filler in the manufacture of ice cream and even desserts where vegetable gums are found to be of service in preventing the product from losing its form as it melts. The difference between the sterculia gums and true tragacanth can be readily proved by a distillation test with water and the determination of the acidity which is due to acetic acid. (See P. J., Nov., 1889; A. J. P., Jan., 1900; 1912, pp. 155 and 393; *Drug. Circ.*, 1909, p. 116.)

GUMMI INDICUM. Br.

INDIAN GUM [Ghatti Gum]

"Indian Gum is a gummy exudation from the stem of *Anogeissus latifolia*, Wall." Br.

The genus *Anogeissus* (Fam. *Combretaceae*) includes four or five different species of tropical trees. Of these *A. latifolia* is widely distributed in Farther India. The tree is large and handsome, and one of the most useful of tropical India. The leaves are broadly elliptical, obtuse at the base and summit. They contain large amounts of tannin and are used in Bombay for tanning. The flowers are axillary and the fruit is 2-winged, being arranged horizontally into dense heads. The gum from this tree is collected in April and is used extensively in calico printing, especially in Lucknow. It is less adhesive than *Acacia* and is usually used in connection with turmeric with which there is some specific combination.

"In vermiform or rounded tears of varying size, colorless or pale yellow; surface dull, fracture vitreous. Slight odor; taste insipid and mucilaginous. Entirely soluble in water, forming a viscous, adhesive mucilage. Insoluble in alcohol (90 per cent.). The aqueous solution is gelatinised by the addition of alcohol (90 per cent.), or solution of lead subacetate; but it is unaffected by the addition of T. Sol. of ferric chloride or of solution of lead acetate (distinction from Amrad and certain other gums). It is not colored blue or brown by a small quantity of N/10 solution of iodine (absence of starch or commercial dextrin). Ash not more than 4 per cent. In India and the Eastern Divisions of the

Empire, Indian Gum may be employed in making the official preparations for which Gum Acacia is directed to be used, one part of the former being taken for every two parts ordered of the latter (see 'Mucilago Gummi Indict')." *Br.*

Uses.—Indian gum is used for the same purposes in pharmacy as acacia. It must not be confounded with the so-called India Gum which is only slightly soluble in water.

Off. Prep.—Mucilago Gummi Indici, *Br.*

Gymnema. *Gymnema silvestre* (Willd.) R. *Br.*—This is a woody climber, belonging to the *Asclepiadaceae*, which grows in Australia, India and also in Africa. The root has for a long time been employed by the natives as a remedy in snake bite, and it is affirmed by T. Dyer (*Nature*, 1887) that directly after the eating of one or two leaves it is impossible to taste sugar, though other tastes are not obscured. Thus, pungency alone is detected in gingerbread, and a sweet orange tastes like a lime. The active principle, gymnemic acid, $C_{32}H_{55}O_{12}$, was discovered by Hooper, and has been used with considerable success as a remedy for *parageusia* and *hallucinations of taste*. The 1 per cent. aqueous solution is to be applied with a brush to the inside of the mouth, or a hot infusion (15 per cent.) of the crude drug may be used. (See *Th. M.*, vs..}

Gymnocladus. *Gymnocladus dioica* (L.) Koch. *Kentucky Coffee-tree. Kentucky Mahogany.* (Fam. *Leguminosae*.)—A tall tree with pinnate leaves growing in the woods from New York southward and west as far as Oklahoma. The fruit is an oblong flattened pod containing several seeds in a fleshy pulp. The seeds are flattish and about 1 cm. in diameter. According to Bartholow, the aqueous extract of the seeds is toxic. (*Am. Drug.*, April, 1886.) Samuel S. Mell (*A. J. P.*, 1887, 230) obtained from them by petroleum benzin about 10 per cent. of fixed oil which is yellowish, saponifiable, and of sp. gr. 0.919. Ether extracted a little wax, fat, and resin. A little tannin and a small quantity of glucoide were also obtained. This latter had a peculiar odor and an acid burning taste. James H. Martin (*A. J. P.*, 1892, 558) obtained a yellow, saponifiable oil from the bean and the bark and a glucoside from the pulp.

**The Dispensatory of the United States of America
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Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

HAEMATOXYLI LIGNUM. Br.

LOGWOOD

"Logwood is the heart-wood of *Haematoxylon campechianum*, Linn." *Br.*
"The heart-wood of *Haematoxylon campechianum* Linne (Fam. Leguminosae) that has not undergone fermentation." *N. F.*

Haematoxylon, *N. F.*; Lignum Campechianum, Lignum Coeruleum; Bois de Campeche ou Bois'Inde, *Fr. Cod.*; Bois de Sang, *Fr.*; Blauholz, Campecheholz, Blutbolz, Kampeschenholz, *G.*

Haematoxylon campechianum is a tree of middle size, usually not more than twenty-four feet high, though, under favorable circumstances, it sometimes rises forty or fifty feet. The trunk is often very crooked, and is covered with a dark rough bark. The branches are beset with sharp spines. The sap-wood is yellowish, but the interior layers are of a deep-red color. The leaves are alternate, abruptly pinnate, and composed of three or four pairs of sessile, nearly obcordate, obliquely nerved leaflets. The flowers, which are in axillary spikes or racemes near the ends of the branches, have a brownish-purple calyx and lemon-yellow petals. They exhale an agreeable odor, said to resemble that of the jonquil.

The tree is a native of Campeche, the shores of Honduras Bay, and other parts of tropical America, and has become naturalized in Jamaica. It is cultivated in tropical America and Asia. The wood, which is the part used in medicine, is a valuable article of commerce, and largely employed in dyeing. It comes to us in logs deprived of the sap-wood and having a blackish-brown color externally. It has been estimated that about 400,000,000 pounds of log-wood are annually consumed. In 1912 Haiti exported about 83,000,000 pounds of logwood to the United

States. (See *A. J. P.*, 1912, p. 86.) According to Louis Siebold, the ground or chipped logwood of commerce is unfit for use as a medicinal agent, because it has been prepared as a dyestuff by being exposed in large moist heaps until its hematoxylin has been converted by oxidation into hematein. As a coloring agent, for commercial purposes, this fermented logwood, according to Siebold, is much superior to the natural wood. An inferior variety of logwood which contains little or no hematoxylin, but a pure yellowish-gray dye is that known as *bastard logwood*. According to the researches of E. S. Earl this bastard logwood is produced by a variety of the species, which, when growing, cannot be distinguished from the ordinary form. (*B. D. A. J.*, i, 31.)

Properties.—Logwood is hard, compact, heavy, of a deep-red color, becoming purplish-black by exposure, internally brown-red, and marked with irregular, concentric circles, splitting irregularly, of a slight peculiar odor, and a sweet, somewhat astringent taste. Logwood is officially described as “Hard, heavy, dull orange to purplish-red externally and reddish-brown internally. In transverse section, alternating yellowish-brown and dark brown wavy tangential lines. In the form of chips or coarse powder, it is free from signs of fermentation, and from green metallic lustre. Slight, agreeable odor; taste sweetish, astringent. Readily imparts a reddish-violet color to *water* made slightly alkaline with *solution of sodium hydroxide*” *Br.*

The N. F. IV description is as follows: " Usually in small chips, reddish-brown, the freshly cut surface dark yellowish-red; a transverse section of the wood shows medullary rays which are up to four cells wide. Odor faint, agreeable; taste sweetish, astringent. Hematoxylin imparts a yellowish color to water containing a little acid, the color being changed to purple or violet-red by alkalies. The powder is reddish-brown and, when examined under the microscope, exhibits medullary ray cells in one to seven rows; wood fibers, long, with thickened walls; wood parenchyma with occasional crystals of calcium oxalate; tracheas from 0.09 to 0.17 mm. in width; walls of the cells colored brownish-red, the inner cells containing resin masses. Hematoxylin yields not more than 3.5 per cent. of ash." N. F.

Its solution affords precipitates with sulphuric, nitric, hydrochloric, and acetic acids, alum, copper sulphate, lead acetate, and ferrous sulphate, striking a bluish-black color with the last mentioned salt. Precipitates are also produced with it by lime water and gelatin. Chevreui found in

logwood a volatile oil, an oleaginous or resinous matter, a brown substance the solution of which is precipitated by gelatin (tannin), another brown substance soluble in alcohol but insoluble in water or ether, a nitrogenous substance resembling gluten, free acetic acid, various salts, and a peculiar principle called *haematoxylin* or *haematin* (which must not be confused with the haematin of the blood), on which the coloring properties of the wood depend. This is obtained by digesting the aqueous extract in alcohol, evaporating the tincture until it thickens, then adding a little water, and submitting the liquid to a new but gentle evaporation. Upon allowing it to rest, hematoxylin is deposited in crystals, which may be purified by washing with alcohol and drying. Thus procured, the crystals are shining, of a yellowish-rose color, bitterish, acrid, and slightly astringent to the taste, readily soluble in boiling water, forming an orange-red solution which becomes yellow on cooling, and soluble also in alcohol and ether. According to Erdmann, who obtained hematoxylin by the process of Chevreui, substituting ether for alcohol, its crystals, when quite pure, are colorless, without a tinge of redness; its taste is sweet, like that of licorice, without bitterness or astringency; and it is not of itself a coloring substance, but affords beautiful red, blue, and purple colors, by the joint action of an alkaline base and the oxygen of the air. He obtained from logwood 9 to 12 per cent. of crystallized hematoxylin, to which he gave the formula $C_{16}H_{14}O_6$. It crystallizes with 1 or with 3 molecules of water, and is readily soluble in hot water or alcohol, but sparingly in cold water or in ether. (*J. Pr. Chem.*, xxxvi, p. 205.) By the combined action of ammonia and oxygen dark violet crystalline scales of *hematein*, $C_{16}H_{12}O_6 + 3H_2O$, are produced. They show a fine green hue, which is also very commonly observable on the surface of the logwood chips of commerce. Hematein may again be transformed into hematoxylin by means of nascent hydrogen or of sulphurous acid. Commercial extract of logwood extracted from the wood by boiling water contains both hematoxylin and hematein. Hematoxylin, in alcoholic solution, is used as an indicator in the U. S. P. IX. (See Hematoxylin Test-solution, Part III.)

Uses.—Logwood is a mild astringent, devoid of irritating properties, and well adapted to the treatment of that relaxed condition of bowels which is apt to succeed *cholera infantum*. It is also occasionally used with advantage in ordinary *chronic diarrhea* and *chronic dysentery*. *Hematoxylin* was found by Com-bemale (*B. M. N.*, xxxiii, 1894) to be very feebly antiseptic, but capable in large doses of producing fatal

gastro-enteritis in the lower animals. It is used not only as a dye-stuff but also as a microscopical stain.

Dose, from ten to thirty grains (0.65-1.9 Gm.).

Off. Prep.—Decoctum Haematoxyli, *Br.*

HAMAMELIDIS CORTEX. Br.

HAMAMELIS BARK [Witchhazel Bark]

" Hamamelis Bark is the dried bark of *Hamamelis virginiana*, Linn." *Br.*

Hamamelidis Cortex, *U. S. VIII*, Witchhazel. Spotted Hazel, Snapping Hazel, Winterbloom; Ecorce de Hamamelis, *Fr. Cod.*: Hamamelis, Zauberhasel, *G.*: Hamamelis, *Sp.*

This bark was deleted from the *U. S. P. IX*, but retained by the British Pharm., 1914. The *U. S. P. VIII* definition was as follows: "The bark and twigs of *Hamamelis virginiana* Linne (Fam. *Hamamelidaceae*)."

Witchhazel is an indigenous shrub, from five to fifteen feet high, growing in almost all sections of the United States, usually on hills or in stony places, and often on the banks of streams. It is the only species of the genus found in Eastern North America, occurring from New Brunswick to Minnesota and southward to Florida and Texas. Schneider asserts that it has been introduced into California and that it is extensively cultivated in this locality. It is specifically characterized by its leaves being obovate or oval, wavy-toothed, and somewhat downy when young. The seeds are black and shining externally, white, oily, and farinaceous within, and edible like the hazelnut. It is remarkable for the late appearance of its yellow flowers, which expand in September or October, and continue until the weather becomes very cold in winter. The fruit, which is a nut-like capsule not unlike the hazelnut, ripens in the following summer, and is often mingled on the same plant with the new blossoms.

Properties.—The bark occurs "in curved or channelled pieces about one and a half millimetres thick, and from one-half to two decimetres long, sometimes covered with a silvery-grey or dark-grey scaly cork marked with transverse lenticels, but frequently freed from the cork, and then exhibiting a nearly smooth reddish-brown outer surface. Inner

surface pale reddish-pink, and finely striated longitudinally; fracture laminated and coarsely fibrous. In transverse section, a cortex containing prismatic crystals of calcium oxalate, a complete ring of sclerenchymatous cells, and numerous tangentially elongated groups of bast fibres. No marked odor; taste astringent." *Br.*

The twigs are "flexible and tough, of irregular length, not more than 6 Mm. in diameter, branching, or bearing nodes at intervals of 2 to 5 Cm.; externally varying from yellowish-brown to deep purplish-brown, lightly longitudinally wrinkled, and having scattered small circular whitish or pale lenticels; bark occupying about one-fifth of the radius; wood greenish-white, lightly radiate, and exhibiting one to three annual rings; pith centric, small." *U. S. VIII.*

Holm (*Merck's Rep.*, xxi, p. 5) has written an illustrated paper on the morphology of hamamelis.

Walter B. Cheney examined witchhazel bark, and found tannin, resin, extractive, but no indication of an alkaloid or other crystalline principle. (*A. J. P.*, 1886, p. 418.) It contains a trace of volatile oil, however. John Marshall, of the University of Pennsylvania, also found that hamamelis root contains tannic acid and a trace of volatile oil, but no other active substance. (*T. G.*; ii, 295.)

Uses.—The bark of the witchhazel is said to have first attracted attention on account of its use by the North American Indians as a sedative application to external inflammations. It was many years ago recommended by James Fountain and N. S. Davis (*N. Y. M. J.*, x, 208; *Trans. Amer. Med. Assoc.*, i, 350) in hemorrhage of the lungs and stomach. Professional attention was strongly directed to the remedy on account of the enormous sale of a much vaunted proprietary remedy said to be made by distilling the bark with very dilute alcohol (six per cent.), and used externally for sprains and bruises, and internally for most of the diseases to which flesh is heir. The pecuniary success of this remedy probably depended in very small part upon the virtues of the witchhazel, which seems to possess no active physiological properties. At least we have injected a very concentrated distillate in large quantities into frogs and into mammals without perceiving any more effects than would be produced by the injection of similar quantities of distilled water, and Guy, in Paris, has reached similar conclusions. This preparation has been so largely used that it has been widely replaced by

a similar preparation officially known as *Aqua Hamamelidis*, which see. The fluidextract of the drug is a mild astringent and has been especially recommended in *varicose veins* and *hemorrhoids*. The dose of the fluidextract given ordinarily is a teaspoonful (3.75 mls) four times a day. It may, however, be given in double the quantity with impunity and probably in such doses is an advantageous astringent.

Dose, of leaves or of bark, thirty grains (2 Gm.).

Off. Prep.—*Aqua Hamamelidis*, *U. S.*; *Tinctura Hamamelidis*, *Br.*

HAMAMELIDIS FOLIA. Br.

HAMAMELIS LEAVES [Hamamelis, U. S. 1890 Witchhazel Leaves]

"Hamamelis Leaves are the fresh or dried leaves of *Hamamelis virginiana*, Linn." *Br.* "The dried leaves of *Hamamelis virginiana* Linne (Fam. *Hamamelidaceae*), collected in autumn before the flowering of the plants, and without the presence of more than 10 per cent. of stems or other foreign matter." *N. F.*

Hamamelidis Folia, *N. F.*; Feuilles de Hamamelis, *Fr. Cod.*; Witchhazel, Witch Hazel Leaves.

These leaves were deleted from the *U. S. P. IX*, but were retained in the *British Pharm.*, 1914, and *National Formulary IV*.

The *National Formulary IV* added the following to the *U. S. P. VIII* definition: "Before the flowering of the plants and without the presence of more than 10 per cent. of stems or other foreign matter."

The *British Pharm.*, 1914, describes the leaves as follows: "Broadly oval in outline, from seven to fifteen centimeters long. Upper surface dark green or brownish-green, under surface paler; apex obtuse, margin sinuate; narrowed towards the base, oblique, slightly cordate, and shortly petiolate. Veins pinnate and prominent on the under surface, where they are furnished with stellate hairs. No marked odor; taste astringent and slightly bitter." *Br.*

The *N. F. IV* description is as follows: "Petioles from 1 to 1.5 cm. in

length; laminae when entire broadly elliptical or rhomboid-ovate, usually inequilateral, mostly from 8 to 12 cm. in length; summits usually acute, sometimes rounded or acuminate; bases slightly heart-shaped and oblique; margins sinuate or sinuate-dentate; upper surfaces pale or brownish-green, occasionally dark brown with a few stiff, straight hairs; lower surfaces lighter in color, somewhat hairy, midrib and veins prominent. Odor slight; taste astringent, slightly aromatic and bitter. Transverse sections show in addition to the epidermal layers, a palisade layer consisting of a single row of cells and a dorsal pneumatic tissue made up of three to six rows of strongly branching cells; large collateral, fibro-vascular bundles occur in the midrib and petiole, the tracheae narrow, mostly spiral and associated with numerous narrow, strongly lignified and porous wood fibers; around the phloem occurs a nearly continuous circle of bast fibers, possessing strongly lignified walls; calcium oxalate in mono-clinic prisms, from 0.01 to 0.035 mm. in diameter, either in the cells of the mesophyll or in crystal fibers associated with the bast fibers. Under the microscope, surface sections of Hamamelis Leaves show upon the lower surface narrow elliptical stomata, about 0.015 mm. in length and with two to four neighboring cells; from both surfaces, but especially from the under surface, arise stellate hairs composed of from four to twelve cells united at the base, the individual cells being from 0.02 to 0.075 mm. in length, either straight or more or less bent and with very thick walls and narrow lumina, the latter sometimes only apparent in the lower portion of the cells. Hamamelis Leaves yield not more than 6 per cent. of ash." *N. F.*

The microscopical characteristics of the ham-amelis leaves have been described by Hans Kramer in *B. P. G.*, xvii, p. 323.

See Hamamelidis Cortex.

Off. Prep.—Fluidextractum Hamamelidis Foliorum, *N. F. (Br.)*; Liquor Hamamelidis, *Br.*; Unguentum Hamamelidis (from Liquid Extract), *Br.*

Hedeoma. *Pennyroyal. American or Mock Pennyroyal. Squawmint. Mosquito Plant. Berbe de Pouliot Americaine, Fr. Amerikanischer Polei, G.*—The U. S. VIII recognized "The dried leaves and flowering tops of *Hedeoma pulegioides* (Linne) Pereoon (Fam. Labiatae)." *U. S. VIII.*

This plant is entirely distinct from *MenthaPulegium*, or European, pennyroyal. It is probable that various other species of the genus are used in the localities in which they grow. Thus, *H. piperita* Bentham is said to be used in Mexico as a substitute for

peppermint, and *H. thymoides* Gray, in Texas as an aromatic diaphoretic.

Hedeoma pulegioides (L.) Pers. (1807) [*Cunila pulegioides* L. (1762); *Melissa pulegioides* L. (1753)] is an indigenous annual plant, from nine to fifteen inches high, with a small, branching, fibrous, yellowish root, and a pubescent, quadrangular stem, which sends off numerous slender erect branches. The plant is common in the Eastern and Middle Western United States, preferring dry grounds. *Hedeoma* was officially described as "branchlets quadrangular, with numerous spreading hairs; leaves opposite, short-petioled, oblong, 15 to 35 Mm. long, thin, obtuse, obscurely serrate, glandular-hairy beneath; flowers in axillary fascicles, with a tubular-ovoid, bilabiate and 5-toothed calyx, and a pale blue, spotted, bilabiate corolla containing two sterile and two fertile, exerted stamens; odor strong, somewhat mint-like; taste aromatic and pungent." U. S. The activity of *hedeoma* depends upon a volatile oil. The oil of *hedeoma* (*Oleum Hedeomae*, U. S. VIII, *Oil of Pennyroyal*), is "A pale yellow, limpid liquid, having a characteristic, pungent, mint-like odor and taste. Specific gravity: 0.920 to 0.935 at 25° C. (77° F.). It should form a clear solution with 2 volumes or more of 70 per cent. alcohol. It is dextrogyrate, the angle of rotation varying from about +18° to +22° in a 100 Mm. tube, at a temperature of 25° C. (77° F)." U. S. VIII. Its chemical composition was investigated by E. Kremers (*A. J. P.*, 1887, p. 535) and F. W. Franz (*A. J. P.*, 1888, p. 161). Each of them found a body of the composition C₁₀H₁₈O, boiling at 217° to 218° C. (422.6°-424.4° F.) (constituting, according to Franz, about 33 per cent. of the oil). For this the name *hedeomol* was proposed. Franz also found a body of the composition

C₁₀H₁₇O, boiling at 220° to 225° C. (428°-437° F.), and constituting 12 per cent. of the oil; likewise a body of the composition C₆H₁₂O, boiling at 165° to 170° C. (329°-338° F.), and constituting about 0.7 per cent. of the oil. Both investigators found *formic* and *acetic acids*, and Kremers considers *isoheptoic acid* also to be present. Beckmann and Pleissner (*Ann. Ch. Ph.*, cclxii, p. 1) found in American as well as in Spanish and Algerian pennyroyal oil a ketone, C₁₀H₁₆O, to which they gave the name of *pulegone*. This compound forms with hydroxylamine an oxime, C₁₀H₁₆NOH.H₂O, crystallizing in beautiful needles melting at 157° C. (314.6° F.), and with hydrogen bromide a crystalline compound melting at 40.5° G. (104.9° F.). The two compounds of the formula C₁₀H₁₈O, discovered by Kremers (*Ph. Rund.*, ix, p. 130), are also ketones and yield corresponding oximes.

American pennyroyal is a gently stimulant aromatic, and may be given in flatulent *colic* and *sick stomach*, or to qualify the action of other medicines. Like most of the aromatic herbs, it possesses the property, when administered in warm infusion, of promoting perspiration, and of exciting the menstrual flow when the system is predisposed to the effort. A large draught of the warm tea is in popular practice often given at bedtime, in recent cases of *suppression* of the menses, the feet having been previously bathed in warm water. The drug may be given in *doses* of two drachms (7.7 Gm.). The oil in doses of two to ten minims (0.12-0.6 mil).

Hedera. *Hedera Helix* L. *Ivy*. (Fam. *Araliaceae*.)—This well-known evergreen creeper is a native of Europe. The fresh leaves have a balsamic odor, especially when rubbed, and a bitterish, harsh, unpleasant taste. They are used for dressing issues, and, in the form of decoction, have been recommended in *sanious ulcers* and *cutaneous eruptions*, particularly *tetter* and the *itch*. The *berries*, which have an acidulous, resinous, somewhat pungent taste, are said to be purgative and even emetic. Vandamme and Chevallier discovered in ivy seeds a peculiar very bitter alkaline principle, *hederine*. It is obtained by treating the seeds with calcium hydroxide, dissolving the precipitated alkaloid in boiling alcohol, and evaporating the alcoholic solution. (*A. J. P.*, xiii, 172.) Posselt has discovered two acids in the seeds, one of which has their taste in a high degree, and was named by him *hederic acid*, the other he did not obtain quite pure. (See *Chem. Gaz.*, 1849, 93.) The seeds were also found to contain a variety of tannic acid, turning ferric salts dark green, to which Posslet gave the name of *hedera-tannic acid*. (*Ann. Ch. Ph.*, lxi, p. 62.) Moore (*J. P. Ex. T.*, 1913, iv) has separated a saponoglycoside which he names *hederin*. This is not poisonous when taken by the mouth, but when injected intravenously causes death by respiratory paralysis. Davies and Hutchinson confirmed the existence of Posslet's hederic acid, and gave it the formula $C_{16}H_{26}O_4$. Kingzett believes that it is not an acid, but a glucoside. J. Vernet [*Ber. d. Chem. Ges.*, xiv, 685] obtained a glucoside, which separated from solution in boiling acetone, in silky needles, melting at $233^{\circ} 0$. ($451.4^{\circ} F.$), insoluble in water, chloroform, and ligroine, slightly soluble in cold acetone, benzene, and ether, more soluble in hot alcohol and hot alkalies. Its formula he gives as $C_{32}H_{54}O_{11}$, and states that it decomposes on heating with diluted sulphuric acid into a body, $C_{26}H_{44}O_6$, which fuses at from 278° - $280^{\circ} C$. (532.4° - $536^{\circ} F.$), and a non-fermentable sugar which reduces Fehling's solution. (*Y. B. P.*, 1877, 508.) Later, Van der Haar isolated two glucosides, *hederin*, $C_{42}H_{66}O_{11}$, and *hederagenin*, $C_{31}H_{50}O_4$. (*A. Pharm.*, 1912, 424.) From the trunks of old ivy plants, growing in the south of Europe and the north of Africa, a resinous substance exudes through incisions in the bark, which has been employed in medicine under the name of ivy gum. It is in pieces of various sizes, of a dark yellowish-brown color internally, of a vitreous fracture, pulverizable, yielding a lively orange-yellow powder, of a peculiar not disagreeable odor when heated or inflamed, and of a bitterish resinous taste. Its chief constituent is resin, though some pieces contain a considerable proportion of bassorin, and other large quantities of ligneous matter. It was formerly used as a stimulant and emmenagogue, but is now scarcely employed. Placed in the cavities of carious teeth, it is said to relieve *toothache*. The light and porous wood of the ivy is sometimes used for making *issue-peas*.

Hedychium. *Hedychium spicatum* Sm. (Fam. *Zingiberaceae*.)—The root of this plant, which is used in perfumery in India has been found by J. C. Thresh to contain *ethylmethyl paracoumarate*. (*P. J.*, Nov. 8, 1884.)

Helenium. *Helenium autumnale* L. *False Sunflower. Sneesewort. Sneezeweed*.—An indigenous perennial, bitter, somewhat acrid composite herb. The leaves and flowers snuffed up in the state of powder produce violent sneezing, and have been used as an errhine. F. J. Koch (*A. J. P.*, 1874, 221) found in the plant a bitter principle believed to be a glucoside, malic acid, traces of tannic acid, albumen, and volatile oil. Reeb found a crystalline bitter principle, *helenin*, with the formula $C_{20}H_{25}O_5$. This has been

physiologically studied by Lamson (*J. P. Ex. T.*, 1913, iv) who found that it is an intense irritant to the mucous membranes, capable of causing a fatal gastroenteritis, and that it acts as a paralyzant to the heart and voluntary muscles. This principle must not be confounded with "*helenin*" from *Inula*. *Helenium nudiflorum* Nutt. has similar properties; *H. tenuifolium* Nutt., a common roadside weed of Mississippi and Louisiana, is stated by Galloway to produce in animals muscular twitchings, passing into violent convulsions, terminating in death. In four negroes helenium caused spasms with delirium and loss of consciousness. (*A. J. P.*, 1872, 309; DC., 1907, 459.)

Helianthemum. *N. F. IV. Rock-rose. Frost-weed. Herbe de Heliantheme de Canada, Fr. Canadisches Sonnenroschen, Gr. Helianthemum canadense* (L.) Michx.—"The dried herb of *Helianthemum canadense* (Linne) Michaux (Fam. *Cistaceae*)." *N. F. Frostwort* grows in all parts of the Eastern United States, preferring dry sandy soils. It is official in the National Formulary IV. The dried herb is employed in medicine and is described as follows: "Stems mostly less than 5 cm. in length, branched above, terete, frequently reddish, canescent, the slender branches mostly erect; leaves very short-petioled, from 1 to 3 cm. in length, and from 4 to 8 mm. in width, oblong to oblanceolate, with entire, revolute margins, green and somewhat rough on the upper surface, canescent underneath; flowers of two kinds, rarely present at the same time, the early ones mostly solitary, pedicelled, with bright yellow corolla, from 2 to 3 cm. in breadth, hairy calyx, about thirty stamens and a single three-carpelled pistil, producing an ovoid capsule, about 7 mm. in length; later flowers apetalous, clustered in the leaf-axils, nearly sessile, having but four stamens and producing a capsule about 4 mm. in length. Odor slightly aromatic; taste astringent and bitter." *N. F.* William Crutcher (*A. J. P.*, 1888, 390) found in it volatile oil, wax, fatty oil, tannin, and apparently a glucoside crystallizing in white needles. Fred J. Kruell found in *H. corymbosum*, Michx., tannin in large proportion, resin, glucose, gum, extractive, chlorophyll, and inorganic salts. (*A. J. P.*, 1874, 358.) Frostwort has an astringent, slightly aromatic, and bitterish taste, and appears to possess tonic and astringent properties; it was formerly employed in *scrofulous diseases*. (See *U. S. D.*, 14th ed.) According to D. A. Tyler (*Pamphlet*, New Haven, 1846), *H. corymbosum* Michx. possesses similar properties, and may be indiscriminately employed with *H. canadense* in *scrofula*, *diarrhea*, and *secondary syphilis*, and locally as a gargle in *scarlatina*, and a wash in *prurigo*. Tyler, however, has known the strong decoction and the extract to produce vomiting. He considers two grains (0.13 Gm.) of the latter a full dose for an adult. The *Fluidextractum Helianthemis* is recognized by the *N. F. IV.* (see Part III). The menstruum is diluted alcohol.

Helianthus. *Helianthus annuus* L. *Common Sunflower. Helianthe, Grand Soleil, Fr. Sonnenblume, G.*—This very large composite is cultivated in this country, in Europe, and especially in China, chiefly for the sake of the fixed oil yielded by the seed. The oil has a sp. gr. of from 0.924 to 0.926, solidifies at -15° C. (5° F.), is colorless or yellowish, limpid, nearly tasteless and odorless, and dries slowly. It is said to make an excellent salad dressing, and to be one of the best burning oils known. The increase in cultivation is stated to be nearly a thousandfold, 275 pounds of oil being a fair yield per acre. For particulars as to cultivation, see *A. J. P.*, 1875, 460; also *N. R.*, 1876, 165. Ludwig and Kromayer (*A. Pharm.* (2), 99, 1 and 285) obtained a tannin which

they called *helianthitannic acid*, and gave it the formula $C_{14}H_9O_8$. On boiling with moderately diluted hydrochloric acid they obtained a fermentable sugar and a violet coloring matter. E. Diek (*In. Dis.*, Gottingen, 1878) found only small quantities of inulin, large amounts of levulin, and a dextro-rotatory sugar. Chardon has obtained a peculiar oleoresin from sunflowers grown in Algeria. (*P. J.*, 1873, 323.) Buschmann obtained from the flowers of Russian helianthus, *betaine* and *choline*, he believed that their presence accounts for the observed activity of the extract. *Tincture of Helianthus* has been used in Russia. (*A. Pharm.*, 1911, 1; *M. R.*, 1908.) The stalk, when treated as is flax, yields a long, fine fiber, which is said to be used in China for the adulteration of silk. The sunflower also enjoys the reputation of protecting against marsh miasmata. (See *N. Y. M. R.*, 1868, 353.) Kazatchkoff states (*B. G. T.*, Oct., 1889) that in the Caucasus the inhabitants employ the sunflower in *malarial fevers*. The leaves are spread upon a bed covered with a cloth, moistened with warm milk, and then the patient is wrapped up in the spread. Perspiration is produced, and the patient is kept in this condition for an hour or two. The same process is repeated every day until the access of the fever has ceased. A tincture of the flowers and the leaves of the sunflower has been recommended by Beldau in combination with balsamics in the treatment of *bronchiectasis*. The Pah Ute Indians are said to use very freely as food the seeds of two indigenous sunflowers, *H. petiolaris* Nutt. and *H. lenticularis*. (*Proc. A. Ph. A.*, xxvii, 178.)

Helleborus. *Helleborus niger* L. *Black Hellebore. Hellebore noir*, Fr. *Schwarze Niesswurzel, Weihnachtswurzel, Winterrose*, Gr. *Elleboro nero*, It. *Eleboro negro*, Sp. (Fam. *Ranunculaceae*).— *Hellebore* is a native of the mountainous regions of Southern and temperate Europe, and is sometimes cultivated on account of the early opening and beauty of its flowers, whose expansion in midwinter has given to the plant the name of *Christmas rose*. Black hellebore is sometimes called *melampodium*, in honor of Melampus, an ancient shepherd or physician, who is said to have cured the daughters of King Prsetus by giving them the milk of goats fed on hellebore. For a history of the use of hellebore by the ancients, see 15th edition, U. S. D.

The formerly official rhizome is knotted, blackish on the outside, white within, and sends off numerous long, simple, depending fibers which are brownish-yellow when fresh, but become dark brown upon drying. The roots of various other plants, not belonging to the same genus, are said to be frequently substituted for the black hellebore. They may usually be readily distinguished by comparing them with the genuine root. The rhizomes of various plants which are sometimes substituted for true hellebore have been examined by Tschirch and Neuber, who state their results as follows:

The rhizome of *H. niger* exhibits a small pith and comparatively large acutely wedge-shaped, radially-elongated wood-bundles. The odor of the rhizome and roots is slight but rather pleasant, especially in the fresh drug. The rhizome of *H. viridis* L. has a large pith and tangentially extended, bluntly wedge-shaped or almost square wood-bundles; older roots exhibit a wood with from five to seven-angular wedges. In both rhizome and root of *H. foetidus* L., the wood is more strongly developed and radiate in appearance; it contains abundance of wood-fibers and encloses little or no pith. The

rhizome of *Actaea spicata* L. is flattened and bears cushion-like protuberances, due to the remains of the aerial stems. The wood-bundles are thickened at either extremity and rounded by wood-fibers, so that in transverse section the wood-ring has a scalariform appearance. The root exhibits a regular three to five-rayed wood, the rays being broader toward the outside. (*S. W. P.*, xl, 410.)

The roots are the portion usually recommended. They are from 0.5 to 6 cm. long and 2 to 3 mm. thick, smooth, brittle, externally black or deep brown, internally white or yellowish-white, with little odor, and a bitterish, nauseous, acrid taste. In their recent state they are extremely acrid. This acidity is diminished by drying, and still further impaired by age. William Bastick discovered a crystalline principle, *helleborin*, $C_{36}H_{42}O_6$, of a bitter taste with a tingling effect on the tongue, not volatilizable, slightly soluble in water, more so in ether and alcohol, and more readily in these liquids hot than cold. (*P. J.*, xii, 274.) Marme and Husemann obtained from black and green hellebore a glucoside, *helleborein*, $C_{37}H_{56}O_{18}$, by precipitating a solution of an extract of the root with solution of lead subacetate, freeing from lead by hydrogen sulphide, and again precipitating with phospho-molybdic acid; by boiling with acid it separated into glucose and *helleboretin*, $C_{14}H_{20}O_3$, a compound of a fine violet color. The helleborein exists both in the root and leaves. It has a taste at once sweet and bitter, is soluble in water and weak alcohol, much less so in ether and absolute alcohol, and is crystallizable in yellowish rhomboidal prisms. It is precipitable by tannic acid and mercurous acetate. (*J. P. C.*, 4e ser., ii, 258.) Husemann and Marme (*Ann. Chem.*, cxxxv, 61) examined more thoroughly the helleborin of Bastick. They found that when boiled with diluted sulphuric acid, or, better, zinc chloride, it is converted into sugar and *helleboresin*, $C_{30}H_{38}O_4$. They obtain this glucoside by treating with hot water the green fatty matter which is dissolved out of the root by boiling alcohol. Though both helleborin and helleborein are poisonous, the products of their decomposition are said to be harmless. Neither of them is volatile.

Helleborein is strongly irritant to the mucous membranes, causing, when applied to the conjunctiva, redness, swelling, and increased secretion, with indirect enlargement of the pupil, and when applied to the nasal membrane, sneezing, though less than veratrine. Small doses produce little effect on the stomach; but, repeated and accumulated, they cause anorexia, nausea even to vomiting, pain, increased secretion, and inflammation both of the stomach and bowels. The experiments of Van der Haide (*A. E. P. P.*, 1885, xix), Trendelenburg (*A. E. P. P.*, 1909, lxi, p. 262) and others demonstrate that physiologically helleborein belongs to the digitalis group of drugs. In small doses it diminishes the rate of the pulse, increases the force and output of the heart, and causes a rise in the blood pressure. In toxic doses, the pulse becomes rapid, and small in volume, and the heart is finally arrested in systole. According to Cushny, the action of helleborein on cardiac inhibition is less than most of the other members of the digitalis group. The *helleborin* of Marme and Husemann is a more active poison, though less irritant to the mucous membrane. It acts on the tongue like aconite. Its influence appears to be directed especially to the nervous system. In the lower animals it causes quickened breathing, restlessness, tension and trembling of the muscles, uncertainty of movement; then retardation of the breathing and pulse, irritability of the peripheral nerves, dilatation of the pupil, loss of hearing,

and finally almost complete anesthesia, with cerebral and spinal congestion, even to apoplexy.

Hellebore was formerly used as a drastic purge in doses of from ten to twenty grains (0.65-1.3 Gm.). This employment has, however, justly passed out of vogue. It was highly esteemed by the ancients in *mania*, *melancholy*, *amenorrhœa*, *dropsy*, and *epilepsy*. *Bacher's pills*, celebrated for the cure of dropsy, consisted chiefly of black hellebore. The glucoside helleborein has been used internally as a cardiac tonic in *doses* of from one-sixth to one-third of a grain (0.010-0.021 Gm.) several times a day, but its irritant action on the stomach militates against its practical usefulness. Ischistowitsch (*Cb. M. W.*, 1887) has used an aqueous extract of hellebore with apparent benefit in *heart diseases*. Venturini and Gasparini (*B. G. T.*, June, 1888) state that helleborein is a local anesthetic, which, in affections of the eye, is preferable to cocaine, because of the great permanency of the anesthesia, and because neither the pupil nor the intra-ocular pressure is affected. They use from three to four drops of a solution, each drop of which represents one one-hundred and sixty-fourth of a grain (0.0004 Gm.). In overdoses hellebore produces inflammation of the gastric and intestinal mucous membrane, with violent vomiting, hypercatharsis, vertigo, cramp, and convulsions, which sometimes end in death. The fresh root applied to the skin produces inflammation and even vesication. The *dose* of the powdered root is from ten to twenty grains (0.65-1.3 Gm.) as a drastic purge, two or three grains (0.13-0.2 Gm.) as an alterative. *Dose*, of the decoction (two drachms to a pint), a fluidounce (30 mils) every four hours till it operates.

Helonias. *N. F. IV. False Unicorn. Chamaelirium luteum* (L.) A. Gray (*C. carolinianum* Willd., *Helonias dioica* Pursh.). *Starwort*.—"The dried rhizome and roots of *Chamaelirium luteum* (Linne) A. Gray. (Fam. *Liliaceæ*)." *N. F.* It is described by the *N. F.* as follows: "Rhizome upright, or oblique, nearly cylindrical, from 0.5 to 3 cm. in length and about 1 cm. in diameter; externally grayish-brown, annulate from scars of bud-scales; upper portion with leaf bases enclosing a small bud; oblique rhizomes with a few stem scars about 0.5 mm. in diameter; lower portion with numerous whitish or pale yellowish, nearly straight or slightly curved wiry roots, from 5 to 8 cm. in length; fracture hard and horny; internally grayish-yellow, cortex from 3 to 4 mm. in thickness, central cylinder with three or four circles of small, nearly circular fibro-vascular bundles. Odor distinctive; taste bitter, slightly astringent. Sections of the rhizome, when examined under the microscope, show parenchyma cells with numerous spherical or ellipsoidal starch grains, varying from 0.002 to 0.015 mm. in diameter; numerous raphides varying from 0.025 to 0.035 mm. in length; the fibro-vascular bundles vary from 0.2 to 0.3 mm. in diameter, the tracheae being at the periphery and the walls marked either with annular or reticulate thickenings or simple pores. In the root the cortex is always attached and there are usually six mestome strands. Helonias yields not more than 5 per cent. of ash." *N. F.* The rhizome and roots are used in medicine. They resemble those of Aletris but the rootlets of helonias are whitish or pale yellowish, nearly straight, grayish-yellow internally and of a bitter, slightly astringent taste. *Fluidextractum Helionatis* is official in the *N. F.* (see Part III).

Hemidesmus Root. Br. 1898. *Hemidesmi Radix*. Indian Sarsaparilla. Nunnari. Raoine de Hemidesmus, Fr. *Hemidesmus-Wurzel*, G.— " The dried root of *Hemidesmus indicus* R. Br." Br., 1898. *Hemidesmus indicus* (Fam. *Asclepiadaceae*) is a climbing plant, with twining, woody, slender stems, and opposite, petiolate leaves, which are entire, smooth, shining, and of a firm consistence. The leaves vary much in size and shape, some being linear and acute, others broad-lanceolate, and others again oval or ovate. The flowers are small, green on the outside, purple within, and disposed in axillary racemes. The fruit consists of two long, slender, spreading follicles. This plant is common over the whole peninsula of Hindostan. The official portion was the root, which has long been used in India as a substitute for sarsaparilla. It is 30 cm. or more long and from 3 to 6 mm. thick, rigid, tortuous, cylindrical, and little branched, consisting of a ligneous center, and a brownish, corky bark, marked with longitudinal furrows and transverse fissures. The odor is aromatic, recalling that of tonqua bean, the taste is aromatic and sweetish. On one side of the root the cork is frequently separated from and raised above the cortex, and is transversely fissured. The transverse section exhibits numerous laticiferous cells in the cortex. For details of microscopic structure, see *P. J.*, 1872, 62. Garden obtained from hemidesmus a peculiar, volatilizable acid principle, which he named *smilasperic acid*, under the erroneous impression that the root was derived from *Smilax aspera*. Pereira proposed to call it *hemidesmic acid*. Scott also obtained a stearopten by distillation with water, presumably the same material. It has not been further investigated.

Hemidesmus root is said to be tonic, diuretic, and alterative. It was introduced into Great Britain from India, and was employed for some time under the name of *Smilax aspera*. It is used for the same purposes as sarsaparilla, and in some instances it is said to have proved successful in syphilis when that medicine had failed, but it cannot be relied upon. The native practitioners in India are said to employ it in nephritic complaints, and in the sore mouth of children. It is used in the form of infusion or decoction, made in the proportion of two ounces of the root to a pint of water. A pint (500 mls) may be given in wineglassful doses in the course of the day. A syrup was official in the Br., 1898.

Heracleum. *Heracleum lanatum* Michx. *Masterwort*. *Cow-parsnip*.—This is one of our largest indigenous umbelliferous plants. The root, which is the part used, bears some resemblance to that of common parsley. It has a strong disagreeable odor and a very acrid taste. Both the leaves and root excite redness and inflammation when applied to the skin. Bigelow considers the plant poisonous. It appears to be somewhat stimulant and carminative, and has been used in *epilepsy*. (See 16th cd., U.S. D.)

Heretine.—An ether-soluble alkaloid obtained from *Heritiera javanica* (*Sterculiaceae*), is said to be effective in the treatment of *epilepsy*, *chorea* and *migraine*.

Hermodyctyls. *Hermodyctyli*.—Under this name are sold in European commerce the roots or bulbs of an uncertain plant, growing in the countries about the eastern extremity of the Mediterranean. By some botanists the plant is thought to be a *Colchicum*, and *C. variegatum* L., a native of the south of Europe and the Levant, is

particularly indicated by Fee, Geiger, and others, while by authors, no less eminent, the roots are confidently referred to *Iris tuberosa* L. They certainly bear a considerable resemblance to the corm of *Colchicum autumnale* L., being heart-shaped, channelled on one side, convex on the other, and from 12 to 25 mm. in length by nearly as much in breadth. As found in commerce, they are destitute of the outer coat, are of a dirty yellowish or brownish color externally, white and amylaceous within, inodorous and nearly tasteless, though sometimes slightly acrid. They are often worm-eaten. Their chief constituent is starch, and they contain no veratrine or colchicine. From this latter circumstance, and from their insipidity, it has been inferred that they are probably not derived from a species of *Colchicum*. They are in fact almost without action upon the system. It is doubted whether they are the *hermodactyli* of the ancients, which acted like colchicum and were useful in *gout* and *rheumatism*. Pereira describes a bitter variety of *hermodactyls*, which was brought from India by Royle. The bulbs are smaller and darker than the others, and have externally a striped or reticulated appearance.

Herniaria. *Herniaria glabra* L. (Fam. *Caryophyllaceae*).—This genus was formerly included in the family *Illecebraceae*, but this is now segregated with the *Caryophyllaceae*. Goblez has obtained from this plant a crystalline principle, *herniarine* (*J. P. C.*, 4e ser., xx, 270), which proved to be methyl-umbelliferone, C₁₀H₈O₃. Schneegans has also discovered an alkaloid, *paronychine*. (*A. J. P.*, 1890, 488.) This plant is recommended by Zeissi in *catarrh of the bladder*. Very active diuretic properties have been attributed to *herniaria* by Kuhn (*Med.Kirn.*, 1908) and others, who have found that it was successful in the treatment of dropsy, whether of cardiac or nephritic origin.

Heteromeles. *Heteromeles arbutifolia* (Poir.) Roem. (Now ascribed to *Photinia arbutifolia* Lindl. (Fam. *Rosaceae*), D. D. Lustig has found in this Californian plant (*toyon* of the Indians) tannic, gallic, and hydrocyanic acids. (*A. J. P.*, April, 1882.)

Heuchera. *Heuchera americana*, L. *Racine d'Heuchere d'Amerique*, Fr. *Amerikanische Sanikelwurzel*, Gr.—The *alum-root* or *American sanicle* is a perennial, herbaceous plant, belonging to the *Saxifragaceae*, which grows in shady, rocky situations from New England to Carolina and westward to eastern Kansas. The rhizome, which was formerly official, is horizontal, somewhat compressed, knotty, irregular, yellowish, and of a strongly styptic taste. Alum-root is powerfully astringent, and may be employed in similar cases with other medicines belonging to the same class. J. Peacock (*A. J. P.*, 1891, 174) found a percentage of tannin ranging from 9.33 to 19.66 reckoned on the dry drug, according to the season of the year when collected; also a percentage of starch, calculated the same way, ranging from 5.17 to 16.32. Frederick Steams (*Proc. A. Ph. A.*, 1858, 263) speaks of two other indigenous species, *H. villosa* Michx. (*H. caulescens* Purah.) and *H. pubescens* Pursh., as having similar properties; and F. W. Anderson reports (*Botan. Gaz.*, 1887, 65) that the roots of *H. hispida* Pursh., *H. cylindrical*, Douglas, and *H. parvifolia* Nuttall are much used by hunters of Montana and others as astringents, particularly in *diarrhea* caused by the drinking of alkali water.

Hibiscus. *Hibiscus Abelmoschus* L. (*Abelmoschus moschatus* Mouch.) (Fam. *Malvaceae*.) — An evergreen shrub, growing in Egypt, and in the East and West Indies, and yielding the seeds known under the names of *Semen Abelmoschi*, *grana moschata*, *Musk seed*, *Abelmosch*, *Semence on Graine d'Ambrette*, *Ambrettekorner*, *Bisornkomer*, and *Ambrakomer*. These are of about the same size as flaxseed, kidney-shaped, striated, of a grayish-brown color, of an odor like that of musk, and of a warm somewhat spicy taste. They were formerly considered stimulant and antispasmodic, but are now used only in perfumery. The Arabs flavor their coffee with them. They are said to be employed in the adulteration of musk. Another species, *Hibiscus esculentus* L., or *Abelmoschus esculentus* Moench., is cultivated under the name of *okra*, *bendee*, or *gombo* in various parts of the world, for the sake of its fruit, which abounds in mucilage (*gombine*), and is used for thickening soup. The leaves are sometimes employed for preparing emollient poultices. The roots, which are a foot or two long, are said also to abound in mucilage free from any unpleasant odor. Their powder is perfectly white, and superior to the marshmallow. The plant is largely cultivated near Constantinople, where it is much used as a demulcent. (*A. J. P.*, 1860, 224; *P. J.*, 1904, 892.) The bark is also used in making paper and cordage.

Hieracium. *Hieracium venosum* L. (Fam. *Compositae*.) *Rattlesnake Weed*. *Poor Robin's Plantain*. *Eperviere*, Fr. *Habichtskraut*, G.— The plant is common, growing in dry places and open woods from Maine to Georgia and westward. The leaves and roots are thought to possess medicinal virtues, and, being deemed astringent, have been used in *hemorrhagic diseases*. The juice is supposed by some to have the power of removing warts. Dose of infusion (two ounces to the pint), a wineglassful (60 mils).

Hoang-Nan.—This is the bark of *Strychnos malaccensis* Benth. (Fam. *Loganiaceae*), a climbing plant, which grows in Malacca and surrounding countries. Brucine and strychnine are stated to have been found in it, brucine being the more abundant of the two. It has been found to produce in animals general tetanic spasms similar to those caused by strychnine. It probably has the same range of medicinal application as has *nux vomica*, although special virtues have been claimed for it in the treatment of *chronic skin diseases*. Dose of powdered bark, three grains (0.2 Gm.).

Holigarna. *Holigarna longifolia* Roxb. Now *Senecarpus longifolia* Blume. (Fam. *Anacardiaceae*.)—According to David Hooper (*P. J.*, xxv, 1895), the black juice of this tree, which is used in India as the basis of a varnish, is actively vesicant, and contains a body closely allied to, if not identical with cardol.

Hordeum. *Barley Orge*, Fr. *Gerste*, G.—The grains of *Hordeum sativum* Jessen, and its cultivated varieties. The original country of the cultivated barley is unknown. The plant has been found growing wild in Sicily and in various parts of the interior of Asia.

Pillitz found (*Zeit. An. Chem.*, 1872) in the dry barley 14.3 per cent. of insoluble albuminoids, 2.1 per cent. of soluble albuminoids, 62.6 per cent. of starch, 1.9 per cent. of dextrin, 2.7 per cent. of sugar, 1.7 per cent. of extractive material, 3.1 per cent. of fat, 1.4 per cent. of soluble ash, 1.2 per cent. of insoluble ash, and 8.9 per cent. of lignin. The presence of sugar seems to have been shown by Kuhnemann (*Ber. d.*

Chem. Ges., 1875 and 1876), who found a crystallized dextrogyrate sugar which did not reduce alkaline copper solution, and an amorphous lasvograte mucilaginous substance called sinistrin. According to Kuhnemann, barley does not contain dextrin.

Clifford Richardson (*Bulletin No. 9, Department of Agriculture, 1886*) gives the following as the average composition of American barley: water, 6.47 per cent.; ash, 2.87; oil, 2.67; sugar, etc., 7.02; dextrin and soluble starch, 3.£"5; starch, 62.09; albuminoids soluble in 80 per cent. alcohol, 3.66; albuminoids insoluble in 80 per cent. alcohol, 7.86; fiber, 3.81; total, 100.00. He finds, moreover, that on an average the grain makes up 84.78 per cent. and the hull 15.22 per cent. of the barley.

Barley contains *hordein*, a proteid substance somewhat related to *gliadin* which is derived from the kernels of wheat and rye. Hordein is soluble in alcohol. The name was formerly given to a pulverulent mixture obtained from barley which was believed to be a definite substance.

Hulled barley is merely the grain deprived of its husk, which, according to Einhoff, amounts to 18.75 parts in the hundred.

Barley meal is formed by grinding the seed, previously deprived of their husk. It has a gray-ish-white color; the constituents are the same as described above for barley. It may be made into a coarse, heavy, hard bread, which in some countries is much used for food.

Pearl barley (*Hordeum decortiatum*, Br., 1885) is the seed deprived of all its investments and afterwards rounded and polished in a mill. It is in small round or oval grains, having the remains of the longitudinal furrow of the seeds. and of a pearly whiteness. It is wholly destitute of *hordein*, and abounds in starch, with some gluten, sugar, and gum. This is the proper form of barley for medicinal use.

Barley in the form of the decoction, popularly known as *barley water*, affords a mucilaginous drink much employed from the time of Hippocrates to the present. Pearl barley is the form usually preferred for the preparation of the decoction, made by pouring four pints of boiling water on two troyounces of pearl barley and boiling away to two pints, and straining. It is especially used in infant feeding, as it seems to prevent the formation of large milk curds.

Houttuynia. *Houttuynia californica* B. et H., now *Anemopsis californica* Hook. et Arn. *YerbaMansa*.—The root of this piperaceous Californian plant is employed by the natives in *chronic malaria*, and also in *diarrhea* and *dysentery*, and has been used with asserted good results in *gonorrhoea* and *rheumatism*. For elaborate histological study, see D. O., May, 1897. *Dose* of the fluidextract, from fifteen to sixty minims (0.9-3.75 mls). A decoction of this root was used by the Indians as a local application in cuts and ulcers as well as internally in *diarrhea* and *dysentery*. It has also been recommended as a local application in nasal and pharyngeal *catarrhs*. The investigations of Lloyd (*A. J. P.*, 1879) showed a characteristic volatile oil and a tannin together with gum and a fixed oil.

Huamanripa.—This is a Chilean drug, the plant growing on the slope of the Cordilleras at considerable heights. Lapater found it to be stimulating, emetic, sialagogue, and diaphoretic. (*West. Drug.*, 1886,410.)

HUMULUS. U. S.

HOPS Humul.

"The carefully dried strobiles of *Humulus Lupulus* Linne (Fam. *Moraceae*) bearing their glandular trichomes and without the presence or admixture of more than 2 per cent. of stems, leaves or other foreign-matter. Preserve it in tightly-closed containers, protected from light." *U. S.*

Lupulus, *Br. Pharm.* 1898; Hop; Strobili Humuli, s. Lupuli; Houblon, *Fr. Cod.*; Hopfen, *G.*; Luppolo, *It.*; Lupulo (Fruto de), Hombrecillo, *Sp.*

Hops, under the title "Lupulus" were deleted from the British Pharm. (1914).

The hop plant is a twining, rough perennial having angular, rough, flexible stems, which twine around neighboring objects in a spiral direction from left to right, and climb to a great height. The leaves are opposite, and stand upon long footstalks. The smaller are sometimes cordate; the larger have three or five lobes; all are serrate, of a deep green color on the upper surface, and, together with the petioles, extremely rough, with minute prickles. At the base of the footstalks are two to four smooth, ovate, reflexed stipules. The flowers are numerous, axillary, and furnished with bracts. The staminate flowers are a yellowish-white, and arranged in panicles; the pistillate, which grow on a separate plant, are pale green, and disposed in solitary, peduncled aments, composed of membranous scales, ovate, acute, and tubular at the base. Each scale bears, near its base, on its inner surface, two flowers, consisting of a roundish compressed ovary, and two styles, with long filiform stigmas. The aments are converted into ovate membranous cones or strobiles, the scales of which contain, each, at its base, two small achenes, surrounded by a yellow, granular powder or the so-called *Lupulin*. Only the pistillate plants are cultivated by the hop growers in Europe, and it is interesting to note that the unfertilized pistillate plants produce strobiles richer in aroma and more plenteous in lupulin. The

plants flower in August and the fruits are harvested during September. The hops grown in this country contain a great many achenes, showing that the staminate plants are also cultivated. The strobiles are collected when the scales change from a light golden to a somewhat deeper hue.

The hop plant is a native of North America and Europe. In parts of New England, New York, and Michigan it is extensively cultivated, and most of the hops consumed in the United States is supplied by those districts. England probably produces the largest quantity of hops, with Germany and Austria next in order. The part of the plant used is the fruit or strobiles. These, when fully ripe, are picked, dried by artificial heat, packed in bales, and sent into the market under the name of hops.

By separating the volatile oils and determining its acid and ester value, Rabak (*C. D.*, lxxxv, 376) is able to distinguish American grown from imported hops. He finds that the European hops always show a lower ester value in the volatile oil than do the American.

Hops consists of numerous thin, translucent, veined, leaf-like scales, which are of a pale greenish-yellow color, and contain near the base two small, round, black achenes. They are officially described as follows: "Strobile ovoid-cylindrical, about 3 cm. in length, consisting of a narrow, hairy, flexuous rachis and numerous, imbricated, yellowish-green to pale brown, obliquely-ovate, membranous scales, the base of each with numerous, yellowish-brown, glandular hairs, and frequently infolded on one side, enclosing a subglobular, light brown, very glandular achene; odor strong and characteristic, becoming disagreeable and valerian-like on aging; taste aromatic and bitter. Hops yield not more than 8 per cent. of ash." *U. S.*

Though brittle when quite dry, they are pulverized with great difficulty. Their odor is strong, peculiar and fragrant; their taste very bitter, aromatic, and slightly astringent. Their aroma, bitterness, and astringency are imparted to water by decoction, but the first mentioned property is dissipated by long boiling. The most active part of hops is a substance formed on the surface of the scales, and, in the dried fruit, existing in the state of very small granules. This substance was called *lupulin* by A. W. Ives of New York, by whom its properties were first investigated and made generally known, though it was previously noticed by Sir J. E. Smith of England, and Planche of France. The scales themselves, however.. are not destitute of virtues, and contain, as shown

by Payen and Chevallier, the same active principles as does lupulin, though in less proportion.

Hops are often subjected in Germany to the fumes of burning sulphur, because of the supposition that they keep better when thus treated. Besides, by being partially bleached by the process, old hops, which have suffered from time, having become darker, generally spotted, and weaker, assume a brighter appearance, as if fresher, and generally command a better price in the market. To detect the consequent presence of sulphurous acid, the brewers put a silver spoon in a mixture of hops and water, under the impression that it will produce a black stain upon the silver. But this test will answer only when applied within a fortnight after the use of the sulphur. A more delicate method is that of Heidenreich, who puts twenty or thirty strobiles of the hops in a flask with zinc and hydrochloric acid, and passes the hydrogen evolved through solution of lead acetate. If sulphurous acid be present, hydrogen sulphide will be produced, which will occasion a dark precipitate with the solution. But even this plan often fails when the hops have been kept more than three or four weeks. A modification of this test has been proposed by R. Wagner. For the solution of lead acetate used in Heidenreich's method there is to be substituted a solution of sodium nitroprusside, so weak as to have a very light brown color, to which have been added a few drops of solution of potassium hydroxide. If the gas evolved contain the minutest proportion of sulphur, a violet color will be produced when the first bubble passes into the solution; and this will, by a continuance of the process become a magnificent purple. The least trace of sulphurous acid may thus be found, but a few months after the sulphuring of hops none at all can be detected.

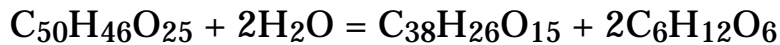
Hops are said to be sometimes threshed in order to separate the lupulin, which is sold separately. Their efficiency is thus, no doubt, greatly impaired. Hops thus treated have the scales more or less broken; and any parcel presenting this appearance is to be suspected. Hops often contain a variable quantity of lupulin in consequence of the granules of this substance separating, especially on agitation, and seeking the lower portion of the mass, which thus becomes richer, while the upper is poorer. They should always be examined in reference to the lupulin they contain, and, if nearly or quite destitute of it, should be deemed of inferior value and not be used medicinally.

LUPULIN, N. F. IV.—Lupulin is obtained by rubbing or threshing and sifting the strobiles, of which it constitutes from one-sixth to one-tenth by weight. It is in the state of a yellowish powder, mixed with minute particles of the scales, from which it cannot be entirely freed when procured by a mechanical process. It has the peculiar flavor of hops, and appeared to Lebaillif and Raspail, when examined by the microscope, to consist of glandular hairs filled with a yellow matter. They originate in a cell formed among those of the epidermis, and, when fully developed, secreting a resinous matter. (*J. P. C.*; 3e ser., xxvi.) It is inflammable, and when moderately heated becomes somewhat adhesive. The odor of lupulinic grains resides in the essential oil. This is obtained to the extent of 0.9 per cent. by distilling hops with water. When distilled from the fresh strobiles the oil has a greenish color, but a reddish brown when old hops have been employed. It is devoid of rotatory power, neutral to litmus paper, and gives no remarkable coloration with concentrated sulphuric acid. According to Chapman (*J. Chem. S.*, 1895, 54, 780) the essential oil consists of two terpenes, one C₁₀H₁₆, and the other C₁₀H₁₆, boiling between 160° and 171° C. (320° and 339.8° F.) and a sesquiterpene called *humulene*, boiling at 263° to 266° C. (505.4°-510.8° F.). This latter makes up almost two-thirds of the oil. There is also a small amount of an oxygenated constituent, probably C₁₀H₁₈O. The bitter principle formerly called *lupulin* or *lupulite* was first isolated by Lermer, who called it the *bitter acid of hops* (*Hopfenbittersaure*). It crystallizes in large brittle rhombic prisms, and possesses the peculiar bitter taste of beer. Its composition is C₃₂H₅₀O₇. Lupulin consists chiefly of wax (*myricyl palmitate*, according to Lermer) and resins, one of which is crystalline and unites with bases.

Besides the constituents of the glands, hops contain, according to Etti, *lupulo-tannic acid* and *phlobaphene*. The former is a whitish, amorphous mass, soluble in alcohol, hot water, or acetic ether, but not in ether. By heating the *humulo-tannic acid* to 130° C. (266° F.), or by boiling its aqueous or alcoholic solution, it gives off water and is transformed into phlobaphene, a dark-red amorphous substance,



The latter substance, on boiling it with diluted adneral acids, becomes hydrolized, and furnishes glucose and hop-red, according to the reaction:



From raw phlobaphene, ether removes the bitter principles of hops, a colorless crystallizable and a brown amorphous resin, besides chlorophyll and essential oil. (*Pharmacographia*, 2d ed.) The existence of a peculiar alkaloid in hops, suggested by Lermer in 1863, and confirmed by Griessmayer, has been denied. A. Chaston Chapman (*P. J.*, 1912, xcii, 878), found cultivated hops to contain from 1.7 to 4 per cent. of nitrogen which is a constituent of the following principles recognized by him in an investigation of the -subject: aspartic acid, 1-asparagine, choline, betaine, adenine, histidine, hypoxanthine, and ar-ginine, besides an unidentified base, no trace of a morphine-like alkaloid could be detected, although this has been stated by some authorities to be present. Etti found arable (pectic) acid, phosphates, nitrates, malates, citrates, and also sulphates, chiefly of potassium, to occur in hops. The amount of ash afforded by hops dried at 100° C. (212° F.) would appear to be on an average about 6 to 7 per cent. (U. S. P. IX not more than 8 per cent.) H. Bungener has isolated from hops a bitter crystalline substance, $\text{C}_{25}\text{H}_{35}\text{O}_4$, which is insoluble in water, but soluble in alcohol and alkaline solutions. He believes it to be identical with Lenner's hop-bitter acid, to be feebly acid, and to possess the character of an aldehyde. (*P. J.*, 1884.)

Uses.—Hops are an aromatic bitter and hence may be useful in atonic dyspepsia. By many they are believed to have a sedative effect on the nervous system and are used in *hysteria*, *restlessness*, *isomnia*, and the like. Whether this latter action is due to anything more than an effect through the imagination is open to question.

An *infusion* prepared with half an ounce of hops and a pint of boiling water may be given in the dose of four fluidounces (120 mils). The tincture was a British official preparation of hops, but the alcohol probably acts more decidedly upon the system than the hops. The fluidextract of hops of the N. F. IV is superior because of the relatively smaller amount of alcohol. A pillow of hops has proved useful in allaying restlessness and producing sleep in nervous disorders. They should be moistened with water containing a trace of glycerin previously to being placed under the head of the patient, in order to prevent rustling. Fomentations with hops, and cataplasms made by mixing them with some emollient substance, are often beneficial in local pains and

tumefactions.

The effects of hops may be obtained conveniently by the use of *lupulin*, which, although at one time much employed as an anaphrodisiac, has fallen into deserved desuetude.

Dose, thirty to ninety grains (2.0-5.8 Gm.).

Off. Prep.—Elixir Humuli (from Fluidextract), *N. F.*; Fluidextractum Humuli, *N. F.*; Tinctura Humuli, *N. F.*

Hura. *Hura crepitans* L. *Sandbox tree*. *Assacou*. *Sablier*, Fr. *Sandbuxsenbaum*, G.—This tree belonging to the family of *Euphorbiaceae* is indigenous to tropical America and is extensively cultivated in the tropics. It is characterized by the tendency of its fruit when ripe to break with violence into several pieces, and thus scatter the seeds. It is an acrid emeto-cathartic; in large doses acting as a violent poison. The fresh juice, the seeds, and a decoction of the bark all have these properties; an oil expressed from the seeds is actively purgative. According to Richet, the toxicity is due to the presence of a toxalbumin to which he gave the name of *crepitin*. (*P. J.*, 1910, lxxxiv, p. 571.) The juice of *Hura crepitans*, which, according to J. J. Surie (*Nederl. Tijdsch. voor Pharm.*, 1900, 107), contains a volatile, colorless liquid, *hurin*, closely allied to cardol and is stated by Martins to be used to intoxicate fish, it has been employed to a considerable extent with alleged favorable results in the treatment of the *elephantiasis*, or *leprosy*, of Brazil. (For a method of using it, see *J. P. C.*, xiv, 424.) The juice is extremely acrid, producing on the skin, when applied to it, an erysipelatous redness and a pustular eruption; the natives are said to employ it in the preparation of a poison.

Hydrangea, *N. F. IV. Seven Barks. Common Hydrangea*. (Fam. *Saxifragaceae*.)—It is described by the *N. F.* as "the dried rhizome and roots of *Hydrangea arborescens* Linne. (Fam. *Saxifragaceae*.) Rhizome cylindrical, usually cut into pieces from 3 to 10 cm. in length and from 3 to 20 mm. in diameter; externally light brown to yellowish-brown with a pinkish tinge, longitudinally wrinkled, marked by few elliptical lenticels and occasional prominent buds, short branches or stem scars; from the lower surface arise a few coarse fibrous roots; fracture tough, splintery; internally yellowish-white or light brown, bark thin, easily separable from the distinctly radiate wood which surrounds a prominent whitish pith. Roots attaining a length of 25 cm. and a thickness of 2 mm., irregularly bent and branching, otherwise resembling the rhizome with the exception of the pith being absent. Inodorous; taste sweetish, becoming slightly acrid. Under the microscope, sections of the rhizome of *Hydrangea* show a gray cork of a few rows of tabular cells, a cortex made up chiefly of parenchyma containing starch, large cells containing raphides and small isolated groups of stone cells or sclerenchymatous fibers; a woody cylinder composed of slender wedges made up of prominent tracheae with reticulate thickenings and tracheids separated by medullary rays one to three cells wide, the cells of which are filled with small starch grains; pith of large polygonal cells with prominent simple pores. The powder is light

yellowish-brown, containing irregular fragments consisting of strongly lignified tracheae, tracheids and medullary ray cells; stone cells and sclerenchymatous fibers from 0.05 to 0.2 mm. in length, strongly lignified, the walls marked by simple and branching pores; raphides numerous, from 0.07 to 0.13 mm. in length; starch grains mostly single, more or less ellipsoidal, occasionally with a prominent central cleft and varying from 0.002 to 0.01 mm. in diameter. Hydrangea yields not more than 3 per cent. of ash." *N. F.*

Bondurant (*A. J. P.*, 1887, 122) isolated a characteristic glucoside, hydrangin, crystallizing in stellate clusters, melting at 235° C. (455° F.), and subliming without decomposition. It is decomposed by dilute acids into a resin-like body and glucose. Its aqueous solution fluoresces strongly on addition of an alkali, resembling sesculin, but distinctly different in several particulars. Bondurant also obtained a fixed oil and a volatile oil, the latter containing sulphur. Two resins seemed also to be present, together with saponin and sugar. He found no tannin, however. Y. Asahina has isolated two crystalline substances from the alcoholic extract of the flowers of *H. Hortensia*; *hydragenol* and *hydrangeaic acid*. The first occurs in white, odorless and tasteless crystals which are soluble in alkalies and dissolve in sulphuric acid without color; hydrangeaic acid forms yellowish, shining crystals, and its alcoholic solution when treated with ferric chloride yields a violet color. Its decoction is said to have been used with great advantage among the Cherokee Indians, and subsequently by settlers, in *calculous diseases*. (See *N. J. Med. Rep.*, 1850, 1854, and 1885.) In overdoses it occasions vertigo, oppression of the chest. etc. Dose, thirty grains (1.9 Gm.).

HYDRASTIS. U. S. (Br.)

HYDRASTIS [Golden Seal]

"The dried rhizome and roots of *Hydrastis canadensis* Linne (Fam. *Ranunculaceae*), without the presence or admixture of more than 2 per cent. of the" stems, leaves or other foreign matter and yielding not less than 2.5 per cent. of the ether-soluble alkaloids of Hydrastis." U. S. "Hydrastis Rhizome is the dried rhizome and roots of *Hydrastis canadensis*, Linn." *Br.*

Hydrastis Rhizoma. Br.; Hydrastis Rhizome; Rhizoma Hydrastis; Golden Seal, Yellow Root, Yellow Puceon, Orange Root, Indian Dye, Indian Turmeric, Ohio Turmeric; Indian Paint, Ground Raspberry, Eye Root, Eye balm. Yellow Eye, Jaundice Root; Hydrastis, *Fr. Cod.*; Racine d'Hydrastis du Canada, Sceau d'or, *Fr.*; Canadische Gelbwurzel, Gelbes Blutkraut, *G.*; Idraste, *It.*; Hidrastis del Canada (Rhizoma de), *Sp.*

Hydrastis canadensis is a small, herbaceous, perennial plant, with a thick, fleshy, yellow (rhizome, from which numerous long roots arise,

and an erect, simple, pubescent stem, from six inches to a foot in height. There are usually but two leaves, which are unequal, one sessile at the top of the stem, the other attached to the stem, a short distance below by a thick roundish footstalk, causing the stem to appear as if bifurcate near the summit. The leaves are pubescent, roundish-cordate, with from three to seven, but generally five, lobes, which are pointed and unequally serrate. A solitary flower stands upon a peduncle rising from the basis of the upper leaf. It is without corolla, but with a greenish-white calyx, the sepals of which closely resemble petals, and are very caducous, falling very soon after the flower has expanded. The fruit is a globose, compound, red or crimson berry, half an inch or more in diameter, composed of many fleshy carpels, each tipped with a short curved beak, and containing one or rarely two seeds. The plant grows in moist, rich woodlands in most parts of the United States, and at one time abundantly in the North and West. The fruit bears a close resemblance to the raspberry, but is not edible. The root is the part used. The Indians employed it for staining and dyeing yellow under the name of *yellow puccoon*, and it is said to impart a rich and permanent yellow, and with indigo a fine green, to wool, silk, and cotton. There is but one other species of *Hydrastis* known—viz., *H. jezoensis* Sieb. et Zucc., which is found in Northern Japan.

Enormous quantities of hydrastis are consumed. It is estimated that between 200,000 and 300,000 pounds of the drug are annually used in medicine. As the natural supplies are becoming limited many experiments in the cultivation of hydrastis have been made. It can be grown from cuttings of the rhizome and from seed. It furthermore can be grown with the natural shade of the woodlands or by means of artificial shade. The important articles on the cultivation of hydrastis are the following: John Uri Lloyd, *Proc. A. Ph. A.*, 1905, p. 307, and in *A. Ph. A.*; vol. i, p. 5; Alice Henkel and G. Fred Klugh, *Circ. No. 6, Bureau of Plant Industry, U. S. Department of Agriculture*; J. C. Baldwin, *A. J. P.*, 1913, p. 147. Most of the commercial supplies are obtained from the Ohio Valley. The States producing hydrastis are West Virginia, Ohio, Kentucky and Indiana. The chief market being Cincinnati.

Properties.—The fresh rhizome is juicy, and loses much of its weight in drying. The drug is officially described as “rhizome horizontal or oblique, sub-cylindrical and usually more or less flexuous, from 1 to 5 cm. in length and from 2 to 7 mm. in diameter, occasionally with stem-bases;

externally yellowish or grayish-brown, marked by numerous stem-scars and more or less annulate from scars of bud-scales, otherwise deeply longitudinally wrinkled; on the under and lateral portions arise numerous, long, filiform roots which are easily detached; fracture short, waxy; internally of, a deep yellow color and consisting mostly of parenchyma enclosing an interrupted circle of small fibro-vascular bundles; odor distinctive; taste, bitter. Macerate the drug for a short time in water until it is softened, then make sections and mount them directly in sulphuric acid and examine under the microscope; in a short time numerous acicular or rod-shaped crystals separate, some attaining a length of 0.2 mm. The powder is brownish-yellow ; starch grains numerous, from 0.002 to 0.015 mm. in diameter, mostly single, nearly spherical, and either free or in the parenchyma cells; fragments with the tissues of the fibro-vascular bundles mostly associated with starch-bearing parenchyma; tracheae with simple and bordered pores and occasionally spiral thickenings, and associated with short sclerenchymatous fibers possessing thin walls with simple pores; occasional fragments of tabular cork cells with reddish-brown walls." U. S.

"Rhizome tortuous, simple or branched, from ten to forty millimetres long and from three to ten millimetres thick; yellowish-brown, becoming darker by age. On the upper surface, short ascending branches usually terminated by cup-shaped scars; on the lower surface and sides numerous thin, brittle roots. Fracture clean, resinous; fractured surface brownish-yellow or greenish-yellow. In transverse section, a ring of bright yellow, somewhat distant, wood-bundles. Slight but characteristic odor; taste bitter. Ash not more than 11 per cent." *Br.*

The color of the rhizome, though yellow in the recent root, becomes a dark yellowish-brown by age; that of the rootlets and the interior of the root is yellow, and that of the powder still more so.

Holm gives a valuable illustrated article on the morphology of the hydrastis plant in *Merck's Rep.*, xxii, p. 202. (See also *Chem. Zeit.*, 1894, p. 134.) Roseuthaler has extended his studies of microsublimates to that of hydrastis and finds that the pyroanalytical sublimate of hydrastis gives general alkaloidal reaction and a characteristic reaction with sulphuric acid. (*Apoth. Zeit.*, xxviii, p. 991.) Owing to the high price of hydrastis the quality of the commercial article has steadily deteriorated in recent years, and Lloyd asserts that every drug native to the soil

which resembles this rhizome, either in fiber or in color, has been known to be mixed with it. (*Pharm. Rev.*, xxiii, p. 330.)

"Assay.—Introduce 10 Gm. of Hydrastis, in No. 60 powder, into a 250 mil flask and add 100 mls of ether and proceed as directed under *Belladonnae Radix*, fourth line of the Assay, beginning with the word "Stopper." Modify the process there given by using 50 mls of the ether solution, representing 5 Gm. of Hydrastis, to complete the assay. Use ether instead of chloroform for the final shaking out of the alkaloids, and dry the residue to constant weight at 100° C. (212° F.) instead of titrating. The weight is the amount of ether-soluble alkaloids from 5 Gm. of Hydrastis." *U. S.*

The medicine imparts its virtues and coloring matters to water and alcohol. Examined by Alfred B. Durand of Philadelphia, it was found to contain albumen, starch, fatty matter, resin, yellow coloring matter, sugar, lignin, and various salts. He also discovered a peculiar nitrogenous, crystallizable substance, for which he proposed the name of *hydrastine*. (*A. J. P.*, 1851, p. 112.) It was also found that the root contained another alkaloid, to which it owes its yellow color. F. Mahla first ascertained that this alkaloid of hydrastis was *berberine*. (*Am. J. S.*, Jan., 1862, p. 43.) It exists in large proportion in hydrastis, constituting, according to Perrins, nearly 4 per cent. For a valuable paper by J. U. Lloyd on the preparation of salts of berberine, see *A. J. P.*, 1879, p. 11. Lerre's process based on Lloyd's for preparing hydrastine and berberine will be found in the *U. S. D.*, 19th ed., p. 643.

Wilhelm (*P. J.*, 1888, 325) furnishes a process for obtaining the alkaloids from hydrastis as follows. The extract obtained by treating the coarsely powdered root with water acidified with acetic acid at 37.8° C. (100° F.) is evaporated to a syrup and excess of diluted sulphuric acid added, when berberine sulphate separates. The nitrate neutralized with ammonia water gives a precipitate containing much hydrastine; this is separated, and on adding ammonia water in excess to the filtrate a further precipitate is produced, which contains canadine. Both precipitates, boiled with ethyl acetate, give solutions which, on cooling, deposit hydrastine in large crystals, somewhat colored, but rendered pure by recrystallization. The crystals from the second ammonia precipitate are much purer than those from the first; by slow evaporation of the ethyl acetate solution they can be obtained as large as walnuts.

A substance obtained by the precipitation of an infusion of the root by hydrochloric acid has been for some time known and used by the "Eclectics," under the name of *hydrastin*; it consists of a small proportion of hydrastine, with berberine and resin, and the reader must be cautious not to confound this substance with the alkaloid to which the name properly belongs. Perrins obtained 1.5 per cent. of the eclectic principle from the root, and, having given five grains of it to a rabbit without any other effect than a slight uneasiness which soon ceased concluded justly that it was not poisonous.

Canadine (C₂₀H₂₁NO₄) was extracted by E. Schmidt; it occurs in the form of brilliant, small, "white nodules, melting at 134° C. (273.2° F.). When canadine is dissolved in alcohol and treated with iodine, berberine hydriodide (which is yellow in color) is formed. Canadine was believed to be identical with dihydromethylberberine (*Ph. Post*, 1892, 230), and the formula C₂₁H₂₁NO₄ was given to it. E. Schmidt, however (*A. Pharm.*, 1894, 136-154), has found that its true formula is C₂₁H₂₁NO₄, and, owing to the fact that iodine forms with it berberine hydriodide, he believes that canadine is a *tetrahydroberberine*. Schmidt also obtained, as an additional product of the iodine reaction, the hydriodide of another base, which he believes is intermediate between berberine and canadine. For a process for isolating canadine, see *Proc. A. Ph. A.*, 1894, 1103. The alkaloid discovered by A. K. Hale, and obtained later by Burt and by Lerchen, and which was named *xanthopuccine*, is now considered to be identical with canadine. For processes for making hydrastine and berberine, see *D. C.*, 1897, 34. It is probable, from the odor of hydrastis, that besides the two alkaloids here mentioned it contains also an active volatile principle, but this has not yet been isolated.

LaWall (*Proc. Pa. Ph. A.*, 1912, p. 142) made separate assays of the rhizome and rootlets from a 98-pound lot of the drug. There was present 45.5 pounds of rhizome and 48 pounds of rootlets, the balance being dirt and waste. The rhizomes assayed 2.48 per cent. of hydrastine and the rootlets 1.38 per cent. The average of the entire lot was 1.92 per cent.

Uses.—Hydrastis owes its virtues almost entirely to hydrastine, the alkaloid berberine, aside from some effect as a bitter, being practically inert. It has enjoyed a widespread reputation as a local remedy in

various forms of catarrh, such as *rhinitis*, *gastritis*, *vaginitis*, and *urethritis*.

In chronic or subacute *inflammations* of the *colon* and *rectum* injections of hydrastis are often of great service, and it has been used in *hemorrhoids* with asserted excellent results.

The strength of the local application of hydrastis to be used in various diseases of the mucous membrane varies from five to twenty-five per cent. of the fluidextract. In gonorrhoea from forty to eighty minims (2.5-5.0 mls) of the fluidextract, may be used to the fluidounce (30 mls). In *hemorrhoids* from two to four drachms to the fluidounce may be used. The glycerite is not so useful a local preparation as the fluidextract diluted with water, a deposit of the insoluble resinous substance upon the mucous membrane and its constant prolonged influence being important.

It is essential to recognize the differences, medicinally, between the preparations of hydrastis. The so-called *hydrastin* of commerce is really an impure body, containing berberine, canadine, hydrastine, and probably some resin. The *dose* of this hydrastin is from five to ten grains (0.32-0.65 Gm.).

There is some reason for believing that berberine has a special action upon the gastro-intestinal tract. Marfori has, however, found that even in large therapeutic dose it is without perceptible influence upon the circulation or the nervous system. When, therefore, a preparation of hydrastis is to be used for effects other than a local action on the gastro-intestinal or other mucous membrane, a salt of the pure alkaloid hydrastine should be used.

According to the studies of Faick and Guenste, berberine causes in dogs and rabbits restlessness, convulsive tremblings, hurried respiration, and diarrhea, followed, if the dose has been large enough, by decrease of the breathing rate, widespread paralysis, dyspnea, convulsions, and death. In man as yet no serious symptoms have been recorded as produced by it. Buchner is stated to have taken nearly twenty grains without causing anything more serious than a loose stool. Marek (W. M. W., 1911, 2146) has presented evidence that it possesses valuable oxytocic properties, and is useful in *delayed labor*. It has been employed in internal medicine as a simple bitter, in doses of from two to five grains

(0.13-0.32 Gm.).

Hydroberberine (Canadine), whose molecule contains four atoms of hydrogen more than the molecule of berberine, is said by Marfori to differ from berberine physiologically; it produces in moderate dose an increase in the blood pressure by stimulating the vasomotor center in the medulla, *Opianic*, *hydrastinic*, and *berberinic* acids are said by the same authority to be almost inert physiologically, except that they are feebly antiseptic. (*T. G.*, 1890.)

Hydrocotyle. *Hydrocotyle asiatica* L. *Thick-leaved Pennywort. Indian Pennywort. Bevilacqua.* Fr. *Wassernabel*, G.—This is a small umbelliferous plant growing in Southern Africa and in India, where it has long been used as an alterative; it is apparently indigenous also in the Southern United States. Jules Lepine discovered in it a peculiar oleaginous substance, *vellarin*, having a strong odor recalling that of the plant, and a bitter, pungent, and persistent taste. (*J. P. C.*, 1885, 49.) It is said to be diuretic, and has been given in *fever* and *bowel complaints*; also in *syphilitic* and *scrofulous affections*. (*P. J.*, 1860.)

C. Daruty de Grandpre (*Nouv. Rem.*, April 8, 1888) finds that in small doses it is an energetic stimulant, and that in large doses it is narcotic, producing stupor, headache, and in some persons vertigo with a tendency to coma.

Hygrophila. Br. Add. 1900.—The dried herb including the root of *Hygrophila spinosa* T. And. (*Asteracantha longifolia* Nees). Br. Add. (Fam. *Acanthaceae*.) This species of *hygrophila* has long been used in India as a diuretic in the treatment of *dropsies*, especially where there is hepatic obstruction, and also as a popular *aphrodisiac*. In Southern India the root is an article of commerce, but in Bombay the seeds are commonly employed. By means of petroleum benzin C. H. Warden obtained from the roots a crystalline principle (Phg. Ind., vol. 3). The decoction, of *hygrophila* (*Decoction Hygrophilae*, Br. Add., 1900), two ounces of the root with three pints of water boiled to a pint, is given in *doses* of one-half to two fluid-ounces (15-60 mls).

HylopeiaAethiopica (?).—This plant is asserted to contain an alkaloid, *anonaceine*, which has been employed in combination with other reputed aphrodisiacs under the term of *aphrodisin* in the treatment of *impotence*.

HYOSCYAMUS. U. S. (Br.)

HYOSCYAMUS Hyosc. [Henbane, Hyoscyami Folium P. I.]

“The dried leaves or fruiting tops of *Hyoscyamus niger* Linne (Fam. *Solanaceae*), yielding not less than 0.065 per cent. of the alkaloids of

Hyoscyamus." U. S. " Hyoscyamus Leaves are the leaves of *Hyoscyamus niger*, Linn., collected from the flowering plants, and dried." Br.

Hyoscyami Folla, Br.; Hyoscyamus Leaves, Henbane Leaves, Black Henbane; Stinking Nightshade, Insane Root, Poison Tobacco; Jusquiame noire, Fr. Cod; Belene, Chenile, Fr.; Herba Hyoscyami, P. G.; Bilsenkraut, Bilsenkraut-blatter, G; Giusquiamo, It.; Beleno, Sp.

There are about eleven species of the genus *Hyoscyamus* known; these are distributed from the Canary Islands over Europe and Northern Africa to Asia.

Hyoscyamus niger, or *henbane*, is usually a biennial plant, with a long, tapering, whitish, fleshy, somewhat branching root, not unlike that of parsley, for which it has been eaten by mistake, with poisonous effects. The stem, which rises in the second year, is erect, branching, from one to four feet high, and thickly furnished with leaves. These are large, oblong-ovate, deeply sinuated with pointed segments, undulated, soft to the touch, and at their base embrace the stem. The upper leaves are generally entire. Both the stem and leaves are hairy, viscid, and of a sea-green color. The flowers form long, one-sided, leafy spikes, which terminate the branches, and hang downward. They are composed of a calyx with five pointed divisions, a funnel-shaped corolla, with five unequal, obtuse segments at the border, five stamens inserted into the tube of the corolla, and a pistil with a blunt, round stigma. The corolla is of an obscure yellow color, beautifully variegated with purple veins. The fruit is a globular two-celled capsule, covered with a lid, invested with the persistent calyx, and contains numerous small seeds, which are discharged by the horizontal separation of the lid. The whole plant has a rank, offensive odor.

H. niger is susceptible of considerable diversity of character, causing varieties which have by some been considered as distinct species. Thus, the plant is sometimes annual, the stem simple, smaller, and less downy than in the biennial plant, the leaves shorter and less hairy and viscid, and the flowers often yellow without the purple streaks.

The plant is found in the northern and eastern sections of the United States, occupying waste grounds in the older settlements, particularly cemeteries, old gardens, and the foundations of ruined houses. It is, not, however, a native of this country, having been introduced from Europe. In Great Britain, and on the continent of Europe, it grows abundantly

along the roads, around villages, amidst rubbish, and in uncultivated places. Both varieties were formerly cultivated in England, but at present the biennial is chiefly or solely grown. The annual plant flowers in July or August, the biennial in May or June. For an account of the cultivation of the biennial variety of Hitchin, England, see *P. J.*, Feb., 1860.

Mitlacher, in connection with other plants, has carried on a series of experiments on the cultivation of *Hyoscyamus* and reports on the results of his work in *Ph. Post*, 1911, p. 390 and *Zeit. Oest. Apoth. Ver.*, 1912, p. 401. *Hyoscyamus* has been successfully grown in the testing gardens of the Bureau of Plant Industry. There is usually some difficulty in growing *hyoscyamus* owing to its destruction by insects (*A. J. P.*, 1912, p. 551), but Newcomb was very successful with his experiments in Minneapolis. (*A. J. P.*, 1914, p. 531.) Schneider also has pointed out that henbane thrives well in California and says that it no doubt will do well in the Coast valleys. (*Pac. Pharm.*, iii, p. 192.) Peckolt reports that *Hyoscyamus niger* grows wild in portions of Brazil. (*B. P. G.*; xix, p. 33.) Chevalier has shown that by cultivation the alkaloidal content of *hyoscyamus* can be increased to 0.286 per cent. of total alkaloids. (*C. R. A. S.*, 1910, p. 344.)

H. albus, so named from the whiteness of its flowers, is used in France indiscriminately with the former species, with which it appears to be identical in medicinal properties. *Hyoscyamus muticus* L., of Egypt, is said to grow luxuriantly in the temperate zone and to produce a very much larger proportion of total alkaloids than does the official English plant, although the relative proportions of *hyoscyamine* and *hyoscyine* are not the same. It appeared in the London market in the form of broken stalks with a few capsular fruits and traces of leaves and may become an important source of the alkaloids to the manufacturers.

Properties.—All parts of *Hyoscyamus niger* are active. The official description of the plant is as follows: "Usually much wrinkled, with numerous stems and with the flowering or fruiting tops intermixed; leaves when entire attaining a length of 25 cm., a breadth of 10 cm., ovate or ovate-oblong, very inequilateral, the lower with short petioles, the upper sessile, summits acute, margins coarsely and angularly 1-to 4-toothed or lobed; grayish-green, glandular-hairy, particularly on the lower surfaces; flowers nearly sessile with an urn-shaped, unequally 5-toothed calyx and a campanulate corolla which in the fresh state is of a

yellowish color; fruit a 2-locular pyxis, and enclosed in a large urn-shaped calyx with 5 acute teeth; odor heavy, distinctive; taste somewhat bitter and acrid. Stems from 3 to 10 cm. in length and from 2 to 5 mm. in thickness, nearly cylindrical or somewhat compressed, longitudinally wrinkled and hairy. The powder is grayish-green; under the microscope, it exhibits calcium oxalate crystals usually in the form of 4- to 6-sided, isolated prisms, sometimes in twins, from 0.015 to 0.025 mm. in length, also occurring in spherical aggregates either isolated or attached to the prismatic crystals, sometimes in rosette aggregates, 0.02 mm. in diameter, and occasionally in sphenoidal micro-crystals; hairs numerous, of two kinds; the non-glandular from 2 to 10 cells in length, the glandular with a 1- to many-celled head and a 1- to 4-celled stalk; fragments of epidermis with broadly elliptical stomata from 0.03 to 0.035 mm. in length and with 3 to 4 neighboring cells; fragments of trachea? with simple or bordered pores and spiral or reticulate thickenings, also associated with sclerenchymatous fibers having thin porous walls and showing little or no lignification; pollen grains, nearly smooth and from 0.035 to 0.05 mm. in diameter. The presence of the leaves of *Hyoscyamus muticus* Linne in either the crude or powdered *Hyoscyamus* may be determined by the characteristic, branching, non-glandular hairs occurring on both the stems and leaves of that species. *Hyoscyamus* yields not more than 30 per cent. of ash." *U. S.*

"Pale green, varying in length but seldom exceeding twenty-five centimetres; mostly sessile; exstipulate, triangular-ovate or ovate-oblong, acute, undulated, irregularly toothed, sinuate or pinnatifid, with conspicuous midrib. On both surfaces, but particularly on the under surface and near the veins, long uniserial hairs terminating in pluricellular glands. In the mesophyll prismatic and cluster-crystals of calcium oxalate." *Br.*

Much of the efficacy of *hyoscyamus* depends upon the time at which it is gathered. The leaves should be collected soon after the plant has flowered. In the biennial plant, those of the second year are preferred to those of the first. The latter, according to Houlton, are less clammy and fetid, yield less extractive, and are medicinally much less efficient. It is said that the plant is sometimes destroyed by severe winters in England, and that no leaves of the second year's growth are then obtainable. This is, perhaps, one of the causes of the great uncertainty of the medicine as found in commerce. The root also is said to be much more poisonous in the second year than in the first.

"Assay.—Introduce 30 Gm. of Hyoscyamus, in No. 60 powder, into a 500 mil flask and add 300 mils of a mixture of 1 volume of chloroform and 2 volumes of ether. Stopper the flask, shake it well, and allow it to stand for ten minutes; then add 5 mils of ammonia water and shake the flask vigorously every ten minutes during two hours. Now add 40 mils of distilled water, again shake the flask and when the drug has settled decant 200 mils of the solution, representing 20 Gm. of Hyoscyamus, and proceed as directed under *Belladonna Radix*, beginning with the word 'Filter' on twelfth line of the Assay. Before titration treat the residue twice with 5 mils of ether and evaporate to dryness each time. Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 28.92 milligrammes of the total alkaloids of Hyoscyamus." *U. S. IX.*

The recent leaves have, when bruised, a strong, disagreeable, narcotic odor, somewhat like that of tobacco. Their taste is mucilaginous and very slightly acrid. When dried, they have little odor or taste. Thrown upon the fire, they burn with a crackling noise, as if they contained a nitrate, and at the same time emit a strong odor.

Much of the henbane of commerce is taken from the plant in the first year of its growth. The drug of the market is very variable, frequently containing an excess of sand and the leaves of other species of hyoscyamus. A few years ago, it was admixed with *H. muticus*, a plant growing in Egypt. The latter is readily determined by the presence of characteristic branching non-glandular hairs which are found on both the stems and leaves. (See *A. J. P.*, 1908, p. 361 and Kraemer's "*Scientific and Applied Pharmacognosy.*")

Hyoscyamus is completely extracted by diluted alcohol. The aqueous infusion is of a pale-yellow color, insipid, with the narcotic odor of the plant. The leaves were analyzed by Lind-bergsen, who obtained from them a narcotic principle. They contain a large proportion of potassium nitrate, F. Mahia having obtained, as nearly as he could estimate from his experiments, 2 per cent. of that salt. (*A. J. P.*, 1859, p. 402.) The seeds are very small, roundish, compressed, somewhat kidney-shaped, a little wrinkled, of a gray or yellowish-gray color, of the odor of the plant, and of an oleaginous, bitterish taste. Geiger and Hesse (1833) were the first to demonstrate the existence of an alkaloid in hyoscyamus. Ladenburg stated in 1880 that there are two alkaloids in the plant,—one crystallizable, *hyoscyamine*, and the other amorphous,

hyoscine (scopolamine). Hohn (*Ann. Ch. Ph.*, 157, 98) obtained from the seeds a bitter principle which proved to be a glucoside. He calls it *hyoscypicrin*, and gives it the formula $C_{27}H_{52}O_{14}$.

From experiments made by Hirtz upon the relative medicinal power of extracts from the seeds and from the leaves, he inferred that the former had ten times the strength of the latter. Henbane leaves yield, by destructive distillation, a very poisonous empyreumatic oil.

Uses.—Hyoscyamus combines the therapeutic actions of its two alkaloids, hyoscyamine and scopolamine. Because of the presence of the former it tends to check secretion and to relax spasm of the involuntary muscles, while through the narcotic effects of its scopolamine it lessens pain and exercises a slight somnifacient action. Its most important use is in relief of painful spasmodic affections of the unstriated muscle, as in *lead colic* and *irritable bladder*. It is also employed to allay nervous irritation, as in various forms of *hysteria* or *irritable cough*, but is inferior to scopolamine for these purposes. Externally cataplasms or fomentations of the fresh leaves have been employed to allay pain in *cancerous ulcers* and *hemorrhoids*, but its employment for this purpose is of doubtful advantage.

Hyoscyamus is preferably given in the form of the fluidextract or tincture. The inspissated juice of the fresh leaves (*Extractum hyoscyami viride*, Br.) is exceedingly variable in its operation and is not to be recommended.

Dose, of the leaves, two to five grains (0.13-0.32 Gm.).

Off. Prep.—Extractum Hyoscyami, *U. S.*, *Br.*; Fluidextractum Hyoscyami, *U. S.*; Pilula Colocynthis et Hyoscyami (from extract), *Br.*; Tinctura Hyoscyami, *U. S.*, *Br.*; Pilulae Catharticae Vegetabiles (from Extract), *N. F.*; Pilulae Colocynthis et Hyoscyami (from Extract), *N. F.*; Pilulae Laxativae Post Partum (from Extract), *N. F.*

Hypericum. *Hypericum perforatum* L. *St. John's Wort*. *Millepertuis*, *Casse-diable*, Fr. *Johanniskraut*, Harthen, G. (Fam. *Hypericaceae*).— A perennial herb, with a very acrid juice, naturalized from Europe and a pernicious weed in this country. It has a peculiar balsamic odor, which is rendered more sensible by rubbing or bruising the plant. Its taste is bitter, resinous, and somewhat astringent. It imparts a yellow color to cold water, and reddens alcohol and the fixed oils. Its chief constituents are volatile oil, a resinous substance, tannin, and coloring matter. This latter, known as

hypericum red, is a reddish resin, smelling like the flowers, soluble in alcohol, ether, ethereal and hot fatty oils, coloring the solution from wine red to blood red. It is soluble in alkalies with green color, and gives yellow precipitates with the alkaline earths and metallic salts. As a medicine it was in high repute among the ancients and the earlier modern physicians. Among the complaints for which it was used were *hysteria*, *mania*, *intermittent fever*, *dysentery*, *gravel*, *hemorrhages*, *pectoral complaints*, *worms*, and *jaundice*; but it was, perhaps, most highly esteemed as a remedy in *wounds* and *bruises*, for which it was employed both internally and externally. It probably has somewhat analogous power to the turpentine. It formerly enjoyed great reputation for the cure of demoniacs, and the superstition still lingers among the vulgar in some countries. At present the plant is scarcely used except as a domestic remedy. The summits were given in the dose of two drachms or more. A preparation, *oleum hyperici* or *red oil*, made by macerating four ounces of the tops in a pint of olive oil, is still used in many families for bruises.

Hyssopus. *Hyssopus officinalis* L. *Hyssop*. *Hysope*, Fr. *Isop*, *Ysop*, G.—This is a European labiate plant, found along roadsides in this country, whose flowering summits and leaves have been used in medicine. They have an agreeable aromatic odor, and a warm, pungent, bitterish taste, due to the presence of a volatile oil. This oil is colorless or greenish-yellow, of peculiar odor, sharp camphor-like taste, and neutral reaction. It has a sp. gr. from 0.88 to 0.98, distils between 142° and 162° 0. (287.6°-323.60 F.), and is soluble in its own bulk of alcohol of 0.85 sp. gr. The acid found in the oil has been identified as *l-pinonic* acid, and the ketone *l-pinocamphene*. Hyssop is a warm, gently stimulant aromatic, applicable to the same cases as the other labiate plants.

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Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Iberis. *Iberis amara* L. *Bitter Candytuft*.—A small European herbaceous cruciferous plant. The leaves, stem, and root are said to possess medicinal properties, but the seeds are most efficacious. The plant appears to have been employed by the ancients in *rheumatism*, *gout*, and other diseases. In large doses it is said to produce giddiness, nausea, and diarrhea, and to be useful in *cardiachypertrophy*, *asthma*, and *bronchitis* in *doses* of from one to three grains (0.065--0.2 Gm.) of the seed.

Ibogaine.—This alkaloid was separated by Dybouski and Landrim (*Nouv. Rem.*, 1905) from the roots of the *Tabernanthe Iboga*, a plant found in the Congo. In overdose it causes hallucination and generally paralysis, with death due to failure of the respiratory muscles. In dose of one-third to one-half grain it is said to act as a stimulant to the nervous system somewhat similar to caffeine.

Ignatia, N. F. IV (U. S. P. 1880). *Saint Ignatius Bean*. *Ignatia Amara*. *Semen Ignatice*, *Faba Ignatii*, *Faba Sancti Ignatii*, Lat. *Fève igasurique*, *Fève de Saint Ignace*, Fr. *Ignatius-bohne*, *Bittere Fiebemuss*, *Ignasbohlen*, G. *Fava di Santo Ignazio*, It. *Haba de Santo Ignazio*, Sp.— "The dried ripe seeds of *Strychnos Ignatii* Bergius (Fam. *Loganiaceae*), yielding not less than 2 per cent. of the alkaloids of Ignatia." N. F. IV. *Strychnos Ignatia* Berg. (*Ignatia amara* L. f.) is a large climbing shrub, a native of the Philippine Islands, and introduced into Cochin-China where the seeds were highly esteemed as a medicine, and, having attracted the attention of the Jesuits, were honored with the name of their founder. Fluckiger and Arthur Meyer have found that the seed has a close structural analogy to nux vomica. (*P. J.*, 1881, 1.)

It is described by the N. F. as "heavy, hard, angularly ovate with obtuse angles, from 20 to 30 mm. in length and about 15 mm. in breadth and thickness; externally grayish or reddish-black, nearly smooth with few or no hairs; fracture granular and translucent in small fragments; a small irregular cavity in the center. Nearly inodorous and intensely bitter. The powder is grayish-brown and, when examined under the microscope, exhibits thin cells of the epidermis and the subjacent layer of the seed coat, polygonal cells with thickened, pitted walls; hairs characteristic, spreading and thickened at the base and having linear markings; endosperm tissue, the outer cells small, contents granular, the inner large, with thickened walls; lumen irregular in size and shape. Ignatia yields not more than 4 per cent. of ash." N. F.

Assay.—" Introduce 15 Gm. of Ignatia, in No. 40 powder, into a 250 mil flask and add 150 mils of a mixture of chloroform, 1 volume, and ether, 2 volumes. Stopper the flask, shake it well and allow it to stand ten minutes, then add 10 mils of ammonia water, shake the flask vigorously every ten minutes during two hours and allow it to stand for ten hours. Now add 25 mils of distilled water, again shake the flask well, and, when the drug has settled, decant 100 mils of the solution, representing 10 Gm. of Ignatia. Filter the solution through a pledge! of purified cotton into a separator, and rinse the graduate and cotton with a little ether. Completely extract the alkaloids from the solution by shaking out repeatedly with weak sulphuric acid. Collect the acid washings in a separator, add ammonia water until the solution is decidedly alkaline to litmus, and completely extract the alkaloids by shaking out repeatedly with chloroform. Evaporate the combined chloroform washings to dryness, dissolve the alkaloids from the residue in exactly 10 mils of tenth-normal sulphuric acid V.S., and titrate the excess of acid with fiftieth-normal potassium hydroxide V.S., using cochineal T.S. or methyl red T.S. as indicator. Each mil of tenth-normal sulphuric acid V.S. consumed corresponds to 36.4 milligrammes of the alkaloids of Ignatia." *N. F.*

To Pelletier and Caventou Ignatia beans yielded the same constituents as nux vomica, and, among them, 1.2 per cent. of strychnine and 0.5 per cent. of brucine. J. M. Caldwell found strychnine and brucine, combined with igasuric acid, a volatile principle, extractive, gum, resin, coloring matter, fixed oil, and bassorin, but no starch or albumen. (*A. J. P.*, 1857, 298.) Fluckiger, on the other hand, found 1.78 per cent. of nitrogen, corresponding to about 10 per cent. of albuminoid matter. (*Pharmacographia*, 443.).

They have been used instead of nux vomica, in the preparation of that alkaloid, when their cost would permit of the substitution, but the nux vomica bean has been imported in such large quantities, and is now so low in price, that the ignatia bean is rarely used. The medicinal uses are those of nux vomica.

For process of making the abstract (*Abstractum Ignatiae*, U. S., 1880), see *U. S. D.*, 19th ed., p. 1524. The dose of the abstract is from one-half to one and a half grains (0.032-0.096 Gm.). A tincture is recognized by the *N. F.* (see Part III).

Ilex. *Holly. Houx*, Fr. *Stechpalme Christdorn*, G.—Several species of *Ilex* (Fam. *Aquifoliaceae*) are employed in different parts of the world. The *I. Aquifolium* L., or *European Holly*, is usually a shrub, but in some places attains the magnitude of a middling-sized tree. It is the most beautiful of all evergreens, but is unsuited to our climate, being too tender to withstand the winters in the Northern States and equally affected by the hot, dry summers in the Southern States. A viscid substance called *bird lime* is prepared from the inner bark. The leaves, which are of a bitter, somewhat acrid taste, were formerly much esteemed as a diaphoretic, and in the form of infusion were employed in *catarrh*, *pleurisy*, *smallpox*, *gout*, etc. At one time they enjoyed a brief reputation in France as a cure for *intermittents*. They were used in powder, in the dose of a drachm two hours before the paroxysm, and this dose was sometimes repeated frequently during the apyrexia. Their febrifuge virtues are said to depend on a bitter principle, *ilicin*. Labourdais obtained this principle by boiling a filtered

decoction of holly leaves with animal charcoal, allowing the charcoal to subside, washing it, then treating it with alcohol, filtering off the alcoholic solution, and evaporating it to a syrupy consistence. The liquid thus obtained was very bitter, and, on being allowed to evaporate spontaneously, yielded an amorphous substance, having the appearance of gelatin, which was the principle in question. (See *A. J. P.*, xxi, 89.) A yellow coloring substance called *ilexanthin*, and a peculiar acid called *ilicic acid*, were obtained by F. Moldenhauer. Illicic alcohol, $C_{30}H_{50}O$, was separated by Personne from birdlime and found to be identical with *a*-amyrin. (C. R. S. B., 1908, 862.) Ilexanthin is obtained in the following manner. The leaves are exhausted with alcohol, the alcohol is distilled off, and the residue set aside for several days. A sediment forms, which is separated from the mother liquor, treated with ether to remove the chlorophyll, and then purified by repeated solution in alcohol and crystallization. The composition of ilexanthin is $C_{17}H_{22}O_{11}$. It crystallizes in yellow needles, which change color at $185^{\circ} C.$ ($366^{\circ} F.$), melt at $198^{\circ} O.$ ($388^{\circ} F.$), and at $214^{\circ} O.$ ($417^{\circ} F.$) boil with decomposition, and are not sublimable. It is insoluble in ether, but soluble in alcohol. In cold water it is almost insoluble; but hot water dissolves it freely, and deposits it in crystals on cooling. The *berries* are about the size of a pea, red and bitter, and are said to be purgative, emetic, and diuretic. Ten or twelve of them will usually act on the bowels, and sometimes excite vomiting. Their expressed juice has been used in *jaundice*.

Ilex opaca Ait., or *American holly*, is a middling-sized evergreen tree, growing throughout the Atlantic section of the United States, and especially abundant in New Jersey. It is so similar to the European plant that it has been by some writers considered as the same species. The berries, examined by D. P. Pancoast, were found to contain tannin, pectin, two crystallizable organic principles, and salts of potassium, calcium, and magnesium. One of the crystallizable principles was inodorous and tasteless, the ether inodorous but intensely bitter. The latter was obtained by evaporating a tincture to syrupy consistence, alkalizing with potassium carbonate and, extracting with ether. The ether was allowed to evaporate spontaneously when crystals of the bitter principle were deposited. This is probably pure *ilicin*. (*A. J. P.*, xxviii, 314.) Walter A. Smith (*A. J. P.*, 1887, 1668) obtained a resin soluble in alcohol by the ether extraction, and in the portion of this soluble in water he obtained evidences of a glucoside. This species is said to possess the same medicinal properties as *I. aquifolium* L.

Ilexparaguariensis A. St. Hill (*I. Mate* St.-Hilaire) yields the celebrated Paraguay tea, or Mate, so extensively consumed as a beverage in the interior of South America. It is a small tree or shrub growing wild along the streams in Paraguay, and also cultivated for the sake of its leaves, which are the part used. These are stripped from each plant every two or three years. The period of their collection extends from December to August, sometimes beginning earlier but never continuing later. Companies are formed who penetrate far into the forest at a distance from the settlements, and devote a long time to the collection and preparation of the leaves. These are first dried by exposure to heat, and are then reduced to powder more or less fine, which is kept for several months protected from moisture, and then packed in sacks and delivered to commerce. (A. Demersay, *Ann. Ther.*, 1868, 72; see also *Pharm. Rec.*, May, 1891.)

They have a balsamic odor and bitter taste, and are usually at first disagreeable to the palate. They have a pleasant and corroborant effect upon the stomach, but, when largely taken, cause purging and vomiting. They are used in the form of infusion, which is prepared from the entire leaves as we prepare tea; or, under the name of *cha mate*, a fine powder is put in a cup of hot water by the drinker, and after a moment's stirring, the fluid is sucked up by means of a tube expanded below, and pierced with fine holes, so as to strain out the powder. They contain, besides other substances, a peculiar tannin and the alkaloid caffeine in variable amount. Some fresh leaves of *Ilex Paraguariensis* grown in the Cambridge Botanical Gardens were found by A. H. Allen, after drying at 100° C. (212° F.), to contain: insoluble matter, 57.94 per cent.; tannin, by lead acetate method, 15.62; tannin, by cupric acetate method, 15.66; caffeine, 1.13; total ash, 6.14; soluble ash, 3.56. (*Com. Org. Anal.*, 2d ed., iii. Part II, 527.) Some elaborate proximate analyses of mate are also published by Theodore Peckolt. (*P. J.*, (3), xiv, 121.) The consumption of mate, or yerba, in South America is enormous. Although largely produced in the Argentine Republic, tons are annually shipped to countries in South America. For an interesting account of the method of preparation, and an elaborate analysis, see *P. J.*, vol. xiv, 1017.

The *Ilex vomitoria* Ait. is a handsome evergreen shrub, growing in our Southern States, and especially abundant along the southern coast of Florida. Analysis of its leaves by Venable (*A. J. P.*, 1885, 390) gave 7.39 per cent. of tannic acid and 0.27 per cent. of caffeine. Smith (*A. J. P.*, xlv, 217) found 0.011 per cent. of volatile oil and 0.122 per cent. of caffeine. It is the *cassena* of the North Carolina Indians, who formerly employed a decoction made from the toasted leaves, called *black drink*, or *Yaupon*, both as a medicine and as a drink of etiquette at their councils. It acts as an emetic. The leaves of the *Ilex Dahoon* L., or *Dahoon holly*, have similar properties, and are also said to have entered into the composition of the black drink.

Illicium. *U. S.* 1890. *Star-Anise*.—"The fruit of *Illicium verum* Hooker filius (Fam. *Magnoliaceae*)." *U. S.*, 1890. Of the genus *Illicium*, seven species are recognized, of which two are found on the Atlantic coast of Southern North America, two in Hindostan, and three in China and Japan. Many of the species are possessed of aromatic properties.

The tree yielding star-anise is indigenous to Southeastern Asia and extensively cultivated in subtropical countries. The fruit is chiefly used in the manufacture of a volatile oil which resembles the official oil of anise. The fruit consists of usually 8 boat-shaped follicles or carpels arranged around a central axis. The carpels have an acute summit and taper to a nearly straight beak; externally, they are reddish-brown and somewhat wrinkled; the inner surface is smooth and shiny and encloses a single smooth seed. The odor and taste is aromatic, resembling anise, and this serves to distinguish them from the fruits of the Japanese star-anise which are also known as "*Shikimmi fruits*" or "*Skimmi fruits*." The latter being obtained from *Illicium religiosum* Sieb. et Zucc., a tree which is extensively cultivated in the groves of the Buddhist Temples in Japan.

I. floridanum Ell., *poison bay*, *sweet laurel*, a small evergreen tree or shrub with

oblong-lanceolate, acuminate leaves, which grows westward from Florida along the coast bounding the Gulf of Mexico, has its bark, leaves, and probably also seed vessels endowed with a spicy odor and taste, analogous to those of anise. Another species, *I. parviflorum* Vent. (*I. anisatum* Bartr., not L.), a shrub found by Michaux in the hilly regions of Georgia and Carolina, has a flavor closely resembling that of sassafras root. A decoction of the seeds is said to produce violent gastro-intestinal irritation, followed by motor and sensory paralysis, with convulsions and death if the dose has been sufficient. E. Barial (*Revue Gen. de Clin.*, Oct., 1889) states that he has obtained a poisonous glucoside from the kernel. H. C. C. Maisch (A. J. P., 1885, 280) obtained from the leaves a crystalline alkaloid to which the bitter taste is due, tannin, and a resin. In the root bark and capsules he found volatile oil and a crystalline principle, melting at 100° C. (212° F.), insoluble in alcohol and ether, but soluble in chloroform, and neutral to test paper.

Star-anise was examined by C. E. Schlegel (A. J. P., 1885, p. 426), who found a *saponin* in the aqueous extract; in the alcoholic extract, a crystalline principle of a strong musk-like odor, which did not show alkaloid or glucosidal reactions, and oil of star-anise.

I. religiosum Sieb., or *shikimi*, of India, is very poisonous, causing vomiting and epileptiform convulsions, with dilated pupil and exceedingly cyanosed countenance; in it has been found by J. F. Eykman (*P. J.*, xi, 1046) a crystalline principle, for which the name of *shikimine* or *sikimin* has been proposed.

Eykman (*P. J.*, 1885, p. 985) has shown that in the essential oil of the fruit of *Illicium religiosum*, safrol is found, accompanied by eugenol. On the other hand, the chief constituent of the oil of *I. verum* is anethol. The constituents of low boiling-point in star-anise oil, consisting of terpenes essentially, have been reported upon by the chemists of Schimmel & Co. (*Schim. Rep.*, April, 1893). They find *dextro-pinene*, boiling at 157° to 163° C. (314.6°-325.4° F.), and *laevo-phellandrene*, boiling at from 170° to 175° C. (338°-347° F.). The medicinal properties of the oil of star-anise are similar to those of oil of anise. Sikimin is not used in medicine. Sikimin is violently poisonous, belonging to the group of convulsants of which picrotoxin is the type. Plugge and Schutte associate in this group—*Dioscorine*, the alkaloid of *Dioscorea hirsuta*; *cicutoxin*, from *Cicuta virosa* L.; *coriamyrtin*, a glucoside of *Coriaria myrtifolia* L.; *digitaliresin* and *toxiresin*, prepared by Schmiedeberg from digitalin and digitoxin; *phytolaccatoxine*, the alkaloid of *Phytolacca acinosa*; *sikimin*; *oenanthotoxine*, the alkaloid obtained from the *Oenanthe crocata* L., by Pohl; isonitroso-anilacetone, an artificial substance prepared by Holleman. (See *A. I. P. T.*, iv, 1897.) See table by Eykman showing constituents of oil of *Illicium religiosum* compared with those from allied oils in *U. S. D.*, 19th ed., p. 1526.

Impatiens. *Impatiens biflora* Walt. and *I. pallida* Nutt. *Touch-me-not*. *Jewel-weed*. *Balsam-weed*.—These two species of *Impatiens* (Fam. *Bal-saminaceae*), the former of which is better known commonly as *Spotted Touch-me-not* and the latter as *Pale Touch-me-not*, are indigenous, annual, succulent plants growing in low, moist grounds, and flowering from July to September. They may be known by their tender, juicy,

almost transparent stems; by their yellow flowers, which in *I. pallida* are pale and sparingly punctate, and in *I. biflora* are deeper colored and crowded with dark spots, and by their capsules, which burst elastically, and curl up with the slightest pressure. They probably possess properties similar to those of *I. nolitangere* L., of Europe and Asia, which has an acrid burning taste, and, when taken internally, acts as an emetic, cathartic, and diuretic, though considered dangerous, and therefore little used. Ruan of Philadelphia, employed with great advantage, in piles, an ointment made by boiling the American plants, in their recent state, in lard. The flowers may be used for dyeing yellow. The fresh juice is reputed to be efficacious in the treatment of rhus poisoning. The *I. Balsamina* L., or *balsam-weed*, *touch-me-not*, etc., of the gardens resembles the other species in its effects.

Imperatoria. *Imperatoria Ostruthium* (L.) Kch. *Masterwort*. *Rhizoma Imperatoriae*, P. G. *Imperatoire*, Fr. *Meisterwurz*, *Kaiserwurz*, G.—An umbelliferous plant, indigenous in Southern Europe. The root has a strong odor, similar to that of angelica, and a pungent, aromatic taste, attended by a flow of saliva, and followed by a growing warmth which remains long in the mouth. E. M. Holmes (*P. J.*, March 17, 1877) noticed this root mixed with aconite in the London market, but this probably arose from carelessness, as masterwort is worth twice as much as aconite. A crystallizable, tasteless principle, called *imperatorin*, was extracted from the root by Wacken-roder, and Gorup-Besanez found in the root another principle, to which he gave the name of *ostruthin*. Besides these two crystalline compounds, masterwort contains a volatile oil, composed of a hydrocarbon and an oxygenated compound, probably the aldehyde of angelic acid. (Wagner, *J. P. C.*, Ixii, 283.) Jassoy (*Ap. Ztg.*, v, 150) has since investigated the substance ostruthin and gives it the formula $C_{18}H_{20}O_3$. He states that it does not contain a methoxyl group but a phenol-like hydroxyl. By fusion with potassium hydroxide, it yields along with a carbonaceous residue small amounts of resorcinol and acetic and butyric acids. By the action of bromine in chloroform solution it is changed in the presence of acid sodium carbonate into *tribromostruthin*, $C_{18}H_{19}Br_3O_3$. (Schmidt, *Pharm. Chem.*, Bd. ii, 3te Auf., 1510.) Herzog subsequently examined the rhizomes and found a substance identical with *oxypeucedanin*. (*A. Pharm.*, 1908, 414.) The root of masterwort was formerly used in a wide circle of complaints with so much supposed success as to have gained for it the title of *divinum remedium*. It is, however, merely a stimulant aromatic, which in this country is unknown as a remedy. Its leaves are used as a potherb and to flavor cheese.

INFUSA. U.S.

INFUSIONS

Apozemes, Tisanes, Infusions, *Fr.*; Infusa, *P. G.*; Infusionen, Aufgusse, *G.*; Infusi, *It.*; Infusiones, *Sp.*

These are aqueous solutions obtained by treating with water (without the aid of ebullition), vegetable products only partially soluble in that

liquid. The water employed may be hot or cold, according to the objects to be accomplished. Infusions are generally prepared by pouring boiling water upon the vegetable substance and macerating the mixture in a tightly closed vessel until the liquid cools. The soluble principles are thus extracted more rapidly, and, as a rule, in a larger proportion, than at a lower temperature. Some principles, moreover, are dissolved in this manner which are nearly or quite insoluble in cold water. A prolonged application of heat is in some instances desirable, and this may be effected by placing the vessel near the fire. Cold water is preferred when the active principle is highly volatile, when it is injured by heat, or when any substance of difficult solubility at a low temperature exists in the vegetable, which it is desirable to avoid in the infusion. A longer continuance of the maceration is necessary in this case, and in warm weather there is sometimes danger that spontaneous decomposition may commence before the process is completed. When a strong infusion is required, the process of *percolation* may be advantageously resorted to. The water employed should be free from saline impurities which frequently produce precipitates and render the infusion turbid. Fresh river, rain, or distilled water is usually preferable to water pumped from wells or obtained from springs, except when the latter are known to produce water which will not react with any of the constituents of the infusion.

The substance to be acted on should be sliced or bruised, or in the state of powder, but this last condition is seldom requisite, unless when percolation is employed, and is always inconvenient, as it requires that the infusion should be filtered through paper in order completely to separate the undissolved portion. In other cases it is sufficient to strain it through fine linen or muslin. When percolation is resorted to, the substance should be more or less finely powdered. The United States Pharmacopoeia furnishes a general formula for infusions, which is to be used when the proportions are not specified. In the U. S. P., 1880, the strength of such infusions was fixed at 10 per cent. Experience has shown, however, that this was too strong for general purposes, and in the U. S. Pharmacopoeia of 1890 and the Eighth and Ninth Revision, 5 per cent. has been chosen as the limit.

GENERAL FORMULA FOR INFUSIONS, U. S. P. IX.

"Infusions must be freshly made from the drugs, and, when the strength of Infusions is not otherwise directed, they are to be prepared

by the following general formula: The Drug, coarsely comminuted, fifty grammes [or 1 ounce av., 334 grains]; Water, a sufficient quantity, to make one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Introduce the substance into a suitable vessel provided with a cover, pour upon it one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of boiling water, cover the vessel tightly, and allow it to stand for half an hour. Then strain with expression, and pass enough water through the strainer to make the Infusion measure one thousand mils [or 33 fluidounees, 6¹/₂ fluidrachms]. If the activity of the Infusion is affected by heat, cold water only should be used. -

"Caution.—The strength of Infusions of potent or very active drugs should be specially directed by the physician." *U. S.*

Infusions are usually prepared in glazed earthenware or porcelain vessels fitted with covers. Brande suggests the use of clean metallic vessels, which, when finely polished, retain the heat for a longer time, but they are more liable to chemical alterations, and may sometimes injuriously affect the preparation. Vessels of block-tin are generally well adapted for the purpose.

As infusions do not keep well, especially in warm weather, they should be made extemporaneously and in small quantities. In this country they are usually prepared in the patient's home, and the propriety of their introduction into the Pharmacopoeia has been doubted, but it is desirable to have certain fixed standards for the regulation of the medical practitioner, and it is always preferable to direct infusions from the apothecary, for whose guidance official formulas are necessary. Physicians would, indeed, find an advantage in more frequently directing them to be prepared by the pharmacist, instead of leaving their preparation to the carelessness or want of skill of attendants upon the sick. Infusions may be kept during hot weather, and for many months, by straining them while hot, and pouring them at once into bottles provided with accurately ground stoppers. The bottle must be brim-full, the stopper being made to displace its bulk of the fluid. A common bottle with a cork stopper may be used, if the softened cork be forced into the full bottle, tied down, and at once dipped into hot sealing wax. The hotter the liquid and the freer from the air the better will the infusion keep. Sterilization of infusions by heating them to the boiling point, then preserving in bottles which have been kept hot to destroy

germs, and stoppered with sterilized cotton, is effective, particularly if the bottles have a stopcock near the bottom to draw the infusion when wanted. Almens has proposed a very efficient method of preserving infusions. (*A. J. P.*, April, 1875.) It is as follows: The infusion or decoction is heated for some time in a water bath at 100° C. (212° F.), and the bottle is then fitted with a tight cork, through which a glass tube passes lightly filled with cotton wool. The cork has a second opening, through which a glass tube passes nearly to the bottom of the bottle; this tube is bent at a sharp angle and has fitted to it a piece of India rubber tubing, to which a pinchcock is attached, by means of which the contents may be drawn as wanted. By making very concentrated infusions, as suggested by Donovan, with a mixture of three parts of water and one part of alcohol, they may be long kept, and when used can be diluted with water to the proper strength. Thus, if made four times as strong as the official infusion, they may be diluted with three measures of water. The proportion of alcohol would thus be very small, but it might still be medicinally injurious, and infusions should not be prepared in this way unless with the cognizance of the prescriber.

Battley, of London, introduced a set of preparations, which he called *inspissated infusions*, the advantages of which are that the virtues are extracted by cold water, are not injured by heat used in the evaporation, are in a concentrated state, and are not impaired by time. To prepare them he macerated the material, coarsely powdered, bruised, or finely sliced, in twice its weight of cold distilled water, pressing the solid matter into the liquid repeatedly by a rammer or the hand; then allowed the liquid to drain out, or expressed it in the case of highly absorbent substances, and repeated the process, with an amount of water equal to that which had been separated, until the strength was exhausted. Four or six hours of maceration were usually sufficient. The infusion is then to be concentrated by evaporation, at a temperature not exceeding 71.1° C. (160° F.) to the sp. gr. 1.200, and as much alcohol is to be added as will make its sp. gr. 1.100. These preparations are very analogous to the *fluidextracts* already considered. As a rule, it would probably be preferable to prepare infusions by the process of percolation.

The inspissated infusions must be diluted when administered. The presence of alcohol, though in small quantity, would sometimes be a serious objection. (*P. J.*, x, 129.) *Concentrated infusions* of the strength of 50 per cent. were introduced into the British Pharmacopoeia (1898);

they are mostly made by percolation, and were termed "Liquors." This certainly led to confusion in nomenclature, and it is difficult to understand why they were not called concentrated infusions, particularly as then- almost universal use is for making ordinary infusions by diluting with water. They were dropped from the British Pharm. 1914.

INFUSUM ALSTONIAE. Br.

INFUSION OF ALSTONIA

"Alstonia, bruised, 50 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for half an hour; strain while hot." *Br.*

See Alstonia. Dose, one-half to one fluidounce (15-30 mils).

INFUSUM AURANTII. Br.

INFUSION OF ORANGE PEEL.

Tisane d'Ecorce d'Orange, *Fr.*; Pomeranzenschalenauflguss, *G.*

"Dried Bitter-Orange Peel, cut small, 50 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

A grateful stomachic.

Dose, from one-half to one fluidounce (15-30 mils).

INFUSUM AURANTII COMPOSITUM. Br.

COMPOUND INFUSION OF ORANGE PEEL

Tisane d'Ecorce d'Orange composee, *Fr.*; Pomeranzen und Citronenschalenauflguss, *G.*

"Dried Bitter-Orange Peel, cut small, 25 grammes; Lemon Peel, cut small, 10 grammes;

Cloves, bruised, 5 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

A grateful stomachic in the dose of from one-half to one fluidounce (15-30 mils).

INFUSUM BUCHU. Br.

INFUSION OF BUCHU

Infusum Diosmae, s. Barosmae; Tisane de Buchu, *Fr. Cod.*; Buchuaufguss, *G.*

"Buchu Leaves, freshly broken, 50 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

It has the odor, taste, and medicinal virtues of the leaves, and affords a convenient method of administering the medicine.

Dose, from one to two fluidounces (30-60 mils).

INFUSUM CALUMBAE. Br.

INFUSION OF CALUMBA

Infusion of Columbo; Tisane de Colombo, *Fr.*; Kolombo-Infusion, Kolomboaufguss, *G.*; Infusion de Colombo, *Sp.*

"Calumba Root, cut small, 50 grammes; Distilled Water, cold, 1000 millilitres. Infuse in a covered vessel for half an hour; strain." *Br.*

The *infusion of calumba* is likely to spoil very quickly, especially in warm weather. Calumba contains starch and albumen. Cold water extracts the latter without the former; hot water the former with comparatively little of the latter, which is partially coagulated by the heat. Both starch and albumen are liable to spontaneous change, but the former is much the more permanent of the two. Hence it is, according to Greenish, that the hot infusion keeps best. Indeed, he ascribes the change which takes place in the starch of the hot infusion chiefly to the agency of a little albumen which has escaped coagulation. According to these views, the best plan of preparing infusion of calumba is to exhaust the root with cold water, by which the starch is left behind, and then to heat the infusion to the boiling point in order to coagulate the albumen. (*A. J. P.*, xviii, 141; from *P. J.*) Upon comparing specimens

of the cold and hot infusion, we have not found the results of Greenish fully confirmed. The cold infusion appeared to keep better than the hot. Nevertheless the plan of preparing the infusion above proposed is probably the best. The infusion of calumba is not colored by salts of iron, and may be conveniently administered in connection with them.

Dose, one fluidounce (30 mils), three or four times a day.

INFUSUM CARYOPHYLLI. Br.

INFUSION OF CLOVES

Tisane de Girofle, *Fr.*; Gewilrzelken-Infusion, Gewilrzelkenaufguss, *G.*

"Cloves, bruised, 25 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

The infusion of cloves affords precipitates with lime water, and with the soluble salts of iron, zinc, lead, silver, and antimony. (Phillips.)

Dose, one fluidounce (30 mils).

INFUSUM CASCARILLAE. Br.

INFUSION OF CASCARILLA

Tisane de Cascarille, *Fr.*; Kaskarillaufguss, *G.*

"Cascarilla, in No. 10 powder, 50 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

This infusion affords precipitates with lime water, infusion of galls, silver nitrate, lead acetate and subacetate, zinc sulphate, and ferrous sulphate.

Dose, one fluidounce (30 mils).

INFUSUM CHIRATAE. Br.

INFUSION OF CHIRETTA

Tisane de Chirette, *Fr.*; Chirettaufguss, *G.*

"Chiretta, cut small, 50 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

Dose, from one-half to one fluidounce (15-30 mils).

INFUSUM GENTIANAE COMPOSITUM. Br.

COMPOUND INFUSION OF GENTIAN

Tisane de Gentiane composee, *Fr.*; Enzianaufguss, *G.*

"Gentian Root, thinly sliced, 12.5 grammes; Dried Bitter-Orange Peel, cut small, 12.5 grammes; Lemon Peel, cut small, 25.0 grammes; Distilled Water, boiling, 1000.0 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

The National Formulary IV introduced compound infusion of gentian which differs very slightly from that official in the U. S. P. 1870. (See *N.F.*, Part III.)

It has been the custom with some physicians to prescribe a concentrated infusion made with one-fourth the quantity of menstruum directed by the formula of U. S. P. 1870. This permits the use of a valuable tonic with the presence of but a trifling amount of alcohol. This concentrated preparation keeps well, and it may be diluted with the right quantity of the proper menstruum by the pharmacist to make the infusion of U. S. P. 1870. The use of the alcohol is to assist in dissolving the bitter principle, and at the same time to contribute towards the preservation of the infusion, which, without this addition, is very prone to spoil. The alcohol has, however, been abandoned by the British Pharmacopoeia, and lemon peel substituted.

Dose, one fluidounce (30 mils), repeated three or four times a day.

INFUSUM KRAMERIAE. Br.

INFUSION OF KRAMERIA

Infusion of Rhatany; Tisane de Ratanhia, *Fr.*; Ratanhia-wurzelaufguss, *G.*

"Krameria Root, bruised, 50 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

The *infusion of rhatany* is undoubtedly most efficient when prepared from the root in a state of moderately coarse powder by the mode of percolation with cold water, as directed in the U. S. process of 1870.

Dose, of the infusion, from one to two fluid-ounces (30-60 mls).

INFUSUM QUASSIA. Br.

INFUSION OF QUASSIA

Tisane de Quassie, *Fr.*; Quassiaaufguss, *G.*; Infusion de cuasia amarga, *Sp.*

"Quassia Wood, rasped, 10 grammes; Distilled Water, cold, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain." *Br.*

Boiling water may be employed when it is desirable to obtain the preparation quickly, but cold water affords a clearer infusion. The fifteen minutes maceration directed in the British Pharmacopoeia, considering that cold water is used, appears to us to be too short for the exhaustion of the wood.

Dose, two fluidounces (60 mls), three or four times a day.

INFUSUM RHEI. Br.

INFUSION OF RHUBARB

Tisane de Rhubarba, *Fr.*; Rhabarberaufguss, *G.*; Infuso di rabarbaro, *It.*; Infusion de ruibarbo, *Sp.*

"Rhubarb, in thin slices, 50 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

In order that the rhubarb may be exhausted, it should be digested with

the water near the source of heat, at a temperature somewhat less than that of boiling water. It is customary to add some aromatic, such as cardamom, fennel seed, or nutmeg, which improves the taste of the infusion and renders it more acceptable to the stomach. One drachm of either of these spices may be digested in connection with the rhubarb.

This infusion may be given as a laxative, and is occasionally used as a vehicle for tonic, antacid, or more active cathartic medicines. The stronger acids and most metallic solutions are incompatible with it.

Dose, one to two fluidounces (30-60 mils).

INFUSUM ROSAE ACIDUM. Br.

ACID INFUSION OF ROSES

Infusum Rosae Compositum, *N. F.*; Compound Infusion of Rose; Acid Infusion of Rose; Tisane de Rose composee, *Fr*; Saurer Rosenaufguss, *G*.

"Red-Rose Petals, dried and broken, 25.0 grammes; Diluted Sulphuric Acid, 12.5 mililitres; Distilled Water, boiling, 1000.0 millilitres. Add the Diluted Sulphuric Acid to the Distilled Water; infuse the Red-Rose Petals in the mixture in a covered vessel for fifteen minutes; strain while hot." *Br*.

The formula of the U. S. P. 1870 is preferable to that of the Br. Pharm. on account of the presence of sugar. It is unfortunate, in our opinion, that this elegant infusion was not reinstated at the last revision of the U. S. Pharmacopoeia. We append the formula of the U. S. P. 1870: "Take of Red Rose [dried petals] half a troyounce; Diluted Sulphuric Acid three fluidrachms; Sugar [refined], in coarse powder, a troyounce and a half; Boiling Water two pints and a half. Pour the Water upon the Rose in a covered glass or porcelain vessel; add the Acid, and macerate for half an hour. Lastly, dissolve the Sugar in the liquid, and strain." U. S. The process for this infusion in the N. F. IV is practically the same. (See Part III.)

The red rose serves little other purpose than to impart a fine red color and a slight rose and astringent flavor to the preparation, which owes its medicinal virtues almost exclusively to the sulphuric acid. According to J. B. Barnes, one part of glycerin added to eight or nine parts of

infusion of rose increases greatly its brightness and transparency. It is refrigerant and astringent, and affords a useful and not unpleasant drink in hemorrhages and colliquative sweats. It is much used by British practitioners as a vehicle for saline medicines, particularly magnesium sulphate, the taste of which it serves to cover. It is also employed as a gargle, usually in connection with acids, nitre, alum, or tincture of Cayenne pepper. Dose, two fluidounces (60 mils).

INFUSUM SCOPARII. Br.

INFUSION OF BROOM

Tisane de Genet a balais, *Fr.*; Besenginsteraufguss, *G.*

"Broom Tops, dried and bruised, 100 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

This preparation has been introduced in place of the Decoction of Broom of the British Pharmacopoeia of 1885. Water thoroughly extracts the virtues of broom, and the large quantity of water in each dose aids the diuretic action.

Dose, from one to two fluidounces (30-60 mils).

INFUSUM SENEGA. Br.

INFUSION OF SENEGA

Tisane de Polygale de Virginie, *Fr.*; Senegaaufguss, *G.*

" Senega Root, in No. 10 powder, 50 grammes;

Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for half an hour; strain while hot." *Br.*

Dose, one fluidounce (30 mils).

INFUSUM SENNAE. Br.

INFUSION OF SENNA

Senna Tea; Tisane de Sene, *Fr.*; Sennaufguss, *G.*

"Senna Leaves, 100 grammes; Ginger, sliced, 5 grammes; Distilled Water, boiling, 1000 millii-litres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

We prefer the coriander of the U. S. P. 1870 to the ginger of the British. The infusion deposits, on exposure to the air, a yellowish precipitate, which is said to aggravate its griping tendency; it should, therefore, not be made in large quantities. It is customary to prescribe with it manna and some one of the saline cathartics, which increase its efficacy and render it less painful in its operation. (*See Infusum Sennae Compositum.*) The cold infusion, especially if made by percolation from the coarsely powdered leaves, while probably not inferior in strength to that prepared with boiling water, is said to be less unpleasant to the taste.

Dose, two fluidounces (60 mils).

Off. Prep.—Mistura Sennae Composita, *Br.*

INFUSUM SENNAE COMPOSITUM. U. S.

COMPOUND INFUSION OF SENNA *Inf. Senn. Co.*

Tisane de Sene composee, *Fr.*; Infusum Sennae Compositum, *P. G.*; Wiener Trank, Sennaufguss, *G.*; Infuso di sena con manna, *It.*

"Senna, sixty grammes [or 2 ounces av., 51 grains]; Manna, one hundred and twenty grammes [or 4 ounces av., 102 grains]; Magnesium Sulphate, one hundred and twenty grammes [or 4 ounces av., 102 grains]; Fennel, bruised, twenty grammes [or 309 grains] ; Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6½ fluidrachms]. Pour eight hundred mils [or 27 fluid-ounces, 24 minims] of boiling water upon the senna, manna, and fennel contained in a suitable vessel, and allow the mixture to macerate for half an hour. Then strain, express and dissolve the magnesium sulphate in the Infusion, and again strain. Lastly, add enough water through the strainer to make the Infusion measure one thousand mils [or 33 fluidounces, 6½ fluidrachms]. This preparation must not be dispensed

unless it has been recently prepared." U. S. (See *Mistura Sennae Composita, Br.*)

This preparation is used in Europe and to some extent in this country. The synonym, "*Black Draught*" has been deleted from the U. S. P. IX because of the similarity in name to "*Black Drop*" (*Acetum Opii*), death having resulted through the confusion in names. The taste is bitter and nauseous and the infusion is now rarely employed.

Dose, four fluidounces (120 mils).

INFUSUM UVAE URSI. Br.

INFUSION OF BEARBERRY

Tisane d'Uva Ursi, *Fr.*; Barentraubenblatteraufguss, *G.*

"Bearberry Leaves, bruised, 50 grammes; Distilled Water, boiling, 1000 millilitres. Infuse in a covered vessel for fifteen minutes; strain while hot." *Br.*

Dose, from one to two fluidounces (30-60 mils), three or four times a day.

Insect Powder. *Camomille de Perse, Fr. Persische Bertramblumen, G. Pyrethri Flores.*—The unexpanded or partly expanded flower-heads of several species of *Chrysanthemum* (Fam. *Compositae*). There are two principal commercial varieties: (1) the Dalmatian insect powder which is obtained from *Chrysanthemum cinerariifolium* (Trev.) Bocc., a perennial herb indigenous to Dalmatia and cultivated in the United States. (2) The Persian insect powder is obtained from the flowers of *C. roseum* Web. et Nohr and *C. Marschallii* Aschers, herbs growing in the Caucasus, Armenia and Northern Persia. The flowers are collected from plants that are from two to six years old, carefully dried and preserved. The most powerful insect powder is obtained from the closed or only partly expanded flowers providing they are properly dried and preserved.

Dalmatian Flowers.—"The heads are hemispherical, about 12 mm. in diameter, and consist of a conical torus subtended by a straw-colored involucre and bearing upon the receptacle numerous yellow tubular flowers and a circle of cream-colored ray flowers. The latter are pistillate, the corolla being from 1 to 2 cm. in length, having about 15 delicately veined and 3 short, obtuse or rounded teeth.

Persian Flowers.—"The heads are flattened top-shaped; the involucre scales are greenish-brown; the ray florets are reddish-brown or reddish-purple, attaining a length

of 15 mm., being somewhat plicate and having 7 veins. The disc florets are tubular and yellow.

For details as to the special anatomical character of these flowers, see *P. J.*, Ixvii, 474; also *J. P. C.*, 1902, xv, 409.

C. cinerariaefolium is now being cultivated on a large scale in California, and as more care is given to the preservation during drying of the color and of the volatile oil than in Dalmatia, the California product which is known by the name of *buhach* is said to be superior to the foreign drug. (*C. D.*, August, 1889; see also for method of cultivation, *Reports of the Fourth U. S. Entomological Commission*, 1885, and papers by Seidler, *Riedel's Berichte*, 1913, and Juttner, *Ph. Ztg.*, 1912, 817.)

The insect powder of commerce varies in color from yellow, yellowish-brown, or brownish-yellow to yellowish-green, the finer qualities verging towards brown and the poorer towards green. Brilliant yellow powder should be viewed with suspicion. On microscopical examination of an insect powder, it will be found to consist of fragments of involucre scales composed of sclerenchyma, perhaps bits of stems composed of collenchymatous cells, pollen grains, fragments of the corolla and of its epidermis and papillae. The absence or scarcity of pollen in the powder shows the absence or scarcity of the flowers in the drug, while the proportion of collenchymatous tissue indicates the proportion of stems. As the activity of the insect powder resides in the flower, specimens containing little of the flowers or much of the stems should be rejected. The powder yielded by the Dalmatian plant can usually be distinguished from Persian insect powder by the following characters. The outer surface and edges of the scales of the Dalmatian flowers contain numerous hairs, consisting of a long cell with attenuated ends placed horizontally upon a one- to three-celled stalk. The Persian flowers are almost entirely glabrous, a white hoariness being found only at and near the base of the scales, and very few hairs near the apex; the hairs are of the same structure as the preceding, only the terminal cell being much longer. Sclerenchymatous cells are much more numerous in the Persian than in the Dalmatian. The so-called *Hungarian* or *Russian daisy*, probably a species of the subgenus *Leucanthemum*, was at one time used as an adulterant. The importance of the adulteration is increased by the fact that the Hungarian daisy appears to be entirely free from insecticidal properties. The Hungarian daisy is distinguished from the true *Pyrethrum* by the orange-yellow disk florets, by the depression of the involucre, by its prominent dark receptacle, and by the absence of pubescence and pappus. The odor is less pungent than that of the true insect flower, being more like that of *matricaria*. The difference in odor is more pronounced on infusing in warm water. The Hungarian daisy yields a powder somewhat darker in color than true insect powder. Microscopically, the Hungarian or Russian daisy differs only in the absence from the involucre and stems of the peculiar hairs seen on the scales of the true insect powder, and the presence in their place of certain hairs, consisting of from four to ten cells, and terminating with a much elongated, thin-walled, or inflated cell. There seems to be no recognizable difference between the pollen of the two plants which yield insect powder and of the Hungarian daisy. The presence of quassia, fustic, turmeric, and other adulterants may be made out by the aid of the microscope, and chrome yellow chemically, but the powder of Hungarian daisy cannot be detected

microscopically. According to George R. Durrant, however, the Hungarian powder yields 10 per cent. of ash, whereas true insect powder yields but 6.5 per cent. F. Dietze, after careful study, found that the best method of valuation of insect powder is based on the amount, appearance and odor of the extract obtainable by the use of petroleum spirits boiling under 55° C. (131° P.). With such menstruum true insect powder affords a bright yellow percolate possessing the odor peculiar to the drug. (See *P. J.*, 1905, 902; also 1906, 891; *Ph. Ztg.*, 1905, 871.)

E. H. Gane, 1910, reports that insect powder is adulterated with ground stems and not ground from flowers only, as it should be. One sample from one of the largest pharmaceutical manufacturing houses was composed wholly of ground stems.

Insect powder does not appear to be actively poisonous to man, though it is said to cause some confusion of mind in those who sleep in close apartments where much of it is used. Upon the insects, however, which are apt to infest the person of man and animals, as well as bedding and sleeping apartments, it acts very destructively, first stupefying and then killing them. It is scattered over the person, upon the beds, about apartments, etc., and is even employed as a dressing for ulcers and wounds to prevent the formation of maggots. It also answers for preserving dried insects and plants in cabinet collections. The powder, exhausted by alcohol, is harmless to insects. The activity of insect powder is due to a toxic principle called *pyrethron*, and an amber-yellow syrupy substance which is the ester of certain unidentified species. The flowers also contain 0.5 per cent. of a volatile oil and from 4 to 7 per cent. of several resins. (Fujitani, *Arch. f. exper. Path. u. Pharmak.*, 1909, 61, 47, and *Chem. Zentralblatt*, 1909, 80, ii, 1153.) The ash content varies from 5 per cent. to 8.3 per cent. In a series of experiments, Riley has found that the fumes of the burning powder are very poisonous to insects, and for certain purposes afford a ready mode of application, but that generally an aqueous infusion is the best and cheapest preparation. It is also used now in the form of cones made by making a mass with mucilage of gum arabic, with the addition of a small quantity of potassium nitrate. After drying these are ignited like a fumigating pastile. Twenty-five grains stirred up in two quarts of water were sufficient to kill young cotton worms. The infusion soon spoils. The tincture and the alcoholic extract are both efficient preparations. The tincture (one part to four) has been especially recommended, diluted with ten times its bulk of water, by F. Jager, to keep off vermin from the human body. According to Maisch (*A. J. P.*, 1869, 128), it is capable of causing a vesicular eruption like that produced by the poison ivy.

Insindiyandiya.—This substance, a remedy of the Kaffir doctors of South Africa, is a violent poison, and has been shown by E. M. Holmes to be derived from a *Bersama*, apparently identical with *B. abyssinica* Fresen. (*P. J.*, Ixxiii, 893.)

Inula. *N. F. IV* (*U. S. P.* 1890). *Inula Elecampane*. *Aunee*, Fr. *Alantwurz*, Gr. *Enula Campana*, It., Sp. *U. S.* 1890.—"The dried rhizome and roots of *Inula Helenium* Linne (Fam. *Compositae*), without the presence of more than 5 per cent. of its stem bases or other foreign matter." *N. F. IV*.

Inula Helenium is a stout, perennial herb naturalized from Europe and growing along roadsides and damp pastures from Nova Scotia to North Carolina and westward as far as Missouri. The rhizome and roots are used in medicine. The N. F. description is as follows: "Rhizome usually split into longitudinal or more or less oblique pieces to which may be attached one or more of the roots; up to 8 cm. in length and 4 cm. in diameter; externally grayish-brown to dark brown, longitudinally wrinkled with occasional buds or stem scars and surmounted at the crown by a portion of the overground stem; inner or cut surface somewhat concave, the edges incurved with the overlapping bark, yellowish-brown to grayish-brown, longitudinally striate and more or less fibrous near the cambium zone; fracture short and horny; inner surface light brown and marked by numerous circular or elliptical oleoresinous canals; roots cylindrical and tapering, frequently curved or irregularly curled, up to 13 cm. in length and 1.5 cm. in diameter. Odor aromatic; taste acrid, bitter and pungent. Transverse sections under the microscope show a corky layer of from four to seven rows of broad tabular cells; a cortex of numerous parenchyma cells containing inulin in irregular or fan-shaped masses and a number of large, intercellular, oleoresinous reservoirs arranged in nearly radial rows and forming interrupted circles; woody portion consisting chiefly of parenchyma, a number of tracheae with simple pores of reticulate thickenings and associated occasionally with a few, strongly lignified wood fibers, and oleoresinous reservoirs similar to those occurring in the bark; parenchyma cells in the pith of the rhizome large, containing less inulin than the cells of the wood and bark and separated by large intercellular spaces. The powder is light brown; consisting chiefly of fragments of parenchyma containing inulin and small, irregular, separated masses of inulin; tracheae with simple pores and reticulate thickenings associated occasionally with strongly lignified wood fibers; occasional reddish-brown fragments of the walls of the oleoresinous canals. Inula yields not more than 10 per cent. of ash." N. F. A peculiar principle, resembling starch, was discovered in elecampane by Valentine Rose, of Berlin, in 1804, who named it *alantin*; but the title *inulin*, proposed by Thompson, has been generally adopted. It differs from starch in being deposited unchanged from its solution in boiling water when the liquor cools, and in giving a yellowish instead of a blue color with iodine. It has been found in the roots of several other plants. It may be obtained white and pure by precipitating a concentrated decoction with twice its volume of alcohol, dissolving the precipitate in a little distilled water, treating the solution with purified animal charcoal, and again precipitating with alcohol. (A. J. P., xxxi, 69.) It readily dissolves in about three parts of boiling water; the levogyre solution is perfectly clear and fluid, not paste-like, but on cooling deposits nearly all the inulin. Its formula, according to Kiliani (Tollens, *Handbuch der Kohlenhydrate*, 1888, p. 202), is $3C_{12}H_{20}O_{10} + H_2O$. On prolonged heating with water, more rapidly under the influence of dilute acids, it is changed into levulose and reduces Fehling's solution. As in the case of starch, intermediate products can be obtained before it is completely changed into reducing sugar. Dragendorff obtained by heating with water for ten hours *metinulin*, and by heating for forty to fifty hours *levulin*, an optically inactive amorphous substance easily changing into *levulose*. Tanret, who has since investigated inulin (J. P. C., 27, 449), confirms Kiliani's formula as given above. He finds associated with inulin two closely related principles: pseudo-inulin and inulenin. The first of these, to which the formula $(C_6H_{10}O_5)_n$ is given, forms irregular granules, very soluble in water and weak

alcohol while hot, but only slightly soluble in cold water, and insoluble' in cold alcohol; the second is given the formula $(C_6H_{10}O_5)_{10} \cdot 2H_2O$, and forms microscopical needles slightly soluble in cold water and weak alcohol. The amount of inulin varies according to the season, but is most abundant in autumn. Dragendorff obtained from the root in October not less than 44 per cent., but in spring only 19 per cent. A crystallizable substance was long since noticed to collect in the head of the receiver when the elecampane root is submitted to distillation with water. Similar crystals may also be observed after carefully heating a thin slice of the root, and are even found as a natural efflorescence on the surface of a root that has been long kept. They can be extracted from the root by means of alcohol, and precipitated with water. Kallen (*Ber. d. Chem Ges.*, 1873, 1876) has found that these crystals consist chiefly of the anhydride, $C_{15}H_{20}O_2$, of *alantonic acid*, melting at $66^\circ C.$ ($150.8^\circ F.$), and that what was formerly known as *helenin* was a mixture of these with a liquid, *alantol*, $C_{10}H_{16}O$, boiling at $200^\circ C.$ ($392^\circ F.$), the true *helenin* and *alant camphor*. The crystals of *helenin*, C_6H_8O , have a bitterish taste, but no odor, and melt at $110^\circ C.$ ($230^\circ F.$). The camphor melts at $64^\circ C.$ ($147.2^\circ F.$), and in taste and odor is suggestive of peppermint.

Korab (*L. L.*, vol. i, 1885, p. 672) states that helenin is a powerful antiseptic and bactericide, one part in ten thousand of urine being sufficient to arrest putrefaction, and a few drops of a solution of this strength immediately killing the ordinary bacterial organisms, including the tubercle bacillus. He lauds it as antiseptic in surgery and has given it with alleged success internally in doses of one-third to one grain (0.021-0.065 Gm.) in tubercular and catarrhal *diarrheas*. It is also stated by J. B. Obiol (*L. L.*, April, 1886) to be an efficient local remedy in the treatment of *diphtheria*. Every four hours the false membrane is to be dusted over with powdered camphor, and then painted with a two per cent. solution of helenin in oil of sweet almond. It is affirmed that when the treatment was commenced on the first day of the patches the cure followed in twenty-four hours. Bockenham (*Th. M.*, 1892, p. 145) asserts that helenin inhibits the growth of tubercle bacilli in the dilution of 1 in 10,000 and it has been employed by various writers in the treatment of *pulmonary tuberculosis* in doses of from one-sixth to five grains (0.01-0.32 Gm.). Helenin was also given internally. *Dose*, one and a half grains (0.096 Gm.) to children six years of age.

Elecampane is tonic and gently stimulant, and was employed by the ancients in *amenorrhoea* and other diseases of women, also in *phthisis*, in dropsies, and in *skin affections*, in all of which diseases it was probably of no service. It has been given in powder, in the *dose* of twenty grains to one drachm (1.3-3.9 Gm.), or as a *decoction* (half ounce to the pint) in doses of one to two fluidounces (30-60 mls).

IPECACUANHA. U. S. (Br.)

IPECAC Ipecac. [Ipecacuanha; radix P. I.]

"The dried- root of *Cephaelis Ipecacuanha* (Brotero) A. Richard, known in commerce as Rio Ipecac, or of *Cephaelis acuminata* Karsten, known

in commerce as Cartagena Ipecac (Fam. *Rubiaceae*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter and yielding not less than 1.75 per cent. of the ether-soluble alkaloids of Ipecac." U. S. "Ipecacuanha Root is the dried root of *Psychotria Ipecacuanha*, Stokes." Br.

Ipecacuanhas Radix, Br., Ipecacuanha Root; Poaya, *Braz.* Ipecacuanha annee' ou officinale, *Fr. Cod.*; Racine bresilienne, *Fr.*; Radix Ipecacuanha, *P. G.*; Ruhrwurz, Brechwurz, Ipecacuanha, *G.*; Ipecacuana, *It.*; Ipecacuana (Raiz de), *Sp.*

The term *ipecacuanha*, derived from the language of the aborigines of Brazil, has been applied to various emetic roots of South American origin. The botanical character of the ipecac plant of commerce was long unknown. At the present time the plant is well known, but there is considerable conflict regarding the proper botanical name to designate it. The several Pharmacopoeias differ from each other in the generic names used, and hence there may be some confusion. The U. S. Pharmacopoeia wisely retains the generic name *Cephaelis*, this having been recognized for years in this country. The British Pharmacopoeia uses the generic name *Psychotria*, which practice has been followed in that country for many years. The Swiss and German Pharmacopoeias follow Ehgler and Pranti, and use the generic name *Uragoga*. The latter is probably correct, but in view of the unstability of this subject, particularly as other generic names have been proposed and may even supersede all of these it is wise to adhere to the old name *Cephaelis*, thus causing no confusion.

Cephaelis Ipecacuanha is a small shrubby plant, with a slender root from four to six inches long, marked with annular rugae, simple or somewhat branched, descending obliquely into the ground, and here and there sending forth slender fibrils. The stem is two or three feet long, but, being partly under ground, and often procumbent at the base, usually rises less than a foot in height. It is slender; in the lower portion leafless, smooth, brown or ash-colored, and knotted, with radicles frequently proceeding from the nodes; near the summit, pubescent, green, and furnished with leaves seldom exceeding six in number. These are opposite, petiolate, oblong-obovate, acute, entire, from three to four inches long, from one to two broad, obscurely green and somewhat rough on their upper surface, pale, downy, and veined on the under. At the insertion of each pair of leaves are deciduous stipules, embracing the stem, membranous at the base, and separated above into numerous bristle-like divisions. The flowers are small, white,

each accompanied with a green bract, and collected in a semi-globular head, supported upon a round, solitary, axillary footstalk, and embraced by a monophyllous involucre. The latter being deeply divided into four, sometimes five or six, obovate, pointed segments. The fruit is an ovate, obtuse berry, which is at first purple, but becomes almost black when ripe, and contains two small plano-convex seeds.

Cephaelis tomentosa, of Trinidad, has been studied by Francis Ransom, who finds that it contains emetine, but in too small quantity for commercial purposes. For description of the root, etc., see *P. J.*, xix, p. 258.

The Rio ipecac plant of Brazil flourishes in moist, thick, and shady woods, being most abundant within the limits of the eighth and twenty-second degrees of south latitude. It flowers in January and February, and ripens its fruit in May. The root is active in all seasons, but, as it has to be dried rapidly, collection during the rainy season is relaxed. The native collector, or *poayero*, seizes all the stems of a clump, loosens them by a zigzag motion, and then, thrusting a pointed stick under the roots, tears up the whole mass. The roots, freed from dirt by shaking, are then dried. The amount gathered daily varies from 8 to 30 pounds, according to skill and locality. Extirpation does not take place, because, as shown by the Edinburgh gardeners McNab and Lindsay, a very small fragment of the root, or even a petiole of a leaf, will rapidly produce a new plant. Weddell, indeed, many years since, stated that the remains of the root, often purposely left in the ground, serve the purpose of propagation, each fragment giving rise to a new plant. Ipecac of commerce comes chiefly from the interior province of Matto-Grosso, upon the upper waters of the Paraguay (from which in some years as much as 450,000 kilos are shipped), although some is said to be gathered near Philadelphia north of Rio Janeiro. The chief places of export are Rio Janeiro, Bahia, and Pernambuco. It is brought to the United States in large bags or bales. The importation into the United States have increased from 78,654 pounds in 1914 to 203,734 pounds in 1916.

UNOFFICIAL VARIETIES OF IPECAC.—From time to time there have been imported into Europe various drugs stated to be ipecac, but differing from the official drug. Of these the most important are White Ipecac; the Larger Striated Ipecac of Planchon (*J. P. C.*, Dec., 1872); and the Lesser Striated Ipecac of Planchon.

Larger Striated Ipecac (Planchon). *Violet Striated Ipecac*. *Ipecac of St. Martha*. *Ipecac of Carthagen*. *Striated Elastic Ipecac* (Attfield).—This variety of ipecac is generally acknowledged to be the product of *Psychotria emetica* L., growing in the deep forests of Colombia. The drug occurs in rather long fragments, sometimes 9 or 10 cm., with a thickness of from 5 to 9 mm. The pieces are for the most part almost straight, sometimes sinuous, more rarely tortuous. At distant intervals they are marked by contractions, or circular furrows. Their whole surface is largely striated longitudinally. To their upper part are often attached one or more remaining portions of the stem, distinguished from the root by their much smoother surface. Their color is a grayish-brown, tending sometimes to reddish-brown. Like other ipecacs, they have an outer cortical and a central ligneous portion. The former is soft, so that it may even be penetrated by the nail. It has a horny aspect, and a variable color, passing from whitish, by shades of rose, violaceous, and blackish violet. Its thickness is at least two-thirds of the root, and becomes still greater when this is immersed in water. The central part is yellowish-white. The root has little odor, and a taste scarcely nauseous, sometimes flat, and often sweetish. As to the microscopic characters, the most striking are probably the total absence of the starch granules, and the relatively very small diameter of the vessels in the central part. Chemically this variety is characterized by the presence of 'sugar. It also contains 0.027 per cent. of emetine.

Lesser Striated Ipecac (Planchon). *Ipecac des Cotes d'Or* (Pelletier). *Black Ipecac*. *Black Striated Ipecac*. *Striated Brittle Ipecac* (Attfield). *False Ipecac* (Holmes).—It is probably obtained from a species of *Richardsonia*. It occurs in very short fragments, 2 or 3 cm. long, and 2 or 3 mm. in thickness; some nearly cylindrical, others narrowly fusiform; others again formed of roundish or pyriform segments, somewhat thicker than the preceding, placed end to end. The color is generally of a gray-brown, darker than that of the other kind. The longitudinal striae are fine, and regular on the transverse section. The cortical portion is horny, and its consistence firmer than in the larger kind; the wood is yellowish, and porous. The presence of the starch granules is another of the distinguishing characters of this variety. It contains a larger proportion of emetine than the preceding, yielding, according to the analysis of Pelletier, 9 per cent.

White Ipecac is obtained from *Ionidium Ipecacuanha* St. Hil. (fam.

Violaceae). It is obtained from Brazil. The root is much branched, free from annulations and of a grayish-white or light brownish-yellow color. The bark is very thin and the wood is light-yellow and porous. It is distinguished by the presence of stone cells and freedom from starch. It contains inulin and no emetine.

According to Pelletier, 100 parts contain 5 of an emetic substance, 35 of gum, 1 of nitrogenous matter, and 37 of lignin. (*Histoire abregee des Drogues simples*, i, 514.)

The root of a species of *Ionidium* growing in Quito has attracted some attention as a remedy in *elephantiasis*, under the South American name of *cuichunchulli*. The plant received from Bancroft the name of *I. Marcucci*; but Hooker found the specimen received from Bancroft to be the *I. parviflorum* of Ventenat.

Lindley thinks a specimen he received under the same name from Quito to be the *I. microphyllum* of Humboldt. If useful in elephantiasis, it is so probably by its emeto-purgative action. (See *A. J. P.*, vii, 186.)

Under the name of *East Indian Ipecac* there has appeared in the London markets a root of a pale pinkish-brown color, tapering rapidly from the base to the apex, and having annulations much closer than in the true ipecac. It is especially distinguished from the latter root by being evidently monocotyledonous—that is, without the central woody column—the vascular bundles appearing under a pocket lens as a more or less irregular ring of brownish dots. R. A. Cripp obtained from it a minute quantity of an alka-loidal substance, certainly distinct from the alkaloids of ipecac. (*P. J.*, Iv.) Ranwez and Campion have also described a false ipecac derived from a monocotyledonous plant, *Cryptocoryne spiralis*. (*Ann. Pharm.*, i.)

In 1866 the cultivation of ipecac was introduced into India by King, but it was not until twenty years later (1886), when it was found that ipecac flourished in the Straits Settlements equally as well as in the Province of Minas, Brazil, that its cultivation became successful.

Cephaelis acuminata Karsten is the source of the drug of commerce known as *Cartagena*, *Panama*, or *Savanilla Ipecac*. The plant is indigenous to Colombia. The leaves according to Karsten are elliptical, pointed, the stipules being separated, often almost to their base in a

subulate fringe. The root is much larger and the percentage of active constituents is different from that of Rio ipecac. Humboldt considered *C. acuminata* merely as a different geographical form of *C. Ipecacuanha*. Owing to the scarcity of Rio ipecac the importations of the Cartagena variety is considerable, at times being the only form obtainable. It was for this reason that it was included in the U. S. Pharmacopoeia. Braun discussed the subject of the cultivation of ipecac (*Der Pflanze*, Tanga, i, p. 50) and commented on the available varieties to be selected and the best methods for collecting and treating the drug. Derry states (*C. D.*, lxxx, p. 822) that when established it grows well on virgin soils or where there is a depth of vegetable humus and the situation is moist and shady, but the properties, of the root deteriorate with continued cultivation.

Properties.—Rio ipecac is in pieces 2.4 to 4 mm. thick, variously bent and contorted, simple or branched, consisting of an interior slender, light straw-colored, ligneous cord, with a thick, brittle, brownish, finely wrinkled, cortical covering, which presents on its surface a succession of circular, unequal, prominent rings or rugae, separated by very narrow fissures, frequently extending nearly down to the central fiber. This appearance of the surface has given rise to the term *annele*, or *annulated*, by which the true ipecac is designated by French pharmacists. The cortex is hard, horny, and semi-transparent, breaks with a resinous fracture, and easily separates from the tougher ligneous fiber, which possesses the medicinal virtues of the root in a much inferior degree. On microscopic examination the very thick bark is seen to be formed of uniform parenchymatous cells, without traces of the medullary rays, which are very distinct in the woody central cylinder. Attached to the root is frequently a smoother and more slender portion, which is the base of the stem, and should be separated before pulverization. Pereira has met, in the English market, with distinct bales composed of these fragments of stems, with occasionally portions of the root attached. Much stress has been laid upon the color of the external surface of the ipecac root, and diversity in this respect has even led to the formation of distinct varieties. Thus, the epidermis is sometimes deep brown or even blackish, sometimes reddish-brown or reddish-gray, and sometimes light gray or ash-colored; hence the varieties of ipecac root which were formerly recognized, the *brown*, *red* and *gray*. It is now known that the color of the root varies according to the circumstances of growth and soil, so that coloration as the basis of classification has been abandoned, and the ipecacs of commerce are

divided according to their geographical sources, into the *Brazilian* or *Rio Ipecac*, the *Cartagena* or *Colombia Ipecac*, and the *Johore* or *Indian Ipecac*; of these, the two varieties which are recognized by the U. S. Pharmacopoeia are described as follows: "*Rio Ipecac*.—In cylindrical pieces, curved, and sharply flexuous, occasionally branched, from 3 to 15 cm. in length and from 2.4 to 4 mm. in thickness; externally dark brown, closely annulated, with thickened, incomplete rings, and usually exhibiting transverse fissures with vertical sides; fracture of bark short, of wood tough, bark very thick, light brown, easily separable from the yellowish-white wood; odor very slight, distinctive, the dust sternutatory; taste bitter and nauseous, somewhat acrid. Stems cylindrical, attaining a length of 10 cm. and a thickness of 2 mm., dark brown, finely longitudinally wrinkled and with a few elliptical scars. *Cartagena Ipecac*.—Cylindrical or slenderly fusiform, more or less tortuous, from 3 to 12 cm. in length and from 4 to 6.5 mm. in thickness; externally grayish-brown, the annulations usually not so numerous as in Rio Ipecac, occasionally transversely fissured and with circular scars of roots; bark 2 mm. in thickness, dark brown, smooth, somewhat horny, and easily separable from the light brown wood. Stems attaining a length of 10 cm. and a thickness of from 2 to 3 mm., cylindrical, somewhat zigzag, due to the prominent nodes with their elliptical stem-scars, grayish or dark brown and longitudinally wrinkled; bark thin. The powder from both varieties of Ipecac is light brown; starch grains numerous, single or from 2- to 4- or more compound, the individual grains spherical or polygonal, from 0.003 to 0.017 mm. in diameter; calcium oxalate in raphides, from 0.015 to 0.04 mm. in length, few; tracheids with bordered pores and oblique slit-like pores. The stem bark shows a few, slightly elongated stone cells, from 0.03 to 0.045 mm. in length with thick lignified walls and simple branching pores. Ipecac yields not less than 1.8 per cent. nor more than 4.5 per cent. of ash." U. S.

“In somewhat tortuous pieces seldom more than fifteen centimeters long or six millimetres thick; from dark brick-red to very dark brown; closely annulated externally, the annulations not taking the form of narrow ridges partially encircling the root (distinction from Cartagena ipecacuanha). Fracture short, the fractured surface exhibiting a thick greyish bark and small dense wood. Bark consisting of thin' walled parenchymatous cells, some containing slender raphides, but most filled with simple or compound starch grains, the simple seldom exceeding fifteen microns in length; wood consisting chiefly of tracheids and

containing no vessels or typical medullary rays. In the powdered Root, thin-walled parenchymatous tissue, abundant simple or compound starch grains, the single grains seldom exceeding 15 microns in diameter, acicular calcium oxalate crystals, fragments of brown cork, lignified tracheids and wood-parenchyma; but not more than a very occasional vessel or strongly thickened sclerenchymatous cell. Slight odor; taste bitter. Ash not more than 5 per cent. Yields not less than 2 per cent. of alkaloids when tested by the following process." *Br.*

(Six pages of painful Ipecac pharmaceutical minutae deleted)

Uses.—Ipecac was employed as an emetic by the natives of Brazil when that country was first settled by the Portuguese, but, though described in the work of Piso, it was not known in Europe until 1672, and did not come into use until some years afterwards. John Helvetius, grandfather of the famous author of that name, having been associated with a merchant who had imported a large quantity of ipecac into Paris, employed it as a secret remedy, and with so much success in dysentery and other bowel affections that general attention was drawn to it, and the fortunate physician received from Louis XIV a large sum of money and public honors on the condition that he should make it public.

Ipecac is in large doses emetic, in smaller doses, diaphoretic and expectorant, and in still smaller, stimulant to the stomach, exciting appetite and facilitating digestion. In quantities not quite sufficient to cause vomiting, it produces nausea, and frequently acts on the bowels. As an emetic it is mild, but tolerably certain, and free from corrosive or narcotic properties. The emetic effect seems to be due partly to the local irritant effect of the drug upon the mucous membrane of the stomach, although the experiments of Hatcher show that there is some direct stimulant action upon the vomiting center in the medulla. Of the two alkaloids to which the drug owes its activity it would seem from the experiments of Wild (*L. L.*, 1895, ii, p. 1274) that cephaeline is much more active as an emetic than emetine, although the latter is capable, in sufficient dose, of causing vomiting. Because of the promptness with which the emesis occurs it is scarcely possible for enough of the active principles to be absorbed from the stomach to produce direct systemic effects. When injected subcutaneously or intravenously in large dose, however, the alkaloids act as depressants to the motor side of the spinal cord and probably also to the respiratory center. It would seem that they have some special predilection for the lungs for after toxic doses

alternating areas of pallor and intense hyperemia have been found in the pulmonary tissue.

Originally introduced into Europe as a remedy for *dysentery*, ipecac for centuries was alternately lauded as a specific and condemned as useless in this disease. In 1911 Vedder (*Bull. Manila Med. Soc.*, March, 1911; also *J. A. M. A.*; 1914, Ixii, p. 501) showed that an infusion of ipecac representing one part of the drug in ten thousand destroyed the viability of the *En-tamcebfe*; and that the alkaloid emetine in a one to one-hundred thousand solution had the same effect. He also showed that the drug was possessed of no bactericidal virtues. Since this research reasons for the diversions of opinion as to the usefulness of ipecac are apparent. There are two types of dysentery, one due to a specific amoeba and the other caused by a bacillus. In the latter form of the disease the drug is useless but is probably the most efficacious remedy we possess in the amoebic type of dysentery. The great difficulty in its employment has always been to obviate the emetic effect which sometimes made it almost impossible to get enough of the drug into the intestinal tract to have an effect. In 1912 Rodgers (*B. M. J.*, 1912, i, p. 1424, and ii, p. 405) introduced the hypodermic administration of the alkaloid emetine which has since then become the standard treatment of *amoebic dysentery*. For this purpose from one to three grains of the emetine hydrochloride (0.065-0.2 Gm.) should be injected daily; preferably divided into two or three doses. The treatment is also of value in the various sequelae of dysentery, such as *abscess of the liver*, although it does not always produce complete cures. In 1914 Smith and Barrett (*J. A. M. A.*, 1914, Ixiii, p. 1746) brought forward evidence that *pyorrhoea alveolaris*, or *Rigg's disease*, is due to a specific amoeba, and suggested the use of emetine in its treatment. Their discovery has been confirmed by Bass and Johns (*J. A. M. A.*, 1915, Ixiv, p. 553) and others. Smith and Barrett recommended the direct application of a 1 per cent. solution directly to the pus pockets but Bass and Johns prefer the hypodermic administration.

As an emetic ipecac is rarely used merely for the purpose of evacuating the stomach, but when an action upon the portal circulation is desirable, as in the so-called *biliousness* or *acute alcoholism*, it is often of service. Many clinicians believe that it has a direct influence upon hepatic secretion, but it is more probable that its effects upon the liver are due simply to its emetic action. By virtue of their nauseating effect small doses of ipecac tend to increase various secretions of the body, thus it is

widely used as a diaphoretic, especially in combination with opium (see *Pulvis Ipecacuanhae et Opii*) in the early stages of *acute coryza* and other mild infections. In the same way it acts as an expectorant, and in the early stages of *acute bronchitis* it is one of the most valuable remedies we possess. Many years ago Trousseau affirmed that ipecac possessed valuable hemostatic powers, especially useful in *hemoptysis*, but this use of it failed to receive general recognition. The treatment has been revived by Flandin (*Press. Med.*, 1913) and other French clinicians.

As an emetic ipecac may be given in substance .in the dose of twenty to thirty grains (1.3-2.0 Gm.), repeated in fifteen to twenty minutes if necessary. As an expectorant the syrup is generally preferred. If ipecac itself is used in dysentery it should be given in doses of five grains every hour combined with opium to prevent vomiting. To obviate the nauseating effect of emetine when given by the mouth, Bass and Johns have used a combination with Lloyd's reagent.

Under the name of *riopan*, a preparation asserted to contain 50 per cent. of combined ceph-aleine and emetine has been introduced. This is marketed in the form of tablets each containing one-thirtieth of a grain (0.002 Gm.), which is stated to be equivalent to about a grain and a half of ipecac (0.096 Gm.).

Dose, emetic, twenty to thirty grains (1.3-2.0 Gm.); nauseating, two grains (0.13 Gm.); diaphoretic, one grain (0.065 Gm.); stomachic, one-fourth to one-half grain (0.016-0.032 Gm.).

Off. Prep.—Fluidextractum Ipecacuanhas, U. S. (*Br.*); Pilula Ipecacuanha cum Scilla, *Br.*; Pulvis Ipecacuanhas et Opii, U. S. (*Br.*); Syrupus Ipecacuanhae, U. S.; Trochiscus Ipecacuanhae, *Br.*; Trochiscus Morphines eh Ipecacuanhas, *Br.*; Vinum Ipecacuanhas (from Fluidextract), *Br. N. F.*; Mistura Rhei Composita (from Fluidextract), *N. F.*; Pilulae ad Prandium (Chapman's), *N. F.*; Pilulae Anti-dyspepticae, *N. F.*; Pilulae Laxativaa Compositae, *N. F.*; Pilulae Laxativae Post Partum, *N. F.*; Syrupus Aisari Compositus (from Fluidextract), *N. F.*; Syrupus Cimicifugae Compositus (from Fluidextract), *N. F.*; Syrupus Ipecacuanhae et Opii (from Tincture), *N. F.*; Tinctura Ipecacuanhas et Opii (from Fluidextraet), *N. F.*

IPOMOEAE RADIX. Br.

ORIZABA JALAP ROOT [Mexican Scammony Root]

" Orizaba Jalap Root is the dried root of *Ipomoea orizabensis*, Ledanois." *Br.*

Orizaba Root, Male Jalap, Light, Woody, or Fusiform Jalap; Jalap stalks; Purgo Macho (Mexican).

The genus *Ipomoea* (Fam. *Convolvulaceae*) comprises about 300 species of herbs and shrubs, some being erect, others prostrate, but very many climbing. They are remarkable for their showy flowers, as in *I. purpurea*, the common morning glory of the garden. Many of the species produce large tuberous roots which contain a drastic purgative resin. *Orizaba*, (also known as light or fusiform) *Jalap Root* has been recently introduced into the British Pharmacopoeia as a source of scammony resin. The plant yielding it (*Ipomoea orizabensis*) is indigenous to Mexico and produces a large, fusiform, more or less branching root attaining a length of 5 dm., yellow on its outer surface, milky-white within. The stem is cylindrical, slightly villous and climbing. The leaves are large, petiolate, cordate, acuminate and villous on the veins. The corolla is campanulate and reddish-purple. The capsule is 2-locular and one seeded.

The drug occurs in transverse slices of the root, or in pieces of irregular shape made by vertical section of these slices. The horizontal cut surface is dark from exposure, unequal from the greater shrinking in desiccation of some parts than others, and presents the extremities of numerous fibers, which are often concentrically arranged. Internally the color is grayish, and the texture, though much less compact than that of jalap, is sometimes almost ligneous.

It is officially described as follows: "In irregular, tough, or fibrous pieces of varying size and shape, but often in portions, three to five centimetres wide and two to four centimetres thick, of transverse slices of large roots. Externally greyish-black and wrinkled, internally greyish or brownish. From the transverse surface coarse fibres protrude in irregular concentric circles. Slight odor; taste faintly acrid. Yields to alcohol (90 per cent.) a resin which has the properties enumerated under 'Scammonias Resina.' " *Br.*

See also under *Jalap* for further facts concerning these substances.

Ipomoea root has purgative properties similar to those of true jalap, but is less powerful. It is stated (*J. P. C.*, xxiv, 166) that thirty to sixty grains (2-3.9 Gm.) are required to act effectively. It is, however, rarely employed and is official only as a source of scammony resin.

Iron-Wood. *Ostrya virginiana* (Mill.) Willd. (*O. virginica* Willd. *Carpinus virginiana* Mill.) (Fam. *Betulaceae*.) —The wood of the hop-hornbean is said to be tonic, antiperiodic, and alterative, and the fluidextract has been used in doses of from a half to one fluidrachm (1.8-3.75 mils) in *ague*.

Isatis. *Isatis tinctoria* L. *Woad. Pastel.* (Fam. *Cruciferae*.)—A biennial plant, indigenous to and cultivated in southern and central Europe to central Asia. The leaves have a fugitive, pungent odor, and an acrid, very persistent taste; they have been used in *scorbutic affections, jaundice*, and other complaints, but are of no value. They were formerly of importance as a source of indigo. The leaves are prepared by grinding them to a paste, which is made into balls, placed in heaps, and allowed to ferment. When the fermentation is at an end, the mass falls into a coarse powder, which is woad.

Isopyrum. *Isopyrum thalictroides* L. (Fam. *Ranunculaceae*.)—F. A. Harsten believes he has found two alkaloids, *isopyrine* and *pseudoisopyrine*, in the root of this plant, which grows in the forests of middle and southern Europe. (*A. J. P.*, xlv, 453.)

ISPAGHULA. Br.

ISPAGHULA

"Ispaghula consists of the dried seeds of *Plantago ovata*, Forsk." *Br.*

Ispaghue, Spogel Seeds.

Plantago ovata (*P. Ispaghula* Roxb.) is a herbaceous plant (Fam. *Plantaginaceae*) growing in India and Persia and extending westward to Spain and the Canary Islands. It is either erect or decumbent and varies in height from 2.5 cm. to 1 dm. The leaves are ovate and either glabrous or shaggy hairy. The flower spikes are either cylindrical or reduced to a globular head. The seeds closely resemble those of other species of *Plantago*.

They are described as follows: "Seeds boat-shaped, somewhat acute at

one end, from two to three millimetres long and from one to one and a half millimetres wide; pale greyish-brown, with a darker elongated spot on the convex side; on the concave side the hilum covered with the remains of a thin white membrane. In water the testa swells, producing a viscous mucilage. No odor or taste." *Br.*

The seeds of the *Plantago amplexicaulis* Cav. are also sold in the Indian bazaars as Ispaghula. They resemble the official seeds, but are of a darker color.

They yield to water a viscid mucilage. They are used in India as a demulcent in *dysentery* and various intestinal irritations, and are also slightly laxative. On roasting they are said to become astringent, and as such are used for *diarrheas*, especially of children. By European practitioners they have been chiefly employed in *chronic diarrhea*. In India they are also used for their demulcent effect in catarrhal conditions, especially of the genito-urinary tract.

Dose from one to two and a half drachms (3.9-9.8 Gm.).

Off. Prep.—Decoctum Ispaghulae, *Br.*

Ivarancusa.—The roots of *Andropogon Ivarancusa* Boiss., now considered to be in large part *A. Schoenanthus* L. (Fam. *Gramineae*), a native of Central India. It contains a volatile oil, resin, and a bitter substance, and is stated to be coming into wide vogue on the continent as a diaphoretic drug. It is also used in perfumery.

The Dispensatory of the United States of America Twentieth Edition (1918)

Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger type, unofficial plant drugs and preparations are in smaller type. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Jacaranda.—Several species of this genus (Fam. *Bignoniaceae*) are employed in *syphilis* in Brazil and other portions of South America under the names of *caroba*, *carobinha*, etc. Peckolt (*A. J. P.*, 1882, 134) has found in them a crystalline substance, *carobin*, besides resins and acids, such as *carobic* and *steocarobic acids*, and *carobon*, *caroborelinic acid*, and *caroba balsam*. Hesse (*Ann. Chem.*, cclii, 150) found only an aromatic resin, but no alkaloid. The value of the remedy has been asserted in the *B. M. J.*, vol. i, 1885. For further information, consult *P. J.*, 3d series, vols. v, xii, and xiv, and also *A. J. P.*, 1882.

JALAPA. U. S., Br.

JALAP Jalap.

" The dried tuberous root of *Exogonium Purga* (Wenderoth) Bentham (Fam. *Convolvulaceae*), yielding not less than 7 per cent. of the total resins of Jalap." *U. S.* " Jalap consists of the dried tubercules of *Ipomaea Purga*, Hayne." *Br.*

Radix Jalapae, Radix Ipomoeorum; Jalap Tubereux ou officinal, *Fr. Cod.*; *Tubera Jalapae*, P. G.; Jalape, Jalapen-knollen, Jalapenwurzel, G.; Gialappa, Sciarappa, It.; Jalapa (Raiz de), *Sp.*

The precise botanical origin of jalap remained long unknown. It was at first ascribed by Linnaeus to a *Mirabilis*, and afterwards to a new species of *Convolvulus*, to which he gave the name of *C. Jalapa*. The correctness of the latter reference was generally admitted, and, as the *Ipomoea macrorrhiza* of Michaux, growing in Florida and Georgia, was believed to be identical with the *C. Jalapa* of Linnaeus, it was thought that this valuable drug, which had been obtained exclusively from Mexico, might be collected within the limits of the United States; but the error of this opinion was soon demonstrated. John R. Coxe, of Philadelphia, received living roots of jalap from Mexico in 1827, and

succeeded in producing a perfect flowering plant, of which a description was published by Nuttall (*Am. J. M. S.*, Jan., 1830). The same plant has since been cultivated in various parts of Europe, and has been introduced into the Neilgherry Hills of India, where it grows vigorously. J. H. Balfour (*Curtis's Bot. Mag.*, Feb., 1847) maintains that the plant belongs to the genus *Exogonium* of Choisy, as defined in De Candolle's *Prodromus*, being distinguished from *Ipomoea* by its exerted stamens. Bentham and Hooker, however, do not acknowledge the validity of the various genera into which *Ipomoea* has been broken up by Choisy (*Genera Plantarum*, ii). Engler and Pranti have restored the genus *Exogonium* [*E. Purga* (Wender.) Benth.] for the plant yielding the root called jalap.

The root of *Exogonium Purga* (*Ipomoea Purga* Hayne) is a roundish, somewhat pear-shaped tuber, externally blackish, internally white, with long fibers proceeding from its lower part, as well as from the upper root-stalks. A tuber, produced by Coxe, was, in its third year, between two and three inches in diameter. The stem is round, smooth, much disposed to twist, and rises to a considerable height upon neighboring objects, about which it twines. The leaves are petiolate, heart-shaped, entire, smooth, pointed, deeply sinuated at the base and prominently veined on their under surface. The lower leaves are nearly hastate or with diverging angular points. The flowers, which are large and of a lilac-purple color, stand upon peduncles about as long as the petioles. Each peduncle supports two or, more rarely, three flowers. The calyx is without bracts, five-leaved, obtuse, with two of the divisions external. The corolla is funnel-form. The stamens are five in number, with oblong, white, somewhat exerted anthers. The stigma is simple and capitate.

The jalap plant is a native of Mexico, where it is dug during the whole year, and usually dried over the hearths of the Indian huts. It derives its name from the city of Jalapa, in the state of Vera Cruz, in the neighborhood of which it grows, at the height of about 6000 feet above the ocean. The drug is brought from the port of Vera Cruz in bags containing usually between 100 and 200 pounds. The amount of jalap annually invoiced through the Vera Cruz consulate to the United States is about 200,000 pounds. The jalap plant is now successfully cultivated in the government cinchona plantations in India. Analyses of the Indian tubers show that when grown on fresh soil they contain from 16 to 17 per cent. of resin, and that by manuring the percentage is notably

increased, even to 22 per cent. It has also been cultivated in Jamaica, South America and Ceylon. The jalap grows freely in the south of England, but the season is too short for the production of seed by it, although the root has yielded 11.97 per cent. of resin. (*P. J.*, Feb., 1869.) For an account of the cultivation of jalap in Madras, see *Am. Drug.*, 1896,127.

Properties.—Jalap is officially described as follows: " Fusiform, irregularly ovoid or pyri-form, upper end more or less rounded, lower end slightly tapering, the large roots often incised or cut into pieces; from 4 to 15 cm. in length and from 12 to 60 mm. in diameter; externally dark brown, longitudinally wrinkled or furrowed and with numerous lenticels; hard, compact, not fibrous; when broken, internally dark brown, mealy or waxy, bark from 1 to 2 mm. in thickness outer bundles separated from the outer cortical layer by a distinct, brown cambium zone; odor slight but distinctive, smoky; taste somewhat sweet and acrid. The powder is light brown; starch grains numerous, single or 2- to 3-compound, and more or less swollen, ellipsoidal or ovoid with concentric or excentral lamellae and radiating clefts or fissures, from 0.003 to 0.035 mm. in diameter; calcium oxalate in rosette aggregates from 0.01 to 0.035 mm. in diameter; tracheae short, wide, with simple or bordered pores; lactiferous vessels with' yellowish-brown, resinous masses. Jalap yields not more than 6.5 per cent. of ash." *U. S.*

"Tubercles dark brown, irregularly oblong, napiform or fusiform, three to eight centimetres or more long, the larger being often incised. Hard, compact and heavy; externally wrinkled, and marked with small transverse scars; internally yellowish-grey to dingy brown. In transverse section irregular, dark, concentric lines; examined microscopically numerous compound starch grains, many of which are gelatinised, cluster-crystals of calcium oxalate, and cells containing a resinous emulsion stained yellow by *N/10 solution of iodine*; in the wood, pitted vessels and tracheids. Characteristic odor; taste at first sweet but afterwards acrid and disagreeable. Ash not more than 6.5 per cent. Yields not less than 9 or more than 11 per cent. of resin having the properties of Jalap Resin, when treated by the process described under (*Jalapas Resina.*' " *Br.*

Jalap is usually kept by pharmacists in the state of powder, which is of a yellowish-grey color, and when inhaled irritates the nostrils and throat, and provokes sneezing and coughing'. Jalap yields its active

properties partly to water, and completely to diluted alcohol.

"Assay.—Pack 10 Gm. of Jalap, in No. 60 powder, in a cylindrical percolator and extract it with alcohol until the percolate measures 100 mls. Transfer 20 mls of the percolate to a separator, add 20 mls of chloroform, mix the liquids, then add 20 mls of distilled water and shake the mixture thoroughly. When the liquids have completely separated, draw off the chloroform into a tared beaker, wash the contents of the separator by rotating with 5 mls of chloroform and draw it off into the beaker. Evaporate the chloroform solution on a water bath, add about 2 mls of alcohol, again evaporate, and then dry the residue to constant weight at 100° C. (212° F.). The weight will be the amount of total resins from 2 Gm. of Jalap." *U.S.*

1. Action of solvents.			2. Reactions with Oxidizing Agents on convolvulin and jalapin dissolved in concentrated sulphuric acid.		
Solvent.	Jalapin.	Convolvulin.	Agent.	Jalapin.	Convolvulin.
Chloroform.	Readily soluble.	Slightly soluble.	Potassium dichromate.	Produces odor of rancid butter and reddish-brown color.	Produces odor of rancid butter and olive-green color.
Ether.	Very soluble.	Insoluble.	Potassium permanganate.	Same reactions.	Same reactions.
Petrol. naphtha.	Slightly soluble.	Insoluble.	Potassium nitrate.	Same reactions, but not so strong.	Same reactions.
Oil of turpentine.	Slightly soluble.	Insoluble.	Potassium chlorate.	Same reactions, but not so strong.	Same reactions.
Benzene.	Slightly soluble.	Insoluble.	Manganese dioxide.	Same odor, and color dark green.	Same odor, and color rose-pink.
Carbon disulph.	Easily soluble.	Insoluble.			
Water.	Slightly soluble.	Slightly soluble.			
Hydrochloric acid.	Slightly soluble.	Readily soluble.			
Sulphuric acid.	Very soluble, with production of maroon color changing to black.	Readily soluble, with production of bright red coloration.			
Potassium hydroxide.	Easily soluble.	Easily soluble, with production of odor of whisky when heated.			
Ammonia water.	Readily soluble, more so than convolvulin.	Slightly soluble.			

Buchner and Herberger supposed that they had discovered a basic substance, which they called *jalapin*. G. A. Kayser found that the resin of jalap previously discovered by Cadet de Gassicourt consists of two portions, one of which, amounting to seven parts out of ten, is hard and insoluble in ether, the other is soft and soluble in that menstruum. The hard resin he named *rhodeoretin*, and found to be identical with the jalapin of Buchner and Herberger, By reaction with the alkalies it is converted into an acid, called *rhodeoretinic acid*. Rhodeoretin is slightly soluble in water, freely so in alcohol, and insoluble in ether, chloroform, or benzene. and the alcoholic solution is precipitated both by ether and water. It is dissolved by solutions of the alkalies, more quickly if heated,

and is not precipitated by acids, having become soluble by conversion into the acid above referred to. It purges violently in the dose of three or four grains, and is supposed to be the active principle of jalap. Mayer confirmed and extended the observations of Kayser. He gave the name of *convolvulin* to Kayser's rhodeoretin, and stated its formula as $C_{31}H_{50}O_{16}$. This substance is colorless when pure, dissolving easily in ammonia water, and is not reprecipitated by acids, because of its conversion into *convolvulinic acid*, which is a hydroxide of the glucoside convolvulin. This, on being treated with nitric acid, yields *sebacic acid*. Convolvulin possesses in a high degree the purgative properties of jalap. A. Kromer (*Ph. Z. R.*, 1894, Nos. 1-7) also made a study of convolvulin. He finds it to be laevo-gyrate, and gives it the formula $C_{61}H_{102}O_{27}$, which was later changed (*Die Glykoside*, Van Rijn, 1900, p. 391) and is now given by Hoehnel as $C_{54}H_{96}O_{27}$, which is deduced from its analysis and decomposition products; alkalis decompose it into one molecule of volatile *methylethyl-acetic acid*, $C_5H_{10}O_2$, one molecule of *purginic acid*, $C_{25}H_{46}O_{12}$, and one molecule of *convolvulinic acid*, $C_{45}H_{80}O_{28}$. (See also *A. Pharm.*, 1901, 373.) This latter is amorphous, yielding a white hygroscopic powder soluble in water and alcohol, insoluble in ether; strong sulphuric acid colors it red or brown-red; by the action of acids one molecule of convolvulinic acid yields five molecules of a glucose and one molecule of *convolvulinolic acid*, $C_{15}H_{30}O_3$, which is insoluble in water, melts at $51.5^\circ C.$ ($124.7^\circ F.$), is not colored by sulphuric acid, and is isomeric with jalapinolic acid and scammonolic acid, both of which melt at from 63° to $64^\circ C.$ (145.4° - $147.2^\circ F.$). Mayer obtained from *Ipomoea orizabensis* a resin which he called *jalapin*, which was afterwards shown by Keller to be identical with the resin of scammony. Mayer's jalapin differs from convolvulin in being soluble in ether. The formula of jalapin, according to Samuelson, is $C_{34}H_{56}O_{16}$. Poleck (*A. J. P.*, 1892, p. 465) continued the investigation of the jalapin from *I. orizabensis*, and confirmed the identity of it with scammonin, giving it the formula $C_{34}H_{56}O_{16}$. He suggested that the name of jalapin, which is misleading, should be replaced by *orizabin*. A. F. Stevenson (*N. R.*, 1879, 359) has studied the two resins found in jalap, and furnishes a tabular statement of the differences between the soft resin jalapin and the hard resin convolvulin, which is given in the following table. For the method of obtaining the resin of jalap pure, see *Resina Jalapae*.

Power and Rogerson report a chemical examination of *Ipomoea*

purpurea Roth, known as the common *morning glory*. They conclude that this plant, like many other species of the same genus, contains resins which possess purgative properties, and is thus capable of being used medicinally. (*A. J. P.*, 1908, p. 255.)

Jalap is apt to be attacked by worms, which, however, are said to devour the amylaceous or softer parts, and to leave the resin, so that the worm eaten drug is more powerfully purgative than that which is sound. Thus, out of 397 parts of the former, Henry obtained 72 parts of resin, while from an equal quantity of the latter he procured only 48 parts. Hence, worm eaten jalap should be employed for obtaining the resin, but should not be pulverized, as it would afford a powder of more than the proper strength. The drug is also liable to various adulterations, or fraudulent substitutions, which, however, can usually be detected without difficulty by means of the microscope.

According to Herlant, even in powder it is easy to detect the presence of the root of *Mirabilis Jalapa*, which is sometimes used as an adulterant to jalap, by the presence of raphides of calcium oxalate.

Tampico Jalap (Purga de Sierra Gorda, Mexican).—This drug closely resembles in appearance, odor, and taste the true jalap, but the tubers are somewhat smaller, more elongated and shrivelled. According to Ambrose Andouard, it is the *jalap digite majeur* of Guibourt. Through the efforts of Daniel Hanbury, of London, aided by two Prussian officials in Mexico, Hugo Finck, vice-consul at Cordova, and E. Bonecke, consul-general at Mexico, the origin of the drug was traced to the state of Guanajuato, where it grows along the Sierra Gorda, near San Luis de la Paz. In this place it is purchased from the Indians, and conveyed by mules to Tampico, where it enters into commerce. Through the agency of the same gentlemen, Hanbury, after some failures, succeeded in obtaining a living tuber, from which he raised a flourishing plant that proved to be an undescribed species of the genus *Ipomoea*, differing from *I. Purga* by its bell-shaped corolla and pendulous flower-buds. To it Hanbury gave the name *I. simulans*. (*A. J. P.*, July, 1870.) H. Spirgatis, of Konigsberg, obtained a resin by preparing a tincture of the Tampico jalap, evaporating, washing, boiling the residue in water, redissolving in alcohol, and decolorizing by charcoal. He gave it the name of *tampicin*. Its physical properties are similar to those of the jalap resin. It is brittle, tasteless, inodorous, insoluble in water, soluble in ether and alcohol, and in solution has a feeble acid reaction. By strong alkalies it is changed

into a soluble acid which Sparganis calls *tampicic acid*. By the action of diluted sulphuric, nitric, or hydrochloric acid, it is converted, slowly if cold, but rapidly with heat, into a peculiar acid called *tampicolic*, with sugar. For the mode of preparing these acids, and their properties, the reader is referred to an article in *N. R.*, July, 1871, p. 50. The melting point of tampicin is 130° C. (266° F.); its formula is C₃₄H₅₄O₁₄. The percentage of it yielded by the drug varies from a minimum of 10 per cent. (Hanbury) to a maximum of 15 per cent. (Umney). Andouard states that it is purgative.

The average percentage of resin in Jalap has of late years distinctly lessened; indeed this fact has received official recognition. The U. S. P., 1890, required 12 per cent., and the French Codex, 1884, 16 to 18 per cent. Much of the commercial jalap is far below the lowered official standard, and this appears to be due, not, as believed by Fluckiger, to the extraction of the resin from the roots in Mexico, but to the fact that the wild tubers are collected indiscriminately from November to March; the cultivators of India are very careless in their methods. The lowness of the U. S. P. standard (7 per cent.) is to be regretted, especially as the Br. Ph. requires 11 per cent., but it is probably necessary, practically, to meet the commercial conditions. The German Pharmacopoeia of 1900, however, requires 9 per cent. From a compilation by M. I. Wilbert (*J. A. Ph. A.*, 1914, 1286) the range of 173 reported analyses of jalap was from 3.67 per cent. to 21.76 per cent. (For various analyses of commercial Jalap, see *U. S. D.*, 18th ed., also *J. P.*, lxxii, p. 152.)

A comparison of various methods of assay was made by Dr. P. Seidler (*Ph. Ztg.*, 1912, No. 2, 15), who recommends the process of the P. G.-V., which he says can be still further improved.

The question as to possible substitutes for the official species is also growing in importance. Fluckiger pointed out that the seeds of the *Ipomoea hederacea* (see *Kaladana*) yield 8 per cent. of resin identical with that obtained from *Ipomoea Purga*, and the British Pharmacopoeia now recognizes *Kaladana* and its resin. Shimoyama, of Tokio, has shown that jalap resin can be obtained from the *Ipomoea triloba* (*Pharbitis triloba*) of Japan. M. K. Hyrano confirms this, and states that the seeds of the plant have long been used in Japan, under the name of "*kengashi*" (For details and method of extracting the resin, see *P. J.*, Oct., 1888.)

Jalap should be rejected when it is light, of a whitish color internally, of a dull fracture, spongy, or friable. Powders of calomel and jalap, taken on long voyages to southern climates, are said, when brought back, to have become consolidated, and so far chemically altered as plainly to exhibit globules of mercury. This change is ascribed by Sohaeht and Wackenroder to a fungous growth. (*A. Pharm.*, xxxix, 239.)

Uses.—Jalap is an active cathartic, operating briskly and sometimes painfully upon the bowels, and producing copious watery stools. The aqueous extract purges moderately, without much griping, and is said to increase the flow of urine. The portion not taken up by water gripes severely. The aqueous extract obtained from jalap, previously exhausted by rectified spirit, is said to have no cathartic effect. Jalap was introduced into Europe in the latter part of the sixteenth or the beginning of the seventeenth century, and at one time ranked among the purgative medicines most extensively employed. It is applicable to most cases in which an active cathartic is required, and from its hydragogue powers is especially adapted to the treatment of *dropsy*. It is generally given in connection with other medicines, which assist or qualify its operation. In dropsical complaints it is usually combined with potassium bitartrate.

The combination of jalap with calomel has long been popular, in the United States, in bilious fever and other complaints attended with congestion of the liver or portal circle. In overdoses jalap may produce dangerous hypercatharsis. It is said to purge when applied to a wound. Jalapin when taken internally is probably absorbed, but as yet its presence has never been detected in the urine, and it remains uncertain whether it is eliminated or destroyed. Muller (*In. Dis.*, Dorpat, 1885) found traces of it in the blood, and even in the heart, lungs, and spleen of cats poisoned with it.

The dose of jalap, in powder, is from ten to twenty grains (0.65-1.3 G-m.).

Off. Prep.—Pulvis Jalapaa Compositus, *U. S.*, *Br.*; Pulvis Scammonii Compositus, *Br.*; Resina Jalapae, *U. S.* (*Br.*); Tinctura Jalapae, *Br.*, *N. F.*; Tinctura Jalapae Composita, *Br.*, *N. F.*; Extractum Jalapae, *N. F.*; Fluidextractum Jalapae, *N. F.*; Pilulae ad Prandium (Cole's), *N. F.*; Pilulae Catharticae Vegetabiles (from Resin), *N. F.*; Pulvis Hydrargyri Chloridi Mitis et Jalapae, *N. F.*; Syrupus Sennae Aromaticus, *N. F.*

Jambosa Root.—This is the root of *Jambosa vulgaris* DC., of the Fam. *Myrtaceae*, which is widely cultivated in the tropics under the name of the *rose-apple*. It has been found by A. W. Gerrard to contain an oleoresin, besides a crystalline principle, *jambosin*, C₁₀H₁₅NO₃. Lyons has also found in it minute quantities of an alkaloid. The decoction of the bark of the root is used as an astringent in *dysentery*, *gonorrhoea*, and *leucorrhoea*. (*P. J.*, March, 1884.)

Jambu Assu. *Piper Jaborandi*.—The root of *Piper Jaborandi* Veil. (Fam. *Piperaceae*) is one of the *Pipers* of Brazil, which is used by the natives as a sudorific, a diuretic, and a febrifuge. It is said to contain an alkaloid and a pungent oleoresin. It has no botanical, and probably no medicinal, relation with *pilocarpus*.

Jatropha. *Jatropha macrorhiza* Benth. *Jicama*.— This is a euphorbiaceous plant which inhabits Northern Mexico and the adjoining United States. It is a purgative, acting excessively in overdose, and is believed by the Mexicans to be cholagogue. The dose of the fluidextract is stated to be from one-half to two fluidrachms (1.8-7.5 mls).

Jeffersonia. *Twinleaf.* *Rheumatism Root.* *Jeffersonia diphylla* (L.) Pers. *Twinleaf.* (Fam. *Berberidaceae*.)—This herbaceous perennial is found in woods from New York to Wisconsin, extending southward. The rhizome, which, with the rootlets attached, is the part used, has a brownish-yellow color, and a bitter, acrid taste, which resides in its cortical part, the inner portion being nearly tasteless. E. S. Wayne of Cincinnati, found it to contain albumen, gum, tannic acid, starch, pectin, a fatty resin, hard resin, sugar, lignin, and a peculiar acrid principle having acid properties and resembling polygalic acid. The root is said to be emetic in large doses, tonic and expectorant in smaller doses and not unlike senega, as a substitute for which it is sometimes used. (*A. J. P.*, xxvii, 1.) According to Mayer, of New York, the rhizome of this plant contains a small quantity of berberine and a second white alkaloid. The pectin of Wayne he considers to be saponin. (*A. J. P.*, 1863, 99.) A. W. Flexor proved the absence of berberine from the root. (*Am. Drug.*, 1884.) Gordin has since confirmed this view (1902).

Jellies.—"The form of jelly is sometimes a convenient method of administering medicines, especially the fixed oils, as cod liver oil, castor oil, resinous juices, etc. The following is a formula recommended by Parrish and William C. Bakes. " Take of the fixed oil or liquid resin a troy-ounce; honey, syrup, each, half a troy ounce; gum arabic, in powder, two drachms; Russian isinglass, forty grams; orange-flower water, six fluidrachms. Dissolve the isinglass, with the aid of heat, in half a fluidounce of the orange-flower water, replacing the water as it evaporates. Triturate the other ingredients, with the remainder of the orange-flower water, into a homogeneous mass in a warmed mortar, then add the hot solution of isinglass, stir the mixture as it cools, and set it aside to gelatinize." (*A. J. P.*, 1861, 4.) Any other aromatic water may be substituted for that of the orange flower, and cinnamon water diluted with an equal measure of pure water would probably better cover the offensive taste. In reference to cod liver oil, the bitter-almond, or cherry-laurel water would be still more effectual, care, however, being taken, in this case, that the water be duly diluted, lest too large a

dose of it be administered.

Juglans. *N. F. IV (U. S. P. 1890). Butternut Bark. Oil Nut. White Walnut. Ecorce de Noyer gris, Fr. GraueWallnussrinde, G.*—"The dried inner bark of the roots of *Juglans cinerea* Linne (Fam. *Juglandaceae*), collected in autumn." *N. F.*

J. cinerea is a tree extending in rich woods from New Brunswick to the mountains of Georgia. The fruit, when half grown, is sometimes made into pickles, and, when ripe, affords in its kernel a grateful article of food. The bark is used for dyeing wool a dark-brown color, though inferior for this purpose to that of the black walnut. It is said to be rubefacient when applied to the skin. The inner bark is the medicinal portion; that of the root, being considered most efficient, was directed by the U. S. P. It should be collected in May or June.

On the living tree, the inner bark, when first uncovered, is of a pure white, which immediately on exposure becomes a fine lemon color, and ultimately changes to deep brown. It has a fibrous texture, and under the title of *Juglans* is described as follows in the *N. F. IV*:

"In quills, curved strips, or in chips, from 3 to 10 mm. in thickness; of a deep brown color on both surfaces and throughout, except for the faint, intersecting, whitish, radial, and tangential lines shown in the transverse section; outer surface smooth, somewhat warty; inner surface smooth and striate, bearing fragments of thin stringy fiber: fracture short, rather weak, somewhat fibrous. Odor faintly aromatic; taste bitter, astringent, somewhat acrid.

"The powdered drug is dark-brown and, when examined under the microscope, exhibits numerous rosette aggregate crystals of calcium oxalate, up to 0.050 mm. in diameter; simple rounded or occasionally 2- to 4-compound starch grains, the individual grains being up to 0.015 mm. in diameter, sometimes with a cleft through the center; stone cells, some with thick walls, with simple or branching pores, up to 0.10 mm. long and 0.05 mm. wide, sometimes with reddish contents; long thick-walled sclerenchymatous fibers up to 0.03 mm. in width, occasionally associated with crystal fibers, the latter containing prisms of calcium oxalate from 0.01 to 0.05 mm. in length; fragments of parenchyma containing brownish tannin masses and oil; fragments of epidermal tissue composed of polygonal cells having yellowish-brown walls, some with reddish-brown contents. *Juglans* yields not more than 8 per cent. of ash." *N. F.*

Its medicinal virtues are extracted by boiling water. Bigelow could detect no resin in the bark, and the presence of tannin was not evinced by the test of gelatin, though a brownish-black color was produced by ferrous sulphate. Charles O. Thiebaud found the bark to be destitute of tannic acid and of any vegetable alkaloid, but to contain bitter extractive, oily matter in large proportion, a volatilizable acid, *juglandic acid*, crystallizing in bright, orange-yellow crystals, and appearing to bear some analogy with chrysophanic acid, another acid crystallizing in tabular, colorless crystals, and a volatile acid. (*A. J. P.*, 1872, 253.) Maisch believes that the *juglandic acid* of Thiebaud is the *nucin* of A. Vogel, Jr., found in green walnut peel. (*A. J. P.*, April, 1874, 167.) E.

D. Truman (*A. J. P.*, 1893, 426) made proximate analyses of the root bark and the trunk bark for comparison. In the trunk bark, instead of the crystallizable juglandic acid, he found an uncrystallizable acid and a crystalline resin. Tanret and Villers isolated from the leaves a carbohydrate, nucite, $C_6H_{12}O_6 + 2H_2O$, which fuses at $218^\circ C.$ ($424.4^\circ F.$), is not fermentable, and does not reduce Fehling's solution. It has since been shown to be identical with *inosite*. Tanret also (*Jahresb. f. Pharm.*, 1876, 198.) thinks that he has obtained an alkaloid from walnut leaves, which he proposes to call *juglandine*. The European walnut bark yielded *glycyrrhizin* abundantly to Sestini. *Juglon*, $C_{10}H_6O_3$, the characteristic constituent of *Juglans regia*, has been prepared synthetically by Bernthsen and Semper, and is now recognized as *a-oxynaphthoquinone*, $C_{10}H_5(OH)O_2$, as it can be made from dioxynaphthalene by the action of chromic acid mixture. It is in brownish-red, crystalline needles having a faint odor of walnut hulls, and is sternutatory. (*Ber. d. Chem. Ges.*, 1887, 934.) The fluidextract is recognized by the *N. F.* (see Part III) ; the extract was official in the U. S. P., 1890.

Extractum Juglandis. U. S. 1890. Extract of Juglans. "Juglans, in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]; Diluted Alcohol, a sufficient quantity. Moisten the powder with four hundred mils [or 13 fluidounces, 252 minims] of Diluted Alcohol, and pack it firmly in a cylindrical percolator; then add enough Diluted Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding Diluted Alcohol, until three thousand mils [or 101 fluid-ounces, 212 minims] of tincture are obtained, or the Juglans is exhausted. Distil off the Alcohol from the tincture by means of a water-bath, and evaporate the residue, on a water-bath, to a pilular consistence." *U. S.*, 1890.

Butternut is a mild cathartic resembling rhubarb in its action, but less certain. It was much used during our Revolutionary war as an habitual laxative, and was especially esteemed by Rush in the treatment of *dysentery* and *hepatic congestions*. *Dose*, of the extract, from five to twenty grains (0.32-1.3 Gm.) ; of the fluidextract, thirty to sixty minims (1.9-3.9 mils).

Several products of *Juglans regia* L., or common European walnut, are used medicinally in Europe. The hull of the fruit has been employed as a vermifuge from the times of Hippocrates, and has been recommended in *syphilis* and for old *ulcers*. The expressed oil of the fruit has been deemed efficacious against the *tapeworm*, and is also used as a laxative injection. The leaves, long occasionally employed for various purposes in both regular and domestic practice, have been found by Negrier of Angers, in the highest degree efficacious in *scrofula*. He gave to children a teacupful of a fairly strong infusion, or six grains (0.4 Gm.) of the aqueous extract, or an equivalent dose of a syrup prepared from the extract, two, three, or four times a day, and at the same time applied a strong decoction to the ulcers, and as a collyrium when the eyes were diseased. No injury ever resulted from a long-continued use of the remedy. It appears to act as a moderately aromatic bitter and astringent. (*A. G. M.*, 3e ser., x, 399 and xi, 41.) They are said also to have proved useful as a topical application in

malignant pustule. (*Ibid.*, 5e ser., x, 609.)

Nucitannic Acid.—In the walnut, between the kernel and the shell, is a thin membrane, which closely embraces the cotyledon, called the *episperm*, which consists of two layers, the inner very thin, colorless, translucent, and perfectly tasteless, the outer coarser, somewhat colored, and of a bitter, disagreeable taste. The latter, examined chemically by T. L. Phipson, was found to contain, among other principles, as gallic and ellagic acid, etc., a new variety of tannic acid, which he proposes to name *nucitannic acid* or *nucitannin*, to which the outer membrane chiefly owes its unpleasant taste. It is a glucoside, as when boiled for some hours with diluted hydrochloric acid it splits into glucose and a peculiar red acid substance, which he calls rothic acid, $C_{14}H_{12}O_7$, and the properties of which he has pretty thoroughly investigated. (*Chem. News*, Sept. 3, 1869, p. 116.) For an exhaustive chemical examination of black walnut leaves by Miss L. J. Martin, see *A. J. P.*, 1886, p. 468. The leaves of *J. nigra* L. (*black walnut*), and those of *J. cinerea*, probably possess the same properties.

Juniper Berries. *N. F. IV (U. S. P. 1880).* *Juniperus. Fructus Juniperi*, P. G. *Baccae Juniperi.* *Genievre*, Bates de *Genievre*, Fr. *Gem-einer Wachholder*, *Wachholderbeeren*, G. *Ginepro*, It. *Enebro*, *Bayas de Enebro*, Sp.— "The carefully dried ripe fruit of *Juniperus communis* Linna (Fam. Pinaceae). Preserve Juniper Berries in airtight tin or glass containers, and reject old or insect-infected fruit." *N. F.*

Juniperus communis L. is an evergreen shrub, usually small, but sometimes twelve to fifteen feet high, with numerous very close branches, and varying from an erect shrub to a decumbent or even trailing arborescent plant.

The common juniper is a native of Europe and the northern regions of Asia and North America. Northward it becomes a trailing shrub, seldom more than 2 to 4 dm. high, spreading in all directions, throwing out roots from its branches, and forming beds which are often many rods in circumference. The name of *J. depressa* has been proposed for this variety. The common juniper flowers in May, but does not ripen its fruit until late in the following year. All parts of the plant contain a volatile oil, which imparts to them a peculiar flavor. The wood has a slight aromatic odor, and was formerly used for fumigation. A terebinthinate juice exudes from the tree and hardens on the bark. This has been erroneously considered as identical with the gum known commercially as *sandarach*.

The berries, as the fruit is commonly called, were formerly occasionally brought to the Philadelphia market from New Jersey. But, though equal to the European in appearance, they are inferior in strength, and are not much used. The best come from the south of Europe, particularly from Trieste and the Italian ports. They are "nearly globular, about 8 mm. in diameter; externally smooth, shining, black-brown to purplish-black with a blue-gray bloom, at the apex a three-rayed furrow marks the cohesion of the three fleshy bracta forming the pericarp; internally loosely fleshy, greenish-brown, containing numerous large schizogenous cavities; seeds three, triangular ovate, hard, brown, with large uneven oil glands on the surface. Odor

aromatic; taste sweet, pleasant, terebinthinate, slightly bitter.

"Sections, when examined under the microscope, exhibit a pericarp consisting of an epiderm of a single row of rounded polygonal cells filled with a brown granular substance, at the sutures of the bracts these become blunt papillae; a hypodermis of two or three rows of brown-red, collenchymatous cells thickened at the angles; the fleshy portion (mesophyl) composed of loose, irregular parenchyma with large oval canals and traversed by fibro-vascular bundles with areolated fibers} a sclerenchymatous ring of six to eight rows of very thick cells with pitted walls, many enclosing prismatic crystals of calcium oxalate; the seed-testa shows a layer of two to ten rows of stone cells with radial markings on the walls and each enclosing a polygonal crystal of calcium oxalate; endosperm and embryo rich in fat and aleurone. Juniper Berries yield not more than 5 per cent. of ash." *N. F.*

These properties, as well as their medicinal virtues, they owe chiefly to a volatile oil. (See *Oleum Juniperi*.) The other constituents, according to Trommsdorff, are resin, sugar, gum, wax, lignin, water, and various saline substances. The proportion of these constituents varies according to the greater or less maturity of the berries. The volatile oil is most abundant in those which have attained their full growth and are still green, or in those which are on the point of ripening. In the latter Trommsdorff found 1 per cent. of the oil. In those perfectly ripe it has been partly changed into resin, and in those quite black, completely so. The berries impart their virtues to water and alcohol. They are very largely consumed in the preparation of gin.

The tops of juniper were formerly directed by the Edinburgh and Dublin Colleges. Their odor is balsamic, their taste resinous and bitterish, and they possess similar virtues with the berries.

Juniper berries are gently stimulant and diuretic, imparting to the urine the odor of violets, and producing occasionally, when largely taken, disagreeable irritation in the urinary passages. They are chiefly used as an adjuvant to more powerful diuretics in dropsical complaints. The infusion is a good preparation. It is made by macerating an ounce of the bruised berries in a pint of boiling water, the whole of which may be taken in the course of twenty-four hours. The fluidextract is recognized by the *N. F.* (see Part III), but for most purposes the oil is preferable. (See *Oleum Juniperi*.) Under the trade name of *junol* there appears on the market a hydroalcoholic extract of juniper berries recommended as a diuretic. Juniper berries are not administered in substance; the dose of the fluid extract is one fluidrachm (3.9 mils) (see Part III).

Juniperus Virginiana L. *Red Cedar. Cedre de Virginie, Fr. Virginische Ceder, Rothe Ceder, G.*—The tops of this plant were formerly included in the Secondary List of the U. S. Pharmacopoeia. The tree is an evergreen of slow growth, seldom very large, although sometimes attaining a height of 25 m.

It grows on dry hills or deep swamps from Maine westward to the Rocky Mountains, from Vermont to the Gulf of Mexico, is most abundant and vigorous in the southern section. The interior wood is of a reddish color, and highly valuable on account of its

great durability. Small excrescences, which are sometimes found on the branches of the tree, are popularly known as *cedar apples* and used as an anthelmintic in the dose of from ten to twenty grains (0.65-1.3 Gm.) three times a day. The tops have a pleasant odor, and a strong, bitterish, somewhat pungent taste. These properties reside chiefly in a volatile oil, and are readily imparted to alcohol. The leaves, analyzed by Wm. J. Jenks, were found to contain volatile oil, gum, tannic acid, albumen, bitter extractive, resin, chlorophyll, fixed oil, lime, and lignin. (*A. J. P.*, xiv, 235.) They bear a close resemblance to the leaves of *Juniperus Sabina* L., an European shrub, from which they can be certainly distinguished only by the difference of odor. The *oil of red cedar* is now an article of commerce; it is used generally in perfumery, and was formerly one of the principal constituents of the popular extract of white rose. (*A. J. P.*, 1877, 186.) It possesses, in a marked degree, the well-known agreeable odor of the red cedar wood. Schimmel describes a volatile oil from Haitian cedar wood which differs from our domestic oil of cedar, only in having a higher specific gravity. (*Schim. Rep.*, 1905, 17.) I. W. Brandel obtained from the leaves of *J. Virginiana* 0.47 per cent. of volatile oil, sp. gr. 0.913 at 15° C. (59° P.). It had a very pleasant odor. (*Proc. A. Ph. A.*, 1906, 459.) *Cedrene camphor*, $C_{10}H_{26}O=C_{16}H_{24}+H_2O$, may be obtained by cooling the oil until coagulated, and separating the crystalline portion by expression; the expressed liquid is *cedrene*, $C_{15}H_{24}$, which, after rectification and distillation, has the sp. gr. 0.984 at 15° C. (59° P.), boiling at 237° O. (458.6° P.). Cedrene may also be prepared from the cedrene camphor by the dehydrating action of phosphoric anhydride, $PaOc$. The resemblance of red cedar to savin is said also to extend to its medicinal properties. It is, however, much less energetic, and has not acquired the confidence of the profession. Externally applied it acts as an irritant, and an ointment, prepared by boiling the fresh leaves for a short time in twice their weight of lard with the addition of a little wax, is employed as a substitute for savin cerate in maintaining a purulent discharge from blistered surfaces. Sometimes the dried leaves in powder are mixed with six times their weight of rosin cerate, and used for a similar purpose. But neither of these preparations is as effectual as the analogous preparation of savin.

The volatile oil, which resembles oil of savin in its medicinal properties, has been used for the purpose of producing abortion, and in some cases has caused death. The symptoms have been burning in the stomach, vomiting, convulsions, coma, and a slow pulse, with evidences of gastro-intestinal inflammation after death. (See S. C. Watt, *B. M. S. J.*, vol. xl.)

Under the name of cedar are known in commerce various trees, some of which do not belong to the genus *Juniperus*. The wood of *Juniperus bermudiana* L. is said to be largely used in making pencils. The cedar of Lebanon, *Cedrus Libani* Barrel, and its two varieties, the *African cedar*, *C. atlantica* Manetti, and the *Indian cedar* or *deodar*, *C. Deodara* Loud., are sometimes distilled for oil, and, under the name of *libanol*. An oil obtained from *Cedrus atlantica*, Manetti, or *satin-wood*, has appeared in commerce and is said to be useful in the treatment of blennorrhagia, phthisis, bronchitis, and eruptions upon the skin, having properties very similar to those of the oil of santal. It may be given in capsules up to forty-five grains (3 Gm.) per day. In skin eruptions the 25 per cent. ointment made with vaseline has been used. Other trees known as

cedars are the white cedar, *Cupressusthyoides* L.; the American white cedar, *Thuja occidentalis* Linn.; the Californian white cedar, *Libocedrusdecurrens* Torr.; the New Zealand cedar, *Libocedrus Bidwillii* Hook. The Australian red cedar, *Cedrela Toona* Roxb., and the West India cedar, *Cedrela odorata* L., belong to an entirely different family, the *Meliaceae* (*Cedrelaceae*). The wood of the latter species is used in making cigar boxes, and, according to Schimmel, yields 3 per cent. of a volatile oil, which has a specific gravity of 0.915, boils between 265° and 270° C. (509°-518° F.), and has an optical rotation of 0.053° in a 100 mm. tube. It is said to be a powerful insecticide. (P. J., Aug. 29, 1896, 179.)

KALADANA. Br.

KALADANA [Semen Pharbitidis, Pharbitis Seeds]

"Kaladana consists of the dried seeds of *Ipomoea hederacea*, Jacq." *Br.*

Closely allied to *Ipomoea hederacea* is *I. muricata*, the seeds of which are largely imported into Bombay, from Persia, under the name of *tukm-i-nil*. The juice of this plant is employed to destroy bedbugs, and the seeds are said to be identical in their medicinal properties with those of the official plant.

Ipomoea hederacea Jacq. (*I. caerulea* Kon.; *Pharbitis Nil*, Choissy) is a twining annual plant belonging to the *Convolvulaceae*. It has large blue flowers whence the specific name *Nil* which signifies in Hindustani *blue*. The leaves are three-lobed and the plant, while common throughout India, is found throughout the tropical regions of both hemispheres. Fliickiger found it to contain 8.2 per cent. of resin which corresponded in its various properties to the resin of jalap.

Kaladana seeds are in the form of the segment of a sphere, black, somewhat hairy, weighing from one-half drachm to nearly one drachm.

They are described by the British Pharm., 1914, as follows: "Seeds in the form of a segment of a sphere; usually about five millimetres long, but sometimes much smaller; nearly black. In transverse section, minute dark resin-cells in the plaited cotyledons. Slight odor; taste acrid." *Br.*

From them is prepared *pharbitisin*, *kaladana resin* (*Kaladanae Resina*, Br.), by digesting the seed with alcohol until exhaustion, and precipitating with distilled water.

Uses.—Kaladana seeds were used by the Arabian physicians, under the name of *Habbun-nil*, and have been recommended as a safe and active cathartic by various English physicians resident in India. Their action is probably similar to that of jalap.

Dose, thirty to forty-five grains (2-3 Gm.).

Off. Prep.—Kaladana Resina, *Br.*; Pulvis Kaladanae Compositus, *Br.*; Tinctura Kaladanae, *Br.*

Kalagua.—A study of this South American plant, which has been put upon the market as a specific for tuberculosis, made upon the lower animals by D. H. Bergey, shows that it has no specific influence upon the tubercle bacillus.

Kalmia. *Kalmia latifolia* L. *Laurel. Mountain Laurel. Broad-leafed Laurel. Calicobush. Spoon-wood. Kalmie*, Fr., G.—This well-known ericaceous evergreen shrub is found from New Brunswick to Florida and from Ohio to Louisiana, being especially abundant on the sides of hills and mountains. It is from 1 to 4 m. in height. The leaves, which are supposed to be possessed of poisonous, narcotic properties, have been found by Charles Bullock to contain gum, tannic acid, resin, chlorophyll, fatty matter, a substance resembling mannite, an acrid principle, wax, extractive, albumen, yellow coloring matter, lignin, and salts of potassium, calcium, and iron. (*A. J. P.*, xx, 264.) George W. Kennedy detected the glucoside arbutin in them. (*A. J. P.*, xlvii, 5.) Bourquelot and Fichtenholz stated that the glucoside that they obtained from the leaves of *K. latifolia* is identical with the *asebotin* that Eykmann found in *Andromeda japonica*; both yield a red color with ferric chloride. The leaves are popularly believed to be poisonous to sheep and other small animals, but are said to be eaten with impunity by deer, goats, and grouse. It is also affirmed that severe and fatal poisoning has been produced by eating grouse that have fed upon these leaves. (See 16th ed., U. S. D.) Crawford (Bulletin 121, Bureau of Plant Industry, U. S. Dept. of Agriculture), in experimental investigations, found that laurel caused, either when fed to, or injected into, the lower animals, great salivation, lachrymation and emesis, convulsions, and later paralysis of the extremities, with greatly labored respiration. It is probable, although not proven, that the poisonous principle of this plant is *andromedotoxin*. The leaves have been used internally in *diarrhea* and in *syphilis*, and externally in skin diseases. (See 16th ed., U. S. D.)

It is probable that other species of *kalmia*, as *K. angustifolia* L., or sheep-laurel, and *K. glauca* Ait.; or swamp-laurel, have properties identical with those of *K. latifolia*. A decoction of the leaves of *K. angustifolia* is used by the negroes as a wash for ulcerations between the toes.

Kamala. U. S. 1890. Kamala. *Glandulae Rottlerae*.—The U. S. Pharmacopoeia, under the name of *Rottlera*, U. S., 1870, *Kameela*, formerly recognized the glands and hairs from the capsules of *Mallotus philippinensis* (Lamarck) Muell.-Arg. (Fam. *Euphorbiaceae*.) This tree grows in Abyssinia, Southern Arabia, Hindostan, the East

India Islands, China, and Australia, reaching a height of from fifteen to twenty feet, and yielding a roundish, three-valved, three-locular capsule about the size of a small cherry, thickly covered with a red powder, which is collected in Hindostan by rolling the berries about in large baskets until the freed powder sifts through the open wicker-work.

Kamala, as brought to our market, is a light, finely granular, very mobile powder, of a brownish-red or madder color, with little odor or taste, but producing a slight sense of acidity in the mouth, and feeling gritty under the teeth. (When the grittiness is excessive, the drug has probably been adulterated with earthy matters.) It is inflammable, and flashes almost like gunpowder when dropped into the flame of a candle. It is insoluble in cold and but very slightly soluble in boiling water; but alkaline solutions, alcohol, and ether dissolve a large proportion of it, forming a deep red solution, from which water precipitates resinous matter, "imparting a deep red color to alkaline liquids, alcohol, ether, or chloroform, and a pale yellow tinge to boiling water." *U. S.*, 1890. Under the microscope it consists of garnet-red, semi-transparent, roundish, glandular hairs from 0.040 to 0.100 mm. in diameter, and containing numerous red, club-shaped cells and admixed with minute stellate hairs, and the remains of stalks and leaves, the latter of which are easily removed by careful sifting. It has been examined chemically by Thomas Anderson, of Glasgow, and by G. Leube, in Germany. As given by the former, the constituents are, in 100 parts, 78.19 of resinous coloring matter, 7.34 of albumin, 7.14 of cellulose, etc., a trace of volatile oil and volatile coloring matters, 3.84 of ashes, and 3.49 of water. The amount of earthy impurities, chiefly sand, in commercial kamala, varies greatly, sometimes amounting to fifty or even sixty per cent. It can readily be estimated by heating the drug to redness and weighing the residue. The *U. S. P.*, 1890, permitted the presence of "not more than 8 per cent. of ash." Any specimen of kamala containing more than the official percentage of impurity should be rejected. Rusby states that kamala often comes to this country adulterated. He found one shipment loaded with sand, one with olive stems, one with olive stems and sand, and one with ground bark. Two samples, 40.8 per cent. acid, 43.4 per cent. ash, were mostly sand. (See also *Ph. Rev.*, 1907, 129; *P. J.*, 1906, 258.) Of the resinous coloring substances, Anderson obtained one in a pure state by allowing a concentrated ethereal solution to stand for two days, draining and pressing in bibulous paper the resulting mass of granular crystals, and purifying them from adhering resin by repeated solution in ether and recrystallization. To this substance he gave the name of *rottlerin*. It is in the form of minute crystalline plates, of a yellow color and a satin-like luster, insoluble in water, sparingly soluble in cold but more so in boiling alcohol, and readily dissolved by ether, and by alkaline solutions, which assume a dark red color. Perkin (*Chem. Soc. Trans.*, lxiii, p. 975) shows *rottlerin* to consist of six distinct substances, i.e., *rottlerin*, *isorottlerin*, wax, two resins and a coloring substance. The pure *rottlerin* has the chemical composition $C_{33}H_{30}O_9$. (See also *P. Ztg.*, 1906.) Crude *rottlerin*, sometimes known as *kamalin*, melts when heated moderately, and at a higher heat is decomposed, giving off pungent vapors. A. and W. Perkin (*Ber. d. Chem. Ges.*, xix, 3109) and Jawein (*Ibid.*, xx, 182) both stated that *rottlerin* can be extracted from kamala by the action of carbon disulphide. Jawein gave its fusing point as 200° C. (392° P.), and said that it was easily soluble in hot alcohol and acetic acid. In a later communication, A. G. Perkin (*P. J.*, 1893, 159, 236),

stated that when he extracted it with ether, kamala yielded a dark brownish resinous product from which six distinct substances can be isolated; *rottlerin*, *iso-rottlerin*, a wax, and two resins, one of high and one of low melting point, form the principal constituents. There is also present a trace of a yellow crystalline coloring matter melting at from 192°-193° C. (377.6° 379.4° F.). Perkin also found in kamala a small quantity of a sugar soluble in water. Potassium permanganate oxidizes it to oxalic and benzoic acids; nitric acid of 1.5 sp. gr., on the other hand, oxidizes it to oxalic acid, ortho- and para-nitrocin-namic acids, and para-nitrobenzoic acid. The ashes were in the extraordinary proportion of 25.85 per cent., and of the ashes 83.8 per cent. consisted of insoluble silica. Silica probably enters essentially into the constitution of the minute granules, and its presence accounts for their grittiness under the teeth. The active constituent is supposed to be the resin.

Kamala is actively or even violently purgative in full doses, occasionally causing nausea, but seldom vomiting. Kamala has long been used in India against the *tape worm*, and was first made generally known by C. Mackinnon. (*Ind. Ann. Med. Sci.*, 1854.) Semper (*A. E. P. P.*, 1910, lxiii, p. 10) has found that kamala has a paralyzing effect on motor nerves and muscles, to which action he believes it owes its tenifuge powers. It is given, without previous preparation of the patient, in the dose of from one to three drachms (3.9-11.6 Gm.), suspended in water, mucilage, or syrup. In the latter dose it sometimes acts violently. The worm is usually expelled at the third or fourth stool. If the first dose fails to operate on the bowels, it may be repeated in four hours, or followed by a dose of castor oil. The tincture (four ounces to eight fluidounces of diluted alcohol) is also said to be efficient in doses of from one to four fluidrachms (3.75-15 mls). As an external remedy, kamala is used by the people of India in various affections of the skin, particularly *scabies*. William Moore, of Dublin, has employed it successfully in herpetic ringworm. (*Dublin Hosp. Gaz.*, Nov. 15, 18i57.) A tenifuge composed of kamala and koussin and known as *kamakosin*, is in use on the continent.

KAVAE RHIZOMA. Br.

KAVA RHIZOME

"Kava Rhizome is the peeled, dried, and divided rhizome of *Piper methysticum*, Forst. fil." Br. "The dried rhizome and roots of *Piper methysticum* Forster (Fam. *Piperaceae*)" N.F.

Kava, N. F.; Methysticum; Kava-kava.

The genus *Piper* includes a large number of sub-tropical plants, which are mostly shrubs, and rarely herbs or trees. A number of the species are of great economic importance. *Piper methysticum* is a shrub, several feet high, indigeneous to many of the South Sea Islands. The plant has cordate, acuminate leaves and very short axillary spikes of flowers. The

natives prepare a fermented liquor from the upper portion of the rhizome and the base of the stems.

Kava rhizome occurs "in whitish or light brownish-grey irregularly cuboid or roughly wedge-shaped fragments from which the peri-derm has been sliced off; from one to five centimetres thick. In transverse section, usually exhibiting a central dense pith, surrounded by a distinct ring of narrow, radiating, vascular bundles separated by relatively broad, paler, medullary rays. Fracture starchy. Slight agreeable odor; taste pungent and bitter." *Br.*

The N. F. description is as follows: "Consisting of a large, irregular knotty crown, often 12 cm. or more in diameter, from which proceed numerous, long, cylindrical, tough, nearly simple roots, which tend to fray out into bare, separated fibro-vascular bundles; the crown soft, light, spongy, and granular and very starchy; externally dark-brown or blackish, the crown frequently partly scraped and light brown to light gray; internally white. Odor faint but characteristic; taste aromatic and pungent, slightly bitter, more or less local anaesthesia resulting. The powdered drug, when examined under the microscope, exhibits numerous, simple, or two- to three-compound starch grains, the individual grains being up to 0.045 mm. in diameter, many with radial clefts or triangular fissures at the center; yellow resin and oil cells; narrow sclerenchymatous fibers with thin, strongly-lignified walls; tracheae with scalariform or reticulate markings, up to 0.15 mm. in width; few nearly isodiametric wood parenchyma from the remains of the stem. Kava yields not more than 8 per cent. of ash." *N. F.*

The pharmacognosy of this drug has been written up by Semenow in *Ap. Ztg.*, 1890, p. 216, and True, *Ph. Rev.*, xiv, No. 2. Powdered Kava consists of numerous starch grains which are either single or 2- to 3-compound, the individual grains having central radial clefts with triangular fissures varying from 0.006 to 0.035 mm. in diameter. The sclerenchymatous fibers have thin walls which are strongly lignified. The tracheae have scalariform or reticulate markings. The oil cells frequently contain a yellowish resin. The drug should not yield more than 8 per cent. of ash.

Gobley isolated from kava root a crystalline principle (analogous to piperin), *methysticin*, or *kavahin*, which is without odor and taste, and is probably inert. (*J. P. C.*, Jan., 1860.) It possesses the formula

$C_{15}H_{14}O_5$, and is the methyl ester of p-piperonyl acetic acid, and when purified forms silky, lustrous needles melting at 138° to 139° C. (280.4°-282.2° F.). Kavahin differs from piperin and cubebin in being colored red by hydrochloric acid, the red color fading on exposure to air into a bright yellow, and in being colored by strong sulphuric acid a purplish violet, which passes into green. In 1844 Morson discovered an active principle, *kawine*. This is a greenish-yellow, strongly aromatic and acrid resin. It was again studied by Cuzaut in 1860, and by Lewin in 1886. This latter investigator separates it into two resins, of which the *b*-resin is greasy and of a reddish-brown color, appearing in mass almost black. This is less active than the *a*-resin, which is yellowish-brown, has the characteristic odor of the drug, is freely soluble in alcohol, and placed upon the tongue produces a burning sensation followed by local anesthesia. (A. J. P., 1886, 450.) *Yanagonin* is another glucoside which has been studied by Borsche and Gerhardt. (*Riedels Archives*, 1914, 50.) A volatile oil has also been found in the root. (J. P. C., March, 1862.) Lavielle (*L'Union Pharm.*, Jan., 1889) claims to have obtained an alkaloid, *kavaine*. (See also *Proc. A. Ph. A.*, 1897, 564.)

Uses.—Under the names of *Ava* or *Kava* the natives of the Sandwich Islands have used as an intoxicant a beverage prepared from kava rhizome. The intoxication is wholly unlike that caused by alcohol, being of a silent and drowsy character, accompanied by incoherent dreams, with great loss of muscular power, which is probably due to the action of kava resin upon the spinal cord.

The physiological action of kava and its resin has been investigated by L. Lewin (*Piper Methysticum*, Berlin, 1886), and David Cerna (T. G., 1891). The phenomena which follow the hypodermic injection of the fluidextract of kava or of a solution of its resin are, anesthesia at the point of injection, followed, after absorption, by general paralysis, due to a direct action on the motor side of the spinal cord; the motor nerves and the muscles remain intact. The local anesthesia is due to a paralysis of the sensory nerve filaments, and when the resin is brought in contact with the mucous membranes there is a burning pain, followed in time by a complete loss of sensibility, which is remarkably permanent, since Lewin found that from six to seven minims of a solution of kava injected beneath the skin produced a complete loss of sensibility in the surrounding area, which did not pass away for eight days. (*D. M. Ztg.*, Feb., 1886.) The action of the drug upon the circulation is subordinate to its nervous influence, but according to the experiments of Cerna it does

stimulate the heart, although it decreases the number of pulsations by stimulating the inhibitory nerve centers. The same investigator found that at first it stimulates, afterwards depresses, and finally paralyzes the respiratory center. The insolubility and irritant action of kava resin has lessened its use as a practical local anesthetic.

As long ago as 1857 kava root was employed in the treatment of *gonorrhoea*, and there is much testimony to its value both in the acute and the chronic form of the disease, as well as in *vaginitis*, *leucorrhoea*, *nocturnal incontinence*, and similar conditions of the genito-urinary tract.

Under the name of *gonosan* a twenty per cent. solution of kava resin in oil of sandalwood is used internally in the treatment of *gonorrhoea*. The advantages claimed for it are that it is much less likely to disturb the stomach than sandalwood oil, that it is locally anesthetic and hence relieves the pain and, apparently, also has some anaphrodisiac action. According to Ganz (*All. M. C. Z.*, 1906, p. 213), while not of itself gonocidal it renders the urine permanently antiseptic and so deprives the gonococci of conditions favorable for their growth. The preparation is marketed in capsules containing 0.3 Gan. of which two to four may be given several times a day. (For the methods of determining kava resins in this and similar preparations, see *Ph. Ztg.*, 1914, 284.)

Dose, of kava rhizome, from fifteen to forty-five grains (1-3 Gm.).

Off. Prep.—Extractum Kavae Liquidum, *Br.*, (*N. F.*).

Kefir. *Kephyr.* *N. N. R.* 1917. (See also *Lactic Acid Therapy*.)—From time immemorial the Tartars and the Balkan peoples have employed as a food and beverage one or another form of fermented milk. The Tartars prepared from mare's milk a drink known as *koumiss* or *kumys*. This is prepared by the action of a peculiar ferment known as *kephir* (*kepir*) and called also by the Mohammedans "*the prophet's millet*." In Western Europe, mare's milk not being available, an imitation of kumys has been made from cow's milk, to which the term "*kephir milk*" should be applied, limiting the word kumys to the genuine Tartar drink. The Armenians employed a fermented milk, *madzonn* or *matzoon*. *Giaourdi* is a fermented milk prepared in Greece from sheep and goat's milk with an enzyme obtained from fermented figs. The Bulgarians use a fermented milk known as *yoghourt* (*yaowite*). The Arabians have a fermented milk called *leben*.

The *kefir grains* (or seeds) are white, irregular, roundish bodies about the size of a walnut with a rough, ferruled surface, of gelatinous or, when dried, cartilaginous

consistency. Despite considerable investigation, their composition is not yet definitely settled. They probably contain several micro-organisms as follows: (1) a yeast fungus which Spivak (*N. Y. M. J.*, 1896) believes identical with the ordinary yeast, *Saccharomyces cerevisiae*, but which Beyerinck believes to be a distinct species, *S. Kefir*, (2) *Bacillus Dispora Caucasica* (Kern) or *Bacillus Kephir* (Sorokin), (3) *Bacillus acidi lactici*, (4) other bacteria which are probably of little importance to the process of fermentation.

There are a number of directions for preparing kephir milk, varying more or less in the details. The following is a simple one: About 120 grains of kephir grains are softened by soaking over night in a pint bottle full of water. The following morning the water is poured off and the bottle is three-quarters filled with unboiled milk and tightly stoppered. This is kept at a temperature of 20° C. (68° F.) for from one to three days. The milk is strained through cheese cloth immediately before use and the residue recovered may be used for fermenting other milk. For various other processes see Kobert (*Zeitsch. f. Krankenpflege*, 1904, p. 377; *Ph. Ztg.*, 1904, 819 and 1912, 277), Drasler (*Med. Klin.*, 1908), and Spivak (*N. Y. M. J.*, 1896). According to Spivak, the changes in milk during kephirization are as follows: 1. Fat, salts, and water remain unchanged. 2. The quantity of lactose is gradually lessened from 30-50 per mille to 16-30 per mille in the second-day kephir, and to 12-20 per mille in the third-day kephir. 3. Lactic acid is increased from 3.5-8.6 per mille in second-day kephir to 6.3-9.0 in third-day kephir. 4. Alcohol is produced from 5.3-8.0 mille in second-day kephir to 6.0-10.0 in third-day kephir. 5. Carbon dioxide is generated in quantities approximately 10 per cent. 6. A part of the casein—namely, about 10 per cent.— is transformed into acid albumin and peptone, 10 per cent. into hemialbumose, and the rest loses its lime, and therefore becomes more easily digestible.

There is largely sold, under the name of koumys, a spurious drink which is made by fermenting sweetened milk with ordinary yeast. It is a pleasant beverage, but differs in important regards from the true kephir milk. The following formula has been suggested by L. Wolff (*A. J. P.*, 1880, 291): "Grape sugar, half an ounce. Dissolve it in four ounces of water. Dissolve twenty grains of compressed yeast, or well-washed and pressed out brewer's yeast, in two ounces of milk. Mix the two solutions in a quart champagne bottle, which is to be filled with good cow's milk to within two inches of the top. Cork well, secure the cork with wire, and place in a cellar or ice chest, where a temperature of 10° C. (50° F.) or less can be maintained, and agitate three times a day. In three or four days the koumys is ready for use, and should not be kept longer than four or five days; it should be drawn only with a champagne tap." A beer bottle with patent stopper may be substituted for the champagne bottle.

The composition of true koumys, according to Stalberg, is given below; other analyses may be found in the *J. P. G.*, 1875, 62.

Koumys of June. In 100 parts, alcohol 1.65, fat 2.05, sugar of milk 2.20, lactic acid 1.15, casein 1.12, salts 0.28, carbonic acid 0.75.

Koumys of September. Carbonic acid 1.86, alcohol 3.23, fat 1.05, lactic acid 2.92, casein and salts 1.21. Stalberg gives the following as the result of an analysis of

Swiss koumys, made from cow's skimmed milk to which sugar had been added. Alcohol 3.622, lactic acid 0.256, sugar 2.376, albumin 2.099, butter 2.008, mineral salts 0.574, carbonic acid 1.997. Warnikiewicz found in koumys from cow's milk 6.32 per cent. of solid material, casein 3.08, butter 0.22, milk sugar 1.77, salts 0.33, lactic acid 0.62, alcohol 1.23 parts per hundred. (See also *Konig's Nahrungs- und Genussmittel*, 416-419.)

These fermented milks vary in composition with the milk they are prepared from. In the following analyses, the first three columns are taken from A. J. P., 1887; the matzoon analysis is by Uffelmann.

	Cow's Milk	Koumys	Kephir	Matzoon
Albumin	48	11.2	38	31.2
Butter	38	20.5	20	16.0
Sugar of milk	41	22.0	20	16.2
Lactic acid .....	..	11.5	9	8.3
Alcohol .....	..	16.5	8	2.1
Water and salts ..	873	918.3	905	926.2

Gordon Sharp (*P. J.*, 1892, 512) stated that the composition of koumys is complex, and that the decomposition which its proteids undergo is closely allied to putrefaction.

Kephir milk is useful either as an accessory or sole food in various conditions of malnutrition. Not only does it offer the nutritive elements of milk in a partially digested form, but it is claimed that the living ferments which are contained in it have an influence in aiding digestion in the alimentary canal, and that it also stimulates the appetite. It first came into Europe as a remedy in *pulmonary tuberculosis*, but has also been recommended in various forms of *dyspepsia*, whether functional or organic, in *anemia* and *chlorosis*, in *rachitis*, *chronic rheumatism*, and other conditions of impaired nutrition. It has also been employed as an infants' food with asserted remarkable results. Its value in *phthisis* has been extraordinarily lauded by Uroganski. (*Wiener Med. Wochens.*, 1907.)

Kinkeliba. *Combretum album*. (Fam. *Combretaceae*.)—This is the leaf growing in Western Africa which is affirmed to be of great value in the treatment of bilious *hematuric malarial fevers*. Heckel and Schlagdenhauffen found in the leaves nothing more active than tannin and potassium nitrate. (See Perrot and Lefevre, *Travaux du Laboratoire de Mat. Med.*, p. 67.)

KINO. U. S., Br.

KINO

"The spontaneously dried juice of *Pterocarpus Marsupium* Roxburgh (Fam. *Leguminosae*)." U. S. "Kino is the juice obtained from incisions in the trunk of *Pterocarpus Marsupium*, Roxb., heated to boiling and evaporated to dryness. Known in commerce as East Indian, Malabar,

Madras, or Cochin kino." *Br.*

Gummi (s. Resina) Kino; Indian Kino, Malabar Kino; Kino de l'Inde, *Fr. Cod.*; Kino, *G.*; Goma quino, *Sp.*

The term kino was originally applied to a vegetable extract or inspissated juice taken to London from the western coast of Africa, and introduced to the notice of the profession by Fothergill. Vegetable products obtained from various other parts of the world, resembling kino in appearance and properties, afterwards received the same name, and some confusion and uncertainty still exist, in relation to the botanical and commercial history of the drug. We shall first consider the general properties of official kino, then the several varieties.

Properties.—The official description is as follows: "In small, brittle angular fragments, usually considerably less than 15 mm. in diameter, varying in color from dark reddish-brown to reddish-black; when crushed upon a slide and examined under the microscope the angular fragments are more or less translucent with a glass-like, conchoidal surface, the thinner pieces having a yellowish-red or deep brownish-red color, the pieces often being marked by nearly parallel, curved and straight lines; inodorous; taste very astringent; when masticated it colors the saliva somewhat pink. The powder is of a dark brick-red color; upon the addition of water, the sharp angular fragments assume a deep rich-red color and become more or less rounded and separate into innumerable, small, granular particles among which are a large number of rod-shaped bacteria. On mounting powdered Kino in alcohol the fragments at first assume a deep red color, then mostly dissolve, leaving a number of small, colorless granules and indistinguishable, cellular fragments. Kino is only partly soluble in cold water, and not less than 40 per cent. is soluble in boiling water. The latter solution, when cooled and filtered, shows a faintly acid reaction, gives a dark green precipitate with ferric chloride T.S. and a reddish-violet color with alkalis. The yield of alcoholic extractive is not less than 45 per cent. Kino contains not more than 12 per cent. of moisture, and yields not more than 3 per cent. of ash." *U. S.*

"In small, angular, glistening, opaque, reddish-black, brittle fragments; transparent and ruby-red in thin laminae. Inodorous; taste very astringent. Almost entirely soluble in alcohol (90 per cent.), slowly and incompletely soluble in cold water, not less than 75 per cent. soluble in

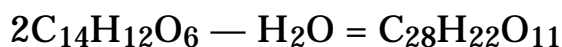
boiling water, the solutions being deep red in color. Almost entirely insoluble in ether. An aqueous solution (1 in 20) yields a voluminous reddish precipitate with dilute mineral acids, and, when largely diluted with water, a greenish-black precipitate with T. Sol. of ferric chloride. Ash not more than 2.5 per cent. In India and the Eastern Divisions of the Empire, Butea Gum (Buteae Gummi) may be employed in making the official preparations for which Kino (distinguished in commerce as East Indian, Malabar, Madras, or Cochin kino) is directed to be used." *Br.*

If in large masses, it may be reduced without difficulty into minute fragments. It is without odor, and has a bitter, highly astringent taste, with a somewhat sweetish after-taste. It burns with little flame, and does not soften with heat. It imparts its virtues and a deep red color to water and alcohol, but is nearly insoluble in ether. Cold water forms with it a clear infusion. Boiling water dissolves it more largely, and the saturated decoction becomes turbid on cooling, and deposits a reddish sediment. The tincture is not disturbed by water. When long kept, it often gelatinizes, and loses its astringency. (See *Tinctura Kino.*) Kino undoubtedly consists chiefly of a modification of tannic acid or tannin, which has received the name of *kino-tannic acid*, with extractive, gum, and sometimes probably a little resin, but we need a careful analysis of the different well-ascertained varieties. The aqueous solution is precipitated by gelatin, the soluble salts of iron, silver, lead, and antimony, mercuric chloride, and sulphuric, nitric, and hydrochloric acids. The precipitate with iron is of an olive or greenish-black color. The alkalies favor the solubility of kino in water, but essentially change its nature and destroy its astringency.

1. EAST INDIA KINO. *Malabar Kino.*—This is the variety at present probably most used and most highly esteemed, and the only one recognized by the British and United States Pharmacopoeias. Its origin was long unknown. It is now ascertained, through the researches of Pereira, Royle, Wight, and others, to be the product of *Pterocarpus Marsupium*, a lofty tree growing upon the mountains of the Malabar coast of Hindostan. Kino is the juice of the tree extracted through longitudinal incisions in the bark and afterwards dried in the sun. Upon drying it breaks into small fragments, and is put into wooden boxes for exportation. It is collected near Tellicherry, and exported from Bombay. It is sometimes imported into this country directly from the East Indies, but more commonly from London. From a communication in the *Journal*

of the Asiatic Society of Bengal, by F. Mason, it appears that kino is also collected in the Tenasserim provinces, in Farther India, and has been exported from Maulmain to Europe. It is produced by a tree called *Padouck*, which Christison recognized from a description furnished to him by Begbie, of Maulmain, as *Pterocarpus Marsupium*, so that this kino has the same origin as that from Malabar. *Pterocarpus indicus*, of the Mauritius Islands, where it is known as sang-dragon, also yields a red kino to commerce.

When kino is boiled in water, the decoction deposits, on cooling, a bright red substance, and a similar deposition takes place when a cold filtered aqueous solution is long exposed with a broad surface to the air. According to Hennig, kino consists of tannic acid about 40 per cent, with a trace of gallic acid, kinoic acid, pectin, ulmic acid, and inorganic salts, with excess of earthy bases. (See *A. J. P.*, xv, 544.) C. Etti obtained a new constituent, *kinoin*, by extracting kino with ether. He finally adopted the following method as more practicable. One part of gum kino is added to 2 parts of boiling diluted (1 to 5) hydrochloric acid. Kino-red immediately separates as a soft mass, becoming gradually solid on cooling, while the *kinoin*, mixed with a small quantity of kino-red, remains in solution. The solid residue is once more boiled with water, the liquids are united and shaken with ether. The ethereal solution, on evaporation, leaves a crystalline reddish residue, which is dissolved in hot water, on tile cooling of which tolerably pure crystals of kinoin are obtained. By continued recrystallization they are obtained colorless. Their formula is $C_{14}H_{12}O_6$, and kino-red is the anhydride of this:



This kino-red heated to 160° to 170° C. (320°-338° F.), parts with a molecule of water and yields a lower anhydride, $C_{28}H_{20}O_{10}$. Both anhydrides are precipitated by gelatin, but kinoin itself is not. When heated with hydrochloric acid to 120° to 130° C. (248°-266° F.), kinoin yields methyl chloride, gallic acid, and catechol, and hence probably has the constitution of a guaiacol or *methyl-catechol gallate*. Kino contains about 1.5 per cent. of kinoin. (*Ber. d. Chem. Ges.*; N. R., Feb., 1897.) Kremel found Malabar kino, Butea gum, eucalyptus kino, and the kino from *Coccoloba uvifera* to be free from Etti's kinoin, but to contain a body acquiring, like kinoin, a red color with ferric chloride, which proved to be *pyrocatechuic acid*; this was present either alone or mixed

with gallic acid. (*A. J. P.*, 1883, 267.) Some doubt was also thrown upon the value of Etti's conclusions by White (*P. J.*, 1903, p. 676), who failed to find several of the constituents reported by Etti. The true chemistry of kino may therefore be considered to be in a somewhat doubtful state. This is probably due to the fact that many different drugs have appeared in commerce under that name. Kino contains in its natural condition an oxidizing enzyme or oxidase which is the cause of the gelatinization which takes place in preparations of this drug. This enzyme can be destroyed by heat and advantage is taken of this fact in making *Tinctura Kino* (which see). In an examination made by David Hooper of ten varieties of East Indian kino, the proportion of tannic acid was found, after thoroughly drying the kino, to vary from 80 to 97 per cent. of the whole mass. (*Agricultural Ledger of India*, No. 11, 1901.)

It is said that catechu, broken into small fragments, has sometimes been sold as kino. Genuine kino is sometimes substituted by the extract of *krameria*. The latter is more brittle and dissolves, more quickly in water.

2. WEST INDIA OR JAMAICA KINO.—This is believed to be the product of the *Coccoloba uvifera* L., or *sea-side grape*. It grows in the West Indies and neighboring parts of the continent. The kino is said to be obtained by evaporating a decoction of the wood and bark, which are very astringent.

Although it has been many years since any large quantity appeared in our markets, it may occasionally be met. It is contained in large gourds, into which it was evidently poured while in a liquid or semi-liquid state, and then allowed to harden. When taken from the gourd it breaks into fragments of various sizes, upon an average about as large as a hazelnut, and having some tendency to the rectangular form. The consistence of these fragments is uniform, their surface smooth and shining, and their color a dark reddish-brown approaching to black. They are, however, neither so glistening nor so black as the East India kino. In mass they are quite opaque, but in thin splinters are translucent and of a ruby redness. They are readily broken by the fingers into smaller fragments, are easily pulverized, and yield a dull-reddish powder, considerably lighter colored than that of the East Indian variety. The West India kino is without odor, and has a very astringent, bitterish taste, with a scarcely observable sweetish after-taste. It adheres to the teeth when chewed, although rather less than the East Indian variety, and colors the saliva red. The solubility of

Jamaica kino was very carefully examined by Robert Bridges, who found that cold water dissolved 89 per cent., and alcohol 94 per cent. The portion dissolved by alcohol and not by water was probably of a resinous nature, as it appeared to be viscid, and very much impeded the filtration of the aqueous solution. Considering the nature of this substance, the form of kino in which it was found is probably, like that from the East Indies, an inspissated juice. Guibourt, who states that Jamaica kino is but slightly dissolved by cold water, must have operated on a different product.

3. SOUTH AMERICAN KINO. *Caraccas Kino*. —In 1839, an astringent extract was described which had been introduced into our market, derived from Caraccas, and known by that name to the druggists. It is probably the same as that described by Guibourt, in the last edition of his *History of Drugs*, as the kino of *Colombia*. As imported, this variety of kino is in large masses, some weighing several pounds, covered with thin leaves, or exhibiting marks of leaves upon their unbroken surface, externally very dark, and internally of a deep reddish-brown or dark port-wine color. Some of the masses are very impure, containing pieces of bark, wood, leaves, etc.; others are more homogeneous, and almost free from impurities. The masses are broken up by means of a mill so as to resemble East India kino, from which, however, this variety differs in being more irregular, less sharply angular, more powdery, and less black. In appearance, taste, odor and other sensible properties this kino closely resembles the West India variety. It is not improbable that they are derived from the same plant, and there is no difficulty in supposing that this may be the *Coccoloba uvifera*, as that tree grows as well upon the continent as in the islands. South American kino was found by Bridges to yield 93.5 per cent. to cold water, and 93 per cent. to alcohol; so that, while it has almost the same solubility as Jamaica kino in alcohol, it is somewhat more soluble in cold water. The aqueous solution in this case was not embarrassed by the adhesive matter which impeded the filtration in the former variety, and the want of a minute proportion of resinous matter in the South American kino is the only apparent difference between the two drugs.

4. AFRICAN KINO.—The original kino employed by Fothergill was known to be the product of a tree growing in Senegal, and upon the banks of the Gambia, on the western coast of Africa, but the precise character of the tree was not ascertained until a specimen, sent home by Muugo Park during his last journey, enabled the English botanists to

decide that it was the *Pterocarpus erinaceus* of Lamarck and Poiret. A particular account of *Pterocarpus erinaceus* and its concrete juice, with a figure, by W. F. Daniell, is contained in the *P. J.* for August, 1854 (vol. xiv, p. 55). The importation of African kino has long ceased. In 1896, however, a consignment of African kino reached London. It was examined by E. M. Holmes, who stated that it was evidently yielded by *P. erinaceus*. (*C. D.*, 1896, 226.) It is said to be still used by the Portuguese of Angola, under the name of *Sangue de Drago*. As described by Fothergill, the African kino, for which he proposed the name of *gummi rubrum astringens Gambinense*, was in lumps of about the size of those of gum Senegal or dragon's blood, and so similar in appearance to the latter that a good judge might easily be deceived. These lumps were hard, brittle, opaque, and almost black, but minute fragments were reddish and transparent like garnet. The drug was inodorous, of a strongly astringent and sweetish taste, and soluble in water to the extent of about five or six parts out of seven, forming a deep red astringent infusion. There can be little doubt that this variety of kino is a concrete juice, which exudes either spontaneously or from wounds in the bark, and hardens in the air. (*Med. Obs. and Inq.*, i, 358.)

MACARANGA KINO is obtained from *Macaranga Roxburghii* Wright, of the Deccan peninsula. It occurs in the form of odorless, tasteless tears or irregular masses. The tears have fibrous fractures and when immersed in water yield unravelling fibers giving the appearance of a sea anemone. According to Hooper, this kino yields from 6 to 15 per cent. of a peculiar tannin and is closely allied to Butea kino, from which it is distinguished by fibrous tears and the fact that it contains so much gum which swells without dissolving in water. (*P. J.*, lxvi, 616.)

MYRISTICA KINO.—There has been produced in Southern India a kino consisting of (Smaller or larger angular pieces, of deep garnet color, in thin fragments, and having the general characteristics of Malabar kino; according to E. Schaer, it is a product of *Myristica malabarica*, of *M. fragrans*, and probably of other species of the genus. In all important respects these kinos are said to correspond with Malabar kino, but to be distinguishable by containing crystals of calcium tartrate. *Myristica Kino* is probably a distinctive product from the so-called *Syndai varnish*, a rich red fluid obtained from the *Myristica gibbosa* Hook. f., and employed in Assam as a varnish. This varnish is highly astringent and after exposure becomes perfectly impervious, the changes being due to the presence of a ferment or enzyme. As has been shown by D. Hooper

(P. J., June 20, 1903), Syndai varnish, if kept in corked bottles, gelatinizes in a few weeks. Edmund White made an investigation into the cause of the gelatinization of tincture of kino (P. J., May, 1903), from which it appeared that this phenomenon was due to the presence in the kino of an enzyme belonging to the oxydases, and this enzyme was subsequently isolated by David Hooper from the fresh juice of *Myristica gibbosa*. (Proc. A. Ph. A., 1903, 733.) It is believed by White that this enzyme may be eliminated from the official as well as other kinos by a judicious method of collection, and considers it probable that the following one, adopted by J. Q. F. Marshall and described in the "Agricultural Ledger" (1900, No. 11, 381), will accomplish this: "A longitudinal cut is made with an axe or knife, called *acha katti*, through the bark of the trees, down to the cambium, about 1½ feet long, and side outs are made to lead into this. A bamboo tube is then fixed at the bottom of the main incision in order to catch the juice. In the course of about twenty-four hours the flow of gum ceases and the bamboo is taken down. When several of these bamboo cups are nearly full they are taken to headquarters and emptied into a large cauldron and the juice boiled. During the boiling, the impurities, consisting of pieces of bark, wood and leaves, rise to the surface and are skimmed off. When sufficiently concentrated to the consistence of a thick extract it is exposed to the sun, in thin layers, in shallow vessels until it is dry enough to crumble to pieces. The kino is then weighed and packed away in wooden cases." (P. J., 1903, 702.)

Botany or Blue Mountain kino is obtained from *Angophora lanceolata* Cav. Colombo kino is obtained from a number of species of *Angophora*. Hooper (P. J., 1908, xxvii, 161) reports the occurrence of three new astringent plant juices or kinos. They are derived from *Jatropha Curcas*, from South Salem; *Xylia doldbriformis*, from Burma; and *Parkia insignis* ("Myauk-ta-nyet"), also from Burma.

Uses.—Kino is powerfully astringent, and in this country is much used for the suppression of morbid discharges. In diarrhea, not attended with febrile excitement or inflammation, it is often an excellent adjunct to opium and the absorbent medicines, and is a favorite addition to chalk mixture. It is also used in *chronic dysentery* when astringents are admissible; in *leucorrhoea* and *diabetes*; and in *passive hemorrhages*, particularly those from the uterus and the intestines. The infusion may be made by pouring eight fluidounces of boiling water on two drachms of the extract, and straining when cool; aromatics may be added, if

deemed advisable. The dose of this infusion is a fluidounce (30 mils). The proportion of alcohol in the tincture renders it frequently an unsuitable preparation.

Dose, eight to thirty grains (0.5-2.0 Gm.).

Off. Prep.—Pulvis Catechu Compositus, *Br.*; Pulvis Kino Compositus, *Br.*; Tinctura Kino, *U. S., Br.*; Pulvis Kino et Opii Compositus, *N. F.*; Tinctura Kino et Opii Composita (from Tincture), *N. F.*

KINO EUCALYPTI. *Br.*

EUCALYPTUS KINO [Eucalyptus Gum Red Gum]

"Eucalyptus Kino is an exudation from the stem of various species of Eucalyptus." *Br.*

Eucalypti Gummi, *Br.* 1898; Australian Kino.

Eucalyptus kino is prepared from a number of species of Eucalyptus, but most of the commercial article is prepared from *E. rostrata*, a tree which is very abundant in Western Australia. This tree received its name from the rastrate character of the opercula. Masses of kino are sometimes found in cavities between the wood and the bark, this being due to the evaporation of the sap in these places. It is usually obtained by incising the trees and collecting the exuding liquid which is then dried in the sun. It has been stated that five hundred pounds of the kino are sometimes yielded in a single year by one tree, but this seems to be a great exaggeration. Occasionally the juice reaches England unevaporated. *Kino juice* has a fine deep red color, a slightly aromatic odor, and a decidedly astringent taste, and on evaporation yields a genuine kino in varying amount. It must not be confounded with the so-called *Liquid Kino*, or *apple tree juice*, which is obtained from incisions in the *Angophora intermedia* or *narrow-leaved apple tree* of Australia. This varies from the consistency and colorlessness of water to an orange brown or reddish-brown liquid as thick as molasses. It contains catechin and tannic acid, and is said to be especially employed for the purposes of tanning nets.

Properties.—Australian kino usually occurs in dark, reddish-brown (not reddish-black) masses or grains, which when sufficiently thin may

be translucent and garnet-like. This form of kino is at the present time very largely used and while similar to the official or East Indian Kino in physical and therapeutical properties has not in solution the tendency to gelatinize. For further information concerning it the reader is referred to an elaborate paper on it by J. H. Maiden, in *P. J.*, Oct., 1889; also *A. J. P.*, 1897, 1.

"In very dark reddish-brown grains or small masses. Thin fragments transparent and ruby-red, or garnet-red. Inodorous; taste astringent. Tough and adhering to the teeth when chewed. Not less than 80 per cent. soluble in water, Almost entirely soluble in alcohol (90 per cent.)."
Br.

Eucalyptus kino contains catechin, pyro-catechin and kinoin, and in some specimens a volatile oil, giving a slightly aromatic odor to the drug, which is especially developed by hydrochloric acid. J. H. Maiden (*A. J. P.*, 1895, 575) states that Australian kino contains *eudesmin* and *aromadendrin*. The former of these when purified exists as a pure white mass with a luster resembling spermaceti. It is soluble in hot water, but crystallizes out again on cooling. It is soluble in alcohol, ether, acetic ether, and chloroform, but not in benzene, petroleum spirit, or carbon disulphide. It is dissolved by sulphuric acid with a dark color changing to purple, by nitric acid with a beautiful yellow color. Its formula is given as $C_{26}H_{30}O_8$, and its melting point as $99^{\circ} C.$ ($210.2^{\circ} F.$). The second substance was also obtained crystallized from boiling water, and melted at $162^{\circ} C.$ ($323.6^{\circ} F.$). No analysis has been made of it.

Uses.—It does not equal kino in astringency. It is used for *diarrheas of relaxation*, and other affections for which kino has been employed, and is also largely employed as the basis of lozenges and gargles for the relief of relaxed conditions of the pharynx.

Dose, from five to twenty grains (0.3-1.3 Ghn.).

Off. Prep.—Trochiscus Kino Eucalypti, *Br.*

Kola. *N. F. IV. Cola. Kola Nuts. Semen (Nuces) Colae. Noix de Cola, Noix de Gourou, Café du Soudan, Fr. Kolanuss, G.*—It is described by the *N. F.* as "the dried cotyledons of several species of *Cola* Schott and Endlicher (Fam. *Sterculiaceae*), yielding not less than 1.5 per cent. of caffeine." *N. F.* The official drug is obtained chiefly from the large African tree *Cola Acuminata* R. Br., which is extensively cultivated in various portions of the tropical world for its seeds. The latter, under their Guinea name, or the

Soudan name of *guru nuts*, are extensively employed as a caffeinic stimulant in Africa and other portions of the world. Six hundred tons of them are said to be sent yearly to Brazil for the use of the negroes, who, it is affirmed, also employ the seeds of *Sterculia Chica* A. St.-Hill. and *S. striata* A. St.-Hill. Three varieties of kola nuts are said to be the product of *Cola acuminata*. The most valuable, the kola of Sakhala, is the largest, and is of a white color. The kola of Kassi, of Siarra, and of Toute, is of medium size, red or white. The kola of Maninian is small and red. Of this white kola there are two varieties, one whitish, resembling the kola of Sakhala but smaller; the other more or less rose-colored and larger. The kola nut itself consists of the cotyledons which are "irregularly plano-convex, broadly oval, or approaching circular in outline, from 2.5 to 5 cm. in length, or triquetrous; heavy, hard and tough; brown with the outer surfaces slightly wrinkled, the inner surfaces lighter and smoother; edges slightly incurved and sharp. Odorless; taste slightly astringent. The powdered drug is reddish-brown and, when examined under the microscope, exhibits numerous starch grains, some of which show alteration, the normal grains up to 0.045 mm. in diameter, the smaller ellipsoidal or spherical, the larger ellipsoidal or irregularly oblong and occasionally with a protuberance on one side; many of the larger grains show lamellae and a circular point of origin of growth or a fissure through the center, and a distinct cross when examined with the polarizing microscope; parenchyma cells numerous, about 0.065 mm. in diameter, with reddish-brown walls."

Assay.—"Introduce 6 Gm. of Kola, in No. 60 powder, into a flask and add 120 mls of chloroform and 6 mls of ammonia water. Stopper the flask, shake it frequently for half an hour, then let it stand four hours. Again shake the flask vigorously and, when the drug has settled, filter the liquid rapidly through a pledget of purified cotton and collect 100 mls of the filtrate, representing 5 Gm. of Kola. Evaporate the clear filtrate to dryness and dissolve the residue in 5 mls of weak sulphuric acid with the aid of a gentle heat. When the liquid has cooled, filter it into a separator and wash the container and filter with several small portions of distilled water. Now add ammonia water until the liquid is distinctly alkaline to litmus and shake out the alkaloid with successive portions of chloroform until completely extracted, as shown by testing with iodine T.S. Evaporate the united chloroform solutions and dry the residue to constant weight at 80° C. (176° F.). The weight is the amount of caffeine from 5 Gm. of Kola. Kola yields not more than 3 per cent. of ash." N. F.

Daniell (*P. J.*, 1865) was the first to show that kola nuts contained caffeine. Subsequently an elaborate analysis yielded to Atfield 2 1/3 per cent. of caffeine from the nut. Schuchardt summarizes the results of his chemical analyses as follows: 1. Martinique nuts contained 1.06 per cent. caffeine; 2, Ceylon, 1.39 per cent.; 3, Gaboon, 1.47 per cent.; 4, Tropical West African coast. Sierra Leone, 1.69 per cent.; 5, Tropical West Africa, interior, 1.61 per cent. The chemical studies of Parke, Davis & Co. show that as found in American commerce these nuts contain from 0.72 to 2.02 per cent. of caffeine. Heckel and Schlagden-hauffen (*A. J. P.*, 1884) give theobromine 0.023 per cent., caffeine 2.35 per cent., tannin 1.62 per cent., as the result of their analyses. The researches of Knebel (*A. J. P.*, 1892, 190), confirmed by Hilger (*Ibid.*, 568), show that fresh kola nuts probably contain no caffeine, but a glucoside, *kolanin*, which yields by its decomposition caffeine, glucose, and *kola-red*

(C₁₄H₁₃(OH)₅). Betaine is also stated to be present. The glucoside is decomposed by a ferment present in the nuts, and therefore readily yields the caffeine as a decomposition product. Schweitzer (1895) confirmed the results of Knebel and Hilger, and proposed for kolanin the formula C₄₀H₅₆N₄O₂₁. Knox and Prescott (Proc. A. Ph. A., 1896, 136), after an investigation, assert that the kola ferment does not assist in the liberation of caffeine, but attribute the presence of caffeine to the action of heat and moisture; they also give the name of *kolatannin* or *kola-tannic* add to the tannin of kola nuts, and propose a method of assay. (Proc. A. Ph. A., 1897, 131.) For Carlo's method of assay, see *P. J.*, 1896, 289. Goris (*P. J.*, 1906, lxxvi, p. 261) has separated from the kola nut a basic glucoside to which he gives the name of *kolatine*.

Travellers in Africa assert that the fresh kola nuts have a stimulant action which is not explicable on the ground of their caffeine content. But as they appear in European commerce their action is undistinguishable from that of the other caffeinic drugs. The experiments of Mosso (*A. I. B.*, xix) seem to demonstrate conclusively the inertness of kola-red.

Kola is about equivalent to guarana, tea, coffee, etc., and may be substituted for them. In dose of one hundred and fifty grains (9.8 Gm.) a day, A. Hudson (*T. G.*, ii) has found the nuts to act decisively in cardiac weakness.

The so-called *male kola* is essentially distinct from kola, being said to be the fruit of a small tree, *Garcinia Kola* (fam. *Guttiferae* Heck.), and containing no caffeine. The fruit is oblong, about one and a half to three inches long and from three-quarters to one inch broad; it is trigonal in section, with a readily removable thin testa of a reddish-yellow to dark brown color, covered by markings which resemble those on the seed coat of the nutmeg. It is bitter and astringent. In the section the microscope reveals a number of resinous masses surrounded by cells rich in starch.

The seeds of *Lucuma mammosa* Griesbach (Fam. *Sapotaceae*), sometimes mixed with kola nuts, are recognized at once by their strong odor of prussic acid. Heekel and Schlagdenhauffen have observed the seeds of *Heritiera litoralis* Dryand (fam. *Sterculiaceae*) mixed with kola nuts. These false kola nuts contain no caffeine, and are nearly orbicular and flattened in shape, one of the fleshy, purplish-brown cotyledons being only half the size of the other. (*A. J. P.*, 1887, 446.)

Kosam Seeds. *Fructus Bruceae*, Pharm. Nederland.—The seeds of the *Brucea sumatrana* Roxb. (Fam. *Simarubaceae*) indigenous in China and Southern Asia. Schlagdenhauffen found in them saponin, and Physalis and Bertrand a glucoside, *kosamin*. They are asserted to be useful in *menorrhagia*, also in *dysentery* and *diarrhea*. (*P. J.*, lxiv, p. 463.) According to Power and Salway (*Year-book of Pharmacy*, 1907), the *B. antidysenterica* has similar properties and is largely used in Abyssinia.

Kossala—An Abyssinian remedy against tape worm. (*Proc. A. Ph. A.*, xxvi.) It is said, however, to produce gastric irritation.

KRAMERIAE RADIX. Br.

KRAMERIA ROOT [Rhatany Root]

"Krameria Root is the dried root of *Krameria triandra*, Ruiz and Pav. (Peruvian Rhatany), and also of another species of Krameria, probably *Krameria argentea*, Mart. (Para Rhatany)." Br. "The dried root of *Krameria triandra* Ruiz et Pavon, known in commerce as Peruvian Rhatany, or of *Krameria Ixina* Linne, known in commerce as Savanilla Rhatany, or *Krameria argentea* Martins, known in commerce as Para or Brazilian Rhatany (Fam. Leguminosae), without the presence of more than 5 per cent. of stems or other foreign matter." N. F.

Krameria, N. F.; Rhatany Radix Ratanhae; Ratanhia, Fr. Cod.; Radix Ratanhae. P. G.; Ratanhiawurzel, G; Ratania, It.; Ratania (Raiz de), Sp.

The genus *Krameria* was named in honor of J. G. H. Kramer, a physician and botanist of Temesvar, Hungary.

Krameria was dropped from the U. S. P. IX but retained in the British Pharm., 1914, and in the N. F.

Krameria triandra is a shrub, having a long, much-branched, spreading root, of a blackish-red color; with a round, procumbent, very dark colored stem, divided into numerous branches of which the younger are leafy and thickly covered with soft hairs, giving them a white, silky appearance. The leaves are few, sessile, oblong-ovate, pointed, entire, presenting on both surfaces the same silky whiteness of the young branches. The flowers are lake-colored, and stand singly on short peduncles at the axils of the upper leaves. The stamens are three. The nectary is of four leaflets, the two upper spatulate, the lower roundish and shorter. The fruit is globular, of the size of a pea, surrounded by stiff reddish-brown prickles, and having one or two seeds. It is a native of the Peruvian Andes, growing in dry argillaceous and sandy places. It flowers at all seasons, but is at the height of its bloom in October and November. The root is dug up after the rains, and, according to Tschudi, it is especially obtained in the southern provinces of Peru. Closely allied to it is *K. Ixina* L., which yields *Savanilla Rhatany*. It is, however, distinguished by having four stamens, and occurs in Guiana and Northern Brazil. The name *rhatany* is said to express in the tongue of the Peruvian Indians the creeping character of

the plant yielding the root.

Para or *Brazilian Rhatany* was described by Berg in 1865, and is believed to be the root of the *K. Argentea*. It closely resembles the *Savanilla* variety. Two forms of rhatany which Cotton has described as *Black* and *Brown Antilles rhatany* because produced in these islands have been pronounced by Fluckiger (*P. J.*, July, 1870, p. 84) to be identical with the *Para Rhatany*. According to the studies of Dunwoody (*A. J. P.*, 1890) this rhatany contains the same active principles as the root of *K. Triandra*, but in slightly less quantity.

The British Pharmacopoeia recognizes two varieties of rhatany, which are described as follows: "Peruvian Rhatany is nearly cylindrical, slightly flexuous, reddish-brown; length variable; thickness not exceeding fifteen millimetres. Cork scaly; fracture splintery; wood yellow. In transverse section, bark bright reddish-brown and occupying about one-third of the radius of the section. *Para Rhatany* is cylindrical, nearly straight, dark purplish-brown or almost black, and marked with deep transverse cracks. Fracture short; wood pale reddish-brown. In transverse section, bark dark reddish-brown and occupying about one-half of the radius of the section. Both varieties inodorous; taste of the bark astringent, of the wood scarcely perceptible. Ash not more than 4 per cent." *Br.*

The N. F. description is as follows:

"Peruvian Rhatany.—It consists of a knotty, several to many-headed crown with numerous branching roots, the latter rarely attaining a length of 50 cm. and usually less than 1 cm. in thickness, cylindrical, somewhat tapering, and flexuous or wavy; externally light reddish-brown or brownish-red, more or less marked with dark scaly cork, especially in the upper portion, otherwise nearly smooth, somewhat longitudinally wrinkled and devoid of transverse fissures, fracture of bark slightly fibrous, of wood tough and splintery, the pinkish-brown bark less than one-third of the radius, the wood yellowish or pinkish-white and finely radiate. Inodorous, wood nearly tasteless, bark astringent.

"Savanilla Rhatany and Para Rhatany.—Roots usually separate, less flexuous and tapering than those of Peruvian Rhatany, and usually not exceeding 12 mm. in thickness; externally purplish-brown or

chocolate-brown and marked with numerous transverse fissures; fracture less tough than that of Peruvian Rhatany; internally the bark and wood darker, the bark about two-fifths or more of the radius and more astringent than that of Peruvian Rhatany. Inodorous, wood nearly tasteless, bark astringent. Powdered Krameria is reddish-brown; starch grains simple or two- to four-compound, the individual grains spherical, ellipsoidal, or plano-convex, and sometimes with a central, radial or star-like cleft, from 0.003 to 0.035 mm. in diameter; bast fibers more or less wavy in outline with very much attenuated ends and with non-lignified walls; trachea with simple or bordered pores associated with numerous wood fibers which are narrow-spindle shaped and with thick, porous, slightly lignified walls; numerous cellular fragments with yellowish or reddish-brown walls; calcium oxalate in monoclinic prisms, from 0.01 to 0.1 mm. in length, few or frequently absent. Macerate 2 Gm. of powdered Krameria with 10 mls of alcohol, with occasional stirring for one hour, and filter. The deep reddish colored filtrate obtained yields a dark brownish-red precipitate and a deep orange-red filtrate upon the addition of an excess of alcoholic lead acetate T.S.; this latter filtrate yields no precipitate upon the further addition of a drop or two of alcoholic lead acetate T.S., and yields an olive-brown solution having a purplish fluorescence upon the addition of a drop or two of ferric chloride T.S. Krameria yields not less than 9 per cent. of aqueous extractive and not more than 5 per cent. of ash." *N. F.*

A. rhatany appeared not long since in the London market from Guayaquil. It is described as a large woody root from 1 to 5 cm. in diameter. The bark is of a reddish-brown color with blackish streaks, is thin in comparison to the pith, is of a fibrous texture, and is somewhat striated on the surface and dotted over with small warts. It has a very astringent taste, but no marked odor. E. M. Holmes thinks that it is not the product of the genus *Krameria*. According to the analysis of Passmore, *Guayaquil rhatany* contains a larger quantity of tannin than the Peruvian drug, but less than the Para or the Savanilla rhatany. (*P. J.*, 1903, lxxvi, 878.) A spurious rhatany of unknown botanical origin has appeared in the English market coming from Peru. The root is tapering and varies from two to three and a half inches in length, and a quarter to five-eighths of an inch in diameter. The bark is reddish-brown, rough, scaly and longitudinally grooved. The root has a short fracture and a medullium of about 24 wedge shaped bundles, is odorless and of an astringent taste. For detailed macro- and microscopical descriptions, see P. H. Marsden, P. 3., 1901, 618.

According to an analysis made in the University of Wisconsin, the *Krameria lanceolata* Torrey, of North America, yields 34.5 per cent. of extract and 17 per cent. of tannin, and is therefore richer than the official drug. When treated with iron it strikes a deep-purple color, and is thus easily distinguished from Para rhatany, which gives a dirty brown color, and from Savanilla rhatany, which gives a violet color.

As the astringency is much stronger in the cortical than in the ligneous portions, the smallest pieces are preferable, as they contain the largest proportion of the bark. The powder is of a reddish-brown color. The starch grains occur single or two- to four-compound, the individual grains being spherical, ellipsoidal, or plano-convex, and sometimes with a central, radial, or star-like cleft, from 0.003 to 0.035 mm. in diameter. The bast fibers are more or less wavy in outline with very much attenuated ends and with non-lignified walls. The tracheae possess simple or bordered pores associated with numerous wood fibers which are narrow-spindle shaped and with thick, porous, slightly lignified walls. There are also numerous cellular fragments with yellowish or reddish-brown walls. Calcium oxalate may occur in monoclinic prisms, from 0.01 to 0.1 mm. in length. Macerate 2 Gm. of powdered *Krameria* with 10 mls of alcohol, with occasional stirring for one hour, and filter. The deep reddish colored filtrate obtained yields a dark brownish-red precipitate and a deep orange-red filtrate upon the addition of an excess of alcoholic lead acetate T.S.; this latter filtrate yields no precipitate upon the further addition of a drop or two of alcoholic lead acetate T.S., and yields an olive-brown solution having a purplish fluorescence upon the addition of a drop or two of ferric chloride T.S. *Krameria* should yield not less than 9 per cent. of aqueous extract and not more than 5 per cent. of ash.

The virtues of the root are extracted by water and alcohol, to which it imparts a deep reddish-brown color. From the researches of Vogel, Ghnelin, Peschier, and Trommsdorff, it appears to contain tannic acid, lignin, and minute quantities of gum, starch, saccharine matter, and an acid which Peschier considered as peculiar and named *krameric acid*. The tannic acid of rhatany (*krameria-tannic or ratanhia-tannic acid*) is separated by treating the ethereal extract of the bark with alcohol, and evaporating the alcoholic solution. It gives a dark-green precipitate with ferric chloride, a flesh-colored one with gelatin, and none with tartar emetic. (Gmelin.) The tannin of rhatany, in the presence of

melted potassium hydroxide, is transformed into protocathechuic acid and phloroglucin, and with diluted acids gives glucose and a peculiar red coloring principle called *ratanhia red*, $C_{26}H_{22}O_{11}$. (*J. P. C.*, Jan., 1868, p. 73.) The proportion of red astringent matter obtained by Vogel was 40 per cent. The mineral acids and most of the metallic salts throw down precipitates with the infusion, decoction, and tincture of rhatany, and are incompatible in prescription.

In examining a specimen of extract of rhatany from America, Wiittstein discovered an alkaloid, which he thought to be identical with tyrosine. A somewhat different result was obtained by Ruge, who, after an examination, showed that the new alkaloid is not identical with tyrosine, for it has the formula $C_{10}H_{12}NO_3$, while that of tyrosine is $C_9H_{11}NO_3$, but is rather homologous with it. Like tyrosine, it is an amido-acid, and forms salts equally with mineral acids and with strong bases. It was called *ratanhine* by Ruge. Goldschmidt has since shown (*D. C.*, 1914, 17) that the formula of *rhatanin* is $C_{40}H_{43}NO_3$, and that it is a homologue of tyrosine. It is identical with *angelin*, *geoffrayin*, and *andirin*, which have been described in various plants. He obtained it in crystalline needles, melting at $280^\circ C.$ ($536^\circ F.$). (See *A. J. P.*, 1875, p. 266.)

Cold water extracts all the astringency of rhatany, forming a clear deep-red infusion, which upon careful evaporation yields an almost perfectly soluble extract. The root yields its virtues also to boiling water by maceration, but the resulting infusion becomes turbid upon cooling, in consequence of the deposition of apotheme taken up by the water when heated. By boiling with water a still larger proportion of the apotheme is dissolved, and a considerable quantity of the pure tannin becomes insoluble in cold water, and medicinally inert, either by combining with the starch which is also dissolved, or by conversion into apotheme through the agency of the atmosphere. The decoction is, therefore, an ineligible preparation, and the extract resulting from its evaporation, though greater in weight than that from the cold infusion, contains much less soluble and active matter. Alcohol dissolves a larger proportion of the root than water, but this is owing to the solution of apotheme, and the alcoholic extract contains little if any more of the astringent principle than that prepared by cold water, while it is encumbered with much inert matter. (See *Extractum Krameriae*.)

A very delicate test for the presence of rhatany is given by Gucksmann (*Ph. Post*, 1912, 65), who states that if an extract containing it be diluted with water until almost colorless, the addition of 0.5 Gm. of sodium bicarbonate to 10 mils of the liquid will produce a rose red color.

Uses.—Rhatany is an active astringent, and may be advantageously given in *chronic diarrhea*. It has long been used in Peru as a remedy in bowel complaints, as a corroborant in cases of enfeebled stomach, and as a local application to spongy gums. Ruiz, one of the authors of the Peruvian Flora, first made it known in Europe. In the form of infusion, tincture, or extract, rhatany has been used locally in *fissure of the anus*, *prolapsus ani*, and *leucorrhea*.

Dose, of the powder, twenty to thirty grains (1.3-2.0 Gm.).

Off. Prep.—Extractum Kramerias, *Br.*, *N. F.*; Infusum Krameriae, *Br.*; Pulvis Catechu Compositus, *Br.*; Tinctura Krameriae, *Br.*, *N. F.*; Trochiscus Krameriae (from Extract), *Br.*; Trochiscus Krameriae et Cocainae (from Extract), *Br.*; Fluidextractum Krameriae, *N. F.*; Fluidglyceratum Krameriae, *N. F.*; Pulvis Gambir Compositus, *N. F.*; Syrupus Kramerise, *N. F.*

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Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Lac. *Lacca. Resina (Gummi) Lacca. Laque, Gomme lacque, Fr. Lack, Oummilack, G.*—A resinous substance obtained from several trees growing in the East Indies, particularly from *Croton laccifera* L. (Fam. *Euphorbiaceae*); several species of *Ficus*, especially *F. religiosa* L. and *F. indica* L. (Fam. *Artocarpaceae*), and, according to Valentine Ball, *Schleicheratriijuga* Willd. (Fam. *Sapindaceae*), *Butea frondosa* Roxb., of the Fam. *Leguminosae*, and *Zizyphus jujuba* Lam. (Fam. *Rham-naceae*). Stillman states that *Acacia Greggii* A. Gray (Fam. *Leguminosae*) and *Covillea tridentata* (DC.) Vail. (*Larrea mexicana* Moric.) (Fam. *Zygophyllaceae*), plants growing in Arizona, Colorado, and the Western territories, furnish both shellac and lac dye. (*A. J. P.*, 1880, 409.) Lac is found in the form of a crust, surrounding the twigs or extreme branches, and is generally supposed to be an exudation from the bark, owing to the puncture of an insect belonging to the genus *Coccus*, and denominated *C. lacca*. By some it is thought to be an exudation from the bodies of the insects themselves, which collect in great numbers upon the twigs, and are embedded in the concreted juice, through which the young insects eat a passage and escape. Several varieties are known in commerce. The most common are *stick-lac*, *seed-lac*, and *shellac*.

Stick-lac is the resin as taken from the tree, still encrusting the small twigs around which it originally concreted. It is of a deep reddish-brown color, of a shining fracture, translucent at the edges, inodorous, and of an astringent, slightly bitterish taste. Its external surface is perforated with numerous minute pores, as if made by a needle, and when broken it exhibits many oblong cells, often containing the dead insect. When chewed it colors the saliva red, and when burnt, diffuses a strong, agreeable odor. It is in great measure soluble in alcohol.

Seed-lac consists of minute irregular fragments, broken from the twigs and partially exhausted by water. It is of a light or dark brown color, inclining to red or yellow, feebly shining, almost tasteless and capable of imparting to water less color than the *stick-lac*, sometimes scarcely coloring it at all. It is occasionally mixed with small fragments of the twigs.

Shellac is prepared by melting the *stick-lac* or *seed-lac*, previously deprived of its soluble coloring matter, straining it, and pouring it upon a flat smooth surface to harden, or pulling it out by hand into large thin sheets, which are broken up after cooling.

A variety of lac is mentioned by writers, in the form of cakes, called *cake-lac* or *lump-lac* (*lacca in placentis*); but this is at present rare in commerce.

According to John, lac consists of resin, coloring matter, a peculiar principle insoluble in alcohol, ether, or water, called *laccin*, a little wax, and various saline matters in small proportion. The resin, according to Unverdorben, consists of several distinct resinous principles differing in their solubility in alcohol and ether. The laccin is nearly or quite wanting in shellac, which also contains scarcely any of the coloring principle. Hatchett found in stick-lac 68 per cent. of resin, and 10 of coloring matter; in seed-lac 88.5 per cent. of resin, and 2.5 of coloring matter; in shellac 90.9 per cent. of resin, and 0.5 of coloring matter. The other constituents, according to this chemist, are wax and gluten, besides foreign matters. R. E. Schmidt (*Ber. d. Chem. Ges.*, 1887, 1285-1303) has prepared the lac dye in a pure crystallized state. He gives it the formula $C_{16}H_{12}O_8$, and calls it *laccaic acid*. It was obtained crystallized from ethereal solution. Caustic alkalis dissolve it, giving a magenta color. Baryta water forms a violet lake. Laccaic acid shows some analogy to carminic acid, but the colors they give on wool and silk are different. Laccaic acid is decomposed on heating with concentrated hydrochloric acid to 180° C. (356° F.), as well as on fusing with caustic potash.

Japanese lac from *Rhus vernicifera* was examined by A. B. Stevens. (See *Proc. A. Ph. A.*, 1905, 311.)

The importations of gum shellac for the year 1914 was 16,824,130 lbs., valued at \$2,686,480; and for 1915, 24,308,145 lbs., valued at \$3,018,296.

Lac in its crude state is slightly astringent, and was formerly used in medicine, but at present it is not employed. Shellac is wholly inert. It is sometimes used in alcoholic solution as a glaze for confectionery. The use of such insoluble resinous glaze for a food product is prohibited in some states partly on account of its indigestibility per se and partly because in its preparation for varnish or pigment purposes arsenical compounds are used to heighten the color and many instances are on record where confectionery which had been coated with such glaze contained appreciable amounts of arsenic. A bleached form of arsenic-free lac has recently appeared in commerce, which would seem to be free from many of the objections previously urged against lac in coating confectionery. Stick-lac and seed-lac are used on account of the coloring principle which they contain. Shellac, as well as the other varieties, deprived of their coloring matter, is applied to numerous purposes in the arts. It is the chief constituent of *sealing wax*. The best *red sealing wax* is made by melting together, with a very gentle heat, 48 parts of shellac, 19 of Venice turpentine, and 1 of balsam of Peru, and mixing with the melted mass 32 parts of finely powdered cinnabar. But common rosin is often substituted in part for the lac, and a mixture of red lead and chalk for the cinnabar. For methods of detecting adulteration with rosin see *J. Soc. Chem. Ind.*, 24, 1905; also *Chem. Ztg.*, 1910, 991. The best *black sealing wax* consists of 60 parts of lac, 10 of turpentine, and 30 of levigated bone black; the best *yellow sealing wax*, of 60 parts of lac, 12 of turpentine, and 24 of lead chromate. (Berzelius.) Lac is also used as a varnish, and forms an excellent cement for broken porcelain and

earthenware. It may be dissolved in alcohol, oil of turpentine, benzin, or naphtha. For a method of preparing a colorless varnish from lac the redder is referred to *P. J.*, 1864, 338. Lac has been highly recommended as an adhesive material for the dressing of *wounds, ulcers*, etc. It is prepared for use by dissolving, with the aid of a gentle heat, in alcohol contained in a bottle, sufficient lac to give it a gelatinous consistence, and then closing the bottle. It is used by spreading it on the bandages. For details of the preparation of shellac, see *U. S. D.*, 19th ed., p. 1543.

LACTUCARIUM. U. S.

LACTUCARIUM *Lactucar.*

" The dried milk-juice of *Lactuca virosa* Linne (Fam. *Compositae*). " U. S.

Lactucarium Anglicum, Lactucarium Germanicum; Strong-scented Lettuce, Green Endive; Lactucarium, *Fr. Cod.*; Giftlattichsaft, *G.*; Lactucario, *Sp.*

The plants of this genus yield when wounded a milky-juice, to which, indeed, they owe their generic name. The juice from *L. sativa*, *L. virosa*, and *L. altissima* Bieberstein has been supposed to possess narcotic properties.

Lactuca sativa or *garden lettuce* is an annual plant. The stem, which rises above two feet, is erect, round, simple below, and branching in its upper part. The lower leaves are obovate, undulate and rounded at the summit; the upper are smaller, sessile, cordate, and toothed; both are shining, and of a yellowish-green color. The flowers are pale yellow, small, and- disposed in an irregular terminal corymb. Before the flower-stem begins to shoot, the plant contains a bland pellucid juice, has little taste or odor, and is much used as a salad for the table, but during the period of inflorescence it abounds in a milky juice, which readily escapes from incisions in the stem. The juice is more abundant in the wild than in the cultivated plants. The original native country of the garden lettuce is unknown. The plant has been cultivated from time immemorial, and flourishes equally in hot and temperate latitudes. Some botanists suppose that *L. virosa* of the old continent is the parent of all the varieties of the cultivated plant.

Lactuca virosa, the *acid* or *strong-scented lettuce*, is biennial, with a stem from two to four feet high, erect, prickly near the base, above smooth and divided into branches. The lower leaves are large, oblong-

ovate, undivided, toothed, commonly prickly on the under side of the midrib, sessile, and horizontal; the upper are smaller, clasping, and often lobed; the bracts are cordate and pointed. The flowers are numerous, of a sulphur-yellow color, and disposed in a panicle. The plant is a native of Europe.

It is lactescent, and has a strong disagreeable odor like that of opium, and a bitterish, acrid taste.

Lactucarium is cultivated in Scotland, Germany, Austria and France. According to Fairgrieve (*P. J.*, 1873, iii, p. 972) the plant cultivated in Scotland is the *L. virosa*, var. *montana*. From May to August, or even as late as September, the collectors spread over the field cutting the head of each stalk and scraping the flow into their vessels. This is repeated several times daily until the plants are exhausted. The method of cultivation in the Mosel Valley, Germany, is described by Kieffer (*Ph. Zeit.*, i, p. 143), who states that the drug of Germany is shipped to England and later imported into the United States via San Francisco, where it is supposedly used in the adulteration of opium. The cultivation in France is described by Van Italic (*J. P. C.*, 1913, viii, p. 449).

For various plans which have been suggested for collecting the drug, see 14th ed., *U. S. D.*

Lactucarium, as brought from England, is in small, irregular lumps, about the size of a pea or larger, of a reddish-brown color externally, and of a narcotic odor and bitter taste. As prepared near Edinburgh, it is commonly in roundish, compact, and rather hard masses, weighing several ounces. (Christison.) A variety known in our market as *German lactucarium* is in pieces about 4 cm. long by 2.5 cm. in thickness, four-sided, with one side convex and the three others flat, or slightly concave from shrinking, as if quarter sections of a saucer-shaped cake which had been divided before it was quite dry. The color on the outer or convex surface is darkish brown, that of the out surfaces light yellowish-brown. From experiments by Parrish and Bakes, the German appears to be inferior to the English, as 44 per cent. of spirituous extract was obtained from the latter, and only 36 per cent. from the former, while the two extracts were about equal in their sensible properties. (*A. J. P.*, 1860, p. 226.) French lactucariuna resembles the German, except in being in circular cakes about 4 cm. in diameter. The official description is as follows: "Usually in quarter sections of hemispherical

masses, or in irregular, angular pieces; externally dull reddish- or grayish-brown; fracture tough, waxy; internally light brown or yellowish; somewhat porous; odor distinctive, opium-like; taste bitter. Lactucarium is partly soluble in alcohol and ether and, when triturated with water, it yields a turbid mixture. Treat Lactucarium with boiling water and filter; the filtrate is clear while hot; on cooling it becomes turbid but clears upon the addition of ammonia water or alcohol; it is not colored blue by iodine T.S. (*starch*). An alcoholic solution of Lactucarium gives not more than a faint green color upon the addition of a drop of ferric chloride T.S. (*tannin*). The powder is grayish-brown to dark brown, consisting almost entirely of irregular fragments without any cellular structure: when mounted in hydrated chloral T.S., the fragments become clear, showing granular fragments, and from this deposit, numerous rod-shaped crystals and broad monoclinic prisms as well as aggregates of these, all of which polarize light. In the preparation of powdered Lactucarium, dry the crude drug at a temperature not exceeding 70° C. (158° F.). Lactucarium contains not more than 15 per cent. of moisture, and yields not more than 10 per cent. of ash." *U. S.*

The *thridace* of Francois, at one time supposed to be identical with lactucarium, is in all probability nothing more than the inspissated expressed juice of lettuce, and, indeed, was directed as such in the French Codex of 1837, the leaves being rejected, and the stalks alone, near the flowering period, being subjected to pressure.

The drug of commerce usually has a growth of mold on the surface. If it has penetrated the drug to any extent it reduces its quality. Occasionally specimens are met with that are moldy throughout, and these should be rejected. In color, taste, and odor, lactucarium bears considerable resemblance to opium, and has sometimes been called *lettuce opium*. It does not attract moisture from the air. It yields nearly half its weight to water, with which it forms a deep-brown infusion. It is partly soluble in ether and alcohol. From its resemblance in some of its properties and to opium, it was conjectured to contain morphine, or some analogous principle, but this conjecture is false. There is no doubt as to the complexity of the composition of lactucarium, but so feeble are its properties that it has largely gone out of active use, and its chemistry is of little practical importance. Buchner, Aubergier, and Walz claim severally to have discovered the active principle, which has been named *lactucin*, but the substances obtained by these different chemists are

not exactly identical in properties, and the lactucin of Walz and Aubergier is considered by Lenoir as owing its bitterness (to impurities, separated from which it is without taste and inert. For a full account of the earlier analyses of lactucarium, see 16th edition, *U. S. D.* Ludwig found, in 100 parts, 48.63 of substances insoluble in water, and 51.37 of substances soluble in water. Of the insoluble matter 42.64 parts were of *lactucerin* or *lactucon*, in snow-white aggregated granules, dissolving in strong hot alcohol which deposits it on cooling, readily soluble in ether but insoluble in water, incapable of saponification by potassium hydroxide, and therefore not properly a fat, and in alcoholic solution faintly reddening litmus paper. On the other hand, Hesse states that lactucon which, according to Massner, has the composition $C_{26}H_{44}O_2$, is a mixture of esters, of which one, $C_{36}H_{58}O_2(C_2H_3O)_2$, is a diacetyl ester yielding, when saponified, *a-lactuceryl*, $C_{36}H_{60}O_2$, and acetic acid, while the other is a mono-acetyl ester, $C_{36}H_{59}O_2(C_2H_3O)$. Of the 51.37 parts soluble in water, 6.98 were albumen, 1.75 lactucerin, held in solution by other substances, 27.68 bitter extract soluble in water and in alcohol, and 14.96 aqueous extract insoluble in alcohol of 0.830. The former of these extracts was found to contain a peculiar acid substance called *lactucic acid*, and the lactucin of Aubergier. *Lactucic acid* is of difficult crystallization, light yellow, strongly bitter, without sour taste, of an acid reaction, and readily soluble in alcohol and water. It has as much claim as any other discovered substance to be considered the active principle of lactucarium.

The assertion sometimes made that *Lactuca virosa* contains a mydriatic alkaloid has been denied by J. C. Braithwaite and H. E. Stevenson, *P. J.*, 1903, 148. Farr and Wright (*P. J.*, 1904, p. 16) claim, however, to have definitely established the presence of a mydriatic alkaloid, giving alkaloidal reactions with Mayor's and Threshes reagents, and producing a powerful mydriatic effect upon the eye.

Kromayer (*Ann. Ch. Ph.*, cv, p. 3) found also *lactucopikrin*, $C_{44}H_{32}O_{21}$, a brown, amorphous, and very bitter substance of weak acid reaction. It is easily soluble in water and alcohol. Ludwig's lactucic acid Kromayer considers to be an oxidation product of lactucopikrin.

Hesse (*Handwörterbuch*, iv, p. 8) prepared *lactucerin*, and finds it to crystallize in white needles, fusing point $210^{\circ} C.$ ($410^{\circ} F.$), soluble in hot ligroin, chloroform, and benzene. On fusion with potassium hydroxide it

yields acetic acid and *lactuceryl alcohol*, $C_{18}H_{30}O$, which forms white needles, fusing at $162^{\circ} C.$ ($323.6^{\circ} F.$), and is easily soluble in ether, chloroform, and hot alcohol. Hesse has since (*Ann. Ch. Ph.*, 234, p. 243) determined that lactucarium contains the acetates of α - and β -*lactuceryl alcohol*, $C_{18}H_{30}O$. These compound ethers are saponified with alcoholic potash and water added, which precipitates α - and β -*lactuceryl alcohol*. These are washed, dried in the air, and taken up with boiling alcohol. On cooling, α -lactuceryl alcohol separates out first and can be purified by recrystallization, while the β -lactuceryl alcohol is obtained from the mother liquor. The acetate of α -lactuceryl alcohol fuses at $210^{\circ} C.$ ($410^{\circ} F.$), while that of β -lactuceryl alcohol fuses at $230^{\circ} C.$ ($446^{\circ} F.$). For an examination of Russian lactucarium, by L. Schiperovitch, see *Ph. Z. R.*, or *D. C.*, 1886.

Uses.—The ancients believed that lettuce had soporific properties, and many years ago J. R. Coxe, of Philadelphia, first proposed the employment of the inspissated milky juice as a medicine. It was chiefly, however, through the recommendation by Duncan, Sr., of Edinburgh, that the medicine came into use and was adopted as official in various pharmacopoeias. It is claimed for it that it has, although in a very much inferior degree, the anodyne and calming properties of opium, without its disposition to derange the digestive organs. It has been employed in this country to some extent to allay *cough* and quiet *nervous irritation*, but we believe that the general experience is in accord with our own in finding it to be almost devoid of narcotic properties. We have never been able to obtain any good results from its use. Water distilled from *lettuce* (*eau de laitue*) is used in France as a mild sedative, in the quantity of from two to four ounces. The fresh leaves boiled in water are sometimes employed in the shape of cataplasm. It is said that in Egypt a mild oil is derived from the seeds, fit for culinary use. (See *Syrupus Lactucarii*.)

Dose, ten to twenty grains (0.65-1.3 Gm.), but much larger quantities may be given without obvious effects.

Off. Prep.—*Syrupus Lactucarii* (from. Tincture), *U. S.*; *Tinctura Lactucarii*, *U. S.*

Lamium. *Lamium album* L. *White Dead Nettle*. (Fam. *Labiatae*).—A perennial herb introduced from Europe and found on roadsides and waste places in the United States. Hemo-styptic properties were long since attributed by Lusitanus and by Florain to the flowers of this plant, and, according to the more recent researches by Kalabin (*Cb. G. T.*, xx. No. 12), their decoction produces a rise of the arterial pressure

due to contraction of the peripheral vessels. The extract was found to cause firm, lasting contraction of the uterus, and the saturated tincture, in doses of twenty-five to forty minims (1.6-2.5 mils) every two or three hours, to be useful in *hemorrhagic metritis* and *metrorrhagia*. Its effects in puerperal hemorrhage were not pronounced.

Lantana. *Lantana brasiliensis* Link. *Yerba Sagrada*. (Fam. *Verbenaceae*.)—This Brazilian plant contains, according to Negrete, an alkaloid, *lantanine*, which is actively antiperiodic in doses of from fifteen to thirty grains (1.0-2.0 Gm.) in the twenty-four hours, given directly after the paroxysm. It is also claimed to be an intestinal antiseptic. (T. G., 1885.) *Lantana camara* L., known in the West Indies as *sage tree* or *wild sage*, contains an alkaloid, *lantanine*, said to resemble quinine in its action.

Lappa. *N. F. IV (U. S. P. VIII). Burdock Root. Radix Bardance. Bassies. Beggars' Buttons. Cuckoo Button. Harebur. Bardane, Fr. Cod. Glouteron, Fr. Klettenwurzel, G. Bardana, It.*— "The dried root of *Arctium Lappa* Linne, or of other species of *Arctium* (Fam. *Compositae*), collected from plants of the first year's growth." *N.F.*

The stem of the burdock is succulent, pubescent, branching, and three or four feet in height, bearing very large, cordate, denticulate leaves, which are green on their upper surface, whitish and downy on the under, and stand on long footstalks. The flowers are purple, with heads globose, and in terminal panicles. The involucre consists of imbricated scales, with hooked extremities, by which they adhere to the clothing of man and the coats of animals. The achenes are oblong, somewhat compressed and three-angled, ribbed, truncate. Although a native of Europe, burdock is abundant in the United States, where it grows on the roadsides, among rubbish, and in cultivated grounds. There are three recognized species of *Arctium* in North America—viz., *A. tomentosum* (Lam.) Schk. (*Woolly or Cottony Burdock*); *A. Lappa* L. (*Burdock, Clotbur or Great Bur*); and *A. minus* Schk. (*Common, Burdock*).

It is described by the N. F. as "nearly simple, fusiform, of variable length from 5 to 20 mm. in diameter near the crown; frequently split or in broken pieces; externally grayish-brown, longitudinally wrinkled, the crown somewhat annulate, sometimes surmounted by a woolly tuft of leaf remains; fracture somewhat horny; a dark cambium separating the thick brownish bark from the yellowish porous and radiate wood, centrally hollow or containing a white, pith-like tissue. Odor slight; taste mucilaginous, sweetish, and slightly bitter. The powder is light brown and, when examined under the microscope, exhibits parenchyma cells of the cortex; the medullary rays and wood containing amorphous masses or sphere-crystals of inulin; yellow resin cells occur in the cortical parenchyma of young roots; wood fibers few; no starch and no calcium oxalate. Lappa yields not more than 6 per cent. of ash." *N. F.*

Inulin has been found in it by Guibourt, and sugar by Fee, while F. E. Hendershott believes that it contains a glucoside, besides arabin and pectin and extractives. (*Proceedings of Mich. Pharm. Assoc.*, 1887.) Trimble also obtained from the root a bitter, crystalline glucoside. (*Ph. Era*, 1888, p. 133.) Thos. Donaldson (*A. J. P.*, 1890, p. 123) found 8.6 per cent. of yellow fixed oil and about 1 per cent. of white waxy

matter. A small quantity of volatile oil (0.065 per cent.) has been found in burdock root according to *Haensel's Report*, Oct., 1902. The inulin usually exists in parenchymatous cells in a different state, but if sections of the green root be dehydrated by soaking in 95 per cent. alcohol, the inulin will be found in spheroidal form.

An interesting account of burdock and its use as an edible vegetable in Japan, by Inazo Nitobe, may be found in *A. J. P.*, 1897, 416.

Uses.—Burdock root has been employed as a diuretic and diaphoretic alterative, especially useful in the gouty, scorbutic, and syphilitic and scrofulous diatheses; also in various chronic skin diseases, especially in psoriasis, prurigo, and acne. (*M. S. Rep.*, 1868.) The fresh leaves have been employed both externally and internally in cutaneous eruptions and ulcerations. There is no sufficient reason, however, to believe it has any medicinal virtue. This fluidextract is recognized by the N. F. (see Part III).

Dose, thirty to ninety grains (2.0-5.8 Gm.).

Larch Bark. *Laricis Cortex*. Br. 1885. *Ecorce de Meleze*, Fr. *Larchenrinde*, G.—The bark of *Larix decidua* Mill. (*Larix europaea* DC.) (Fam. *Pinaceae*) was found by Aldridge to contain gum, starch, resin, and tannic acid of the kind which precipitates the salts of iron olive-green. John Stenhouse has obtained from it a peculiar volatile acid, *larixinic acid* (*larixine*). For method of separation, see 16th edition, *U. S. D.* Larixinic acid occurs in beautiful white, lustrous crystals, often more than an inch long, of a peculiar somewhat empyreumatic odor, and a slightly bitter and astringent taste, inflammable, volatilizing at 93° C. (199.4° F.) and melting at 153° C. (307.4° F.), soluble in 87.88 parts of water at 13.3° C. (56° F.), very soluble in boiling water, soluble in cold but much more so in hot alcohol, and sparingly soluble in ether. It readily crystallizes from its solutions. A very singular and characteristic property is that of forming, when added, in strong solution, in excess, to baryta water, a bulky, transparent, gelatinous precipitate, occupying the whole measure of the liquids if concentrated. The probable formula of the acid is C₁₀H₂₀O₅. The inner *larch bark* possesses astringent and gently stimulant properties, and is supposed to have a special tendency to the mucous membranes. It has been found particularly efficacious in *purpura* and other *hemorrhagic affections*, especially *hemoptysis*, and has been given in *bronchitis* with copious expectoration, and in diseases of the urinary passages. It has been used also, mixed with soap and glycerin, as a local remedy in *psoriasis*, *chronic eczema*, and other cutaneous affections. Of the extract from three to five grains (0.20-0.32 Gm.), of the tincture from thirty minims to a fluidrachm (1.8-3.75 mls) or more may be given every three or four hours.

Larkspur Seed. *N. F. IV. Delphinium. Lark's claw. Knight's spur.*—It is described by the N. F. as "the dried seeds of *Delphinium Consolida* Linne or of *Delphinium Ajacis* Linne (Fam. *Ranunculaceae*), without the presence of more than 5 per cent. of foreign matter. Irregularly tetrahedral, or by pressure somewhat triangulate, acute at one end, obtuse or rounded at the other, about 2 mm. in length and equally broad or

slightly narrower, surface black or blackish-brown, deeply and narrowly furrowed, the furrows intersecting so as to give a sharply tuberculate appearance to the surface, with serrate edges; testa crustaceous; kernel whitish, fleshy; embryo small, in fleshy endosperm. Odor very faint; taste bitter, afterward biting and acrid. Larkspur Seed yields not more than 7 per cent. of ash." *N. F.* Thomas C. Hopkins, of Baltimore, found in the seeds of Larkspur, *delphinine*, $C_{22}H_{35}O_6N$, volatile oil, fixed oil, gum, resin, chlorophyll, gallic acid, and salts of potassium, calcium, and iron. (*A. J. P.*, xi.) Rochebrune (*Toxicol. Africaine*, i) has separated alkaloids believed by him to be identical with *delphinine* from *D. peregrinum* L. and *D. mauritanicum* Coss. From the expressed juice of the larkspur *aconitic acid* was obtained by W. Wicke. (*J. P. C.*, 1854.) Moreover, the seeds of the indigenous *D. exaltum* Ait. are stated to have a physiological action similar to that of the larkspur. Larkspur is a common weed in the Western States, where it occasions death among grazing cattle. It is said to lose its toxicity during the flowering period. It is a showy annual, which has been introduced from Europe into the United States, where it has become sparingly naturalized, growing in old grain fields and flowering in June and July. The flowers are bitter and acrid. The seeds are the only part of the plant which is official. In large doses the seeds produce violent vomiting and purging, and are said to be diuretic. A tincture is official in the *N. F.* and has been used in spasmodic *asthma* and *dropsy*, but is mainly employed as a parasiticide in a manner similar to the preparations of *staphisagria*. Dose, ten minims (0.6 mil), gradually increased. Brett has found that *D. peregrinum* L., when growing, is very effective in the destruction of grasshoppers. (*P. J.*, vol. xxi, 1891. See *Staphisagria* in Part I.)

Lathyrus. *Lathyrus sativus* L. (Fam. *Leguminosae*.) *Jarosse, Gesse, Kasari* (Ind.).—The *White* or *Chickling Vetch*, the seed of which is used in Europe as a food both by man and animals, under the name of "*mutters*," produces, when taken too freely, a condition known as *lathyrismus*. Horses which have been fed on the plant for a considerable period drop while performing the lightest work, in consequence of paralysis of the hind extremities, and in many cases death has followed from bilateral paralysis of the recurrent laryngeal nerves and consequent asphyxia. This laryngeal affection does not occur in the human subject, and death very rarely takes place. In man the muscles of the lower extremities below the knee are apt to be especially affected, the abductors more than the adductors. The muscles of the face, neck, and upper extremities are very rarely, if ever, attacked. The reflexes and the general sensibility are usually not influenced; but Giorgieri has seen the tendon reflexes increased. According to Cantani, the galvanic contractility of the paralyzed muscle is altered, and the transverse markings of the muscles are nearly obliterated by fat globules. In fatal cases the spinal cord has been found normal. Astier obtained from the seeds a poisonous alkaline volatile liquid. According to him, this, being volatile, is not present in preparations such as pressed cakes made at a high temperature, which are consequently not poisonous. If, however, such cakes have been prepared at low temperature, they exhibit toxic properties, owing to the retention of the toxic principle. This is in conformity with the experience of the peasants in some parts of Europe, who mix the ground white vetch seeds with wheat flour, and boil the mixture for food. E. M. Holmes states that these seeds should not be used in foods in any proportions, as they are poisonous. (*P. J.*, 1913, 795.)

LAUROCERASI FOLIA. Br.

CHERRY-LAUREL LEAVES

"Cherry-Laurel Leaves are the fresh leaves of *Prunus Laurocerasus*, Linn." Br.

Cherry Bay; Laurier-cerise, *Fr. Cod.*; Kirschchlorbeer, *G.*; Lauroceraso, *It.*; Laurel-cerezo (Hoja de), *Sp.*

Prunus Laurocerasus is a small evergreen tree, rising 15 or 20 feet, with long, spreading branches, which, as well as the trunk, are covered with a smooth, blackish bark. The leaves are oval-oblong, petiolate, from five to seven inches in length, acute, finely toothed, firm, coriaceous, smooth, beautifully green and shining, with oblique nerves, and yellowish glands at the base. The flowers are small, white, strongly odorous, and disposed in simple axillary racemes. The fruit is an oval drupe, very similar in shape and structure to a small black cherry. The cherry-laurel is a native of Asia Minor, but is cultivated in Europe, both for medicinal use and for the beauty of its shining evergreen foliage. Almost all parts of it have more or less of the odor of hydrocyanic acid.

In their recent and entire state cherry-laurel leaves have scarcely any odor; but, when bruised, they emit the characteristic odor of the plant in a high degree. Their taste is somewhat astringent and strongly bitter, with the flavor of the peach kernel. They are officially described as "thick, coriaceous, on short, strong petioles, oblong or somewhat obovate, from twelve to eighteen centimetres long, tapering towards each end, recurved at the apex, distantly but sharply serrate and slightly revolute at the margins; dark green, smooth and shining above, much paler beneath; midrib prominent, with one or two glandular depressions on the under surface near its base. Inodorous, but emitting when bruised an odor resembling that of prussic acid." *Br.*

Cherry-laurel leaves are sometimes substituted by the leaves of other species of *Prunus*. These are readily distinguished in that they do not possess the characteristic glandular hairs which occur on the basal portion of the leaves and petioles of *P. Laurocerasus*. (*B. P. G.*) 1907, p. 325.)

Cherry-laurel leaves yield a volatile oil containing benzaldehyde and hydrocyanic acid by distillation with water, which they strongly impregnate with their flavor. One pound, avoirdupois, of the fresh leaves yields 40.5 grains of the oil. (*Ph. Cb.*, 1855, 205.) The oil resembles that of bitter almonds, for which it is said to be sometimes sold in Europe, where it is employed to flavor liquors and various culinary preparations, but, as the glucoside of cherry-laurel leaves is decomposed more slowly than ordinary crystallized amygdalin, it is liable to hold hydrocyanic acid, and hence to be poisonous. The glucoside referred to has been termed laurocerasin, or "amorphous amygdalin." It is decomposed by emulsin into hydrogen cyanide, benzaldehyde, and sugar, but more slowly than ordinary amygdalin. Its optical activity also differs from that of ordinary amygdalin. (Jacobsen, *Die Glykoside*, 25.) That the oil exists already formed, to a certain extent, in the fresh leaves, is rendered probable by the fact, stated by Winckler, that they yield it in considerable quantity when distilled without water. (*J. P. C.*) xxv, 195.) The fresh leaves are used to flavor milk, cream, etc., and more safely than the oil, though they also are poisonous, when too largely employed.

Uses.—The leaves of the cherry-laurel possess properties similar to those of hydrocyanic acid, and the water distilled from them is much employed in various parts of Europe for the same purposes as that active medicine. But it deteriorates by age, and therefore, as kept by pharmacists, must be of variable strength. J. Broker, a Dutch pharmacologist, has satisfied himself, by numerous experiments, that the proportion of hydrocyanic acid in the leaves varies with the season, the age of the plant, the character of the soil and of the weather, and thinks that, in consequence of this variability, they are inferior for medicinal use to bitter almonds, which in this respect have a more uniform composition. He found the proportion of the acid in the leaves greatest in July, and least in February. (*B. F. M. R.*, Oct., 1868, p. 517.) It is not, therefore, to be regretted that the want of the plant in this country has prevented the general introduction of so variable a remedy as the distilled water. (See *Aqua, Laurocerasi*.)

Off. Prep.—*Aqua Laurocerasi, Br.*

Laurus. *Laurus nobilis* L. *Sweet Bay. Laurier commun, Fr. Lorbeer, G.*—The sweet bay is an evergreen tree of the Fam. *Lauraceae*, inhabiting the countries bordering on the Mediterranean. The leaves are alternate, on short petioles, oval-lanceolate or

oblong, entire, pellucid-punctate, of a firm texture, smooth, shining, deep green upon their upper surface, paler beneath. They have a fragrant odor, especially when bruised, and a bitter, aromatic, somewhat astringent taste. They yield by distillation a greenish-yellow volatile oil. The volatile oil, of which the fruit yields 0.23 per cent., has a sp. gr. 0.88, and is solid at 0° 0. (32° F.). It is largely composed of oxygenated compounds. The constituents thus far recognized are myrcene, phellandrene, methyl-chavicol, citral, methyl-eugenol, chavicol, and eugenol. (*Schim, Rep.*, April, 1897.) Water distilled from the leaves has their peculiar odor. The *berries* when dried are black and wrinkled, and contain two oval fatty seeds within a thin, friable envelope; or they may be considered as drupes, with a kernel divisible into two lobes. They have the same aromatic odor and taste as the leaves, but are more pungent. Besides an essential oil, they contain a fixed oil, which, as obtained by expression from the fresh fruit, is of a greenish color, and aromatic odor from retained volatile oil. One of its chief constituents is the ether of lauric acid, the so-called *laurostearine*, $C_3H_5(H_{12}H_{23}O_2)_3$, which fuses at 45° C. (113° F.). The free acid may be obtained from this by saponification. It cannot be distilled without decomposition. Another constituent of the crude fat is *laurin*, $C_{22}H_{30}O_3$, which can be extracted by alcohol. It forms neutral, easily fusible prisms without odor or taste. Lard, impregnated with the odorous principle of the berries, and colored green by chlorophyll or sometimes by indigo and turmeric, is said to be often substituted for the genuine expressed oil. This may be detected by boiling alcohol, which dissolves the true oil. The leaves, berries, and oil are excitant and narcotic, but are rarely used internally as medicines, and in this country are scarcely employed in any manner. E. M. Holmes, however, states that the berries have been used in Europe to promote miscarriages. (*P. J.*, 1910, 52.) Their chief use is to communicate a pleasant odor to external remedies. The leaves are also used for culinary purposes in communicating their aromatic flavor to soups, stews, etc. They come into commerce frequently as the packing around stick licorice extract from Mediterranean countries.

Lavender Flowers. *Lavandula*. U. S. 1880. *Lavandula vera* DC. (*L. officinalis* Chaix, *L. spica* L.) *Lavender*. *Flores Lavandulae*, P. G. *Lavande*, *Fleurs de Lavande*, Fr. *Lavandelblumen*, *Lavandelbluthen*, G. *Lavendola*, It, *Espliego*, *Alhucema*, Sp.—Lavender is a small labiate shrub. The plant is a native of Southern Europe, and covers vast tracts of dry and barren land in Spain, Italy, and the south of France. In England and America it is very largely cultivated. For method of culture and detailed descriptions of the various varieties that have been educed, see *B. M. S. J.*, Aug., 1873, 165. The cultivation of lavender has become an important industry and attempts are being made to cultivate the finer qualities of lavender in the United States.

For details of lavender culture, see *U. S. D.*, 19th ed., p. 1546.

Lavenderflowers have a strong fragrant odor, and an aromatic, warm, bitterish taste. They retain their fragrance long after drying. Alcohol extracts their virtues, and a volatile oil upon which their odor depends rises with that liquid in distillation. Hager obtained from a pound of the fresh flowers from half a drachm to two drachms of the oil. The flowers are frequently sold for packing away with clothing as a moth

preventive. Lavender is an aromatic stimulant and tonic, but is seldom given in its crude state. The products obtained by its distillation are much used in perfumery, and the volatile oil is official. (See *Oleum Lavandulae*.)

Lawsonia. *Lawsonia inermis* L. (*L. alba* Lam.) *Henna Plant. Mehndi*.—This is a shrub of the Fam. Lythraceae, growing in the Levant, Egypt, Persia, and India, and well known as the source of a dye-stuff denominated *henna*, much used throughout the Mohammedan countries of the East. It is largely cultivated in Egypt. The flowers have a strong, pungent odor, and a distilled water prepared from them is used as a cosmetic. The fruit is thought to have emmenagogue properties. The powdered leaves, under the name of *henna*, are used to stain golden yellow the feet and hair of women of the harem. Abd-el-Aziz of Cairo, Egypt, found in it a brown substance, of a resinoid fracture, having the chemical properties which characterize the tannins, and therefore named by him *hennotannic acid*. Henna has been employed both internally and locally, in *jaundice*, *leprosy*, and affections of the skin.

Ledum. *Ledum palustre* L. *Marsh Tea. Rosmarinus Sylvestris. Marsh Cistus. Wild Rosemary. Ledon, Romarin sauvage, Fr. Porsch, Sumpfporsch, Wilder Rosmarin, G.*—A small evergreen ericaceous shrub, growing in awamps and other wet places in the northern parts of Europe, Asia, and America, and in the mountainous regions of more southern latitudes. The leaves have a balsamic odor, and an aromatic, camphorous, bitter taste, and contain, among other ingredients, volatile oil and tannin. For the properties of the volatile oil, see *J. P. C.*, 4e ser., xx, 244; also *Proc. A. Ph. A.*, xxv, 154. It contains *ledum camphor*, a stearopten, together with valeric and other volatile acids, and *ericinol*, $C_{10}H_{16}O$. The tannin has been named *leditannic acid*, $C_{15}H_{20}O_8$. On boiling with dilute mineral acids it is decomposed, and *ledixanthin*, $C_{30}H_{34}O_{13}$, separates as a yellowish or reddish powder. (Thal, *Ph. Z. R.*, 1883, 268.) Thai also extracted *ericolin*, $C_{34}H_{56}O_{21}$. This is a glucoside, which on heating with diluted sulphuric acid decomposes into sugar and *ericinol*, $C_{10}H_{16}O$, a colorless, peculiar-smelling oil, which turns brown in the air, owing to oxidation. The leaves are thought to be narcotic and diaphoretic, and have been employed in *dysentery* and in various cutaneous affections, particularly *leprosy* and *scabies*. In complaints of the skin they are used both internally and externally, in the form of decoction. In Germany they are sometimes substituted for hops in the preparation of beer. *Ledum groenlandicum* Oeder (*L. latifolium* Ait.), or *Labrador tea*, which is a larger plant than the preceding, is a native of North America, growing in damp places in Canada and the northern part of the United States. The leaves have an agreeable odor and taste, and are esteemed pectoral and tonic. They are said to have been used as a substitute for tea during the war for independence.

Leek. *Porrum. Porreau, Fr. Lauch, G.*—The bulb of *Allium Porrum* Don. (Fam. *Liliaceae*.) The *leek*, which is the national emblem of the Welsh, is a biennial bulbous plant, growing wild in Switzerland, and cultivated in the gardens of Europe and this country for culinary purposes. All parts of it have an offensive, pungent odor and an acrid taste, dependent on an essential oil, of which allyl sulphide, $(C_3H_5)_2S$, is the main ingredient. The bulb, which is the medicinal portion, consists of concentric

layers, like the onion, which it resembles in medicinal properties, though somewhat milder. It is generally stimulant, with a direction to the kidneys. Dose, of expressed juice, a fluidrachm (3.75 mils).

Leonotis. *Leonotis Leonurus* R. Br. *Wild Daggar*.—This handsome tropical labiate is said to possess purgative and emmenagogue properties. (See P. J., May, 1885.) The leaves of this plant are smoked by the Hottentots like tobacco. It is asserted that in overdose it has a narcotic effect. It is used by the South African aborigines as a cathartic, and in the treatment of *snake bite*. A decoction is also employed externally for various skin eruptions. (P. J., 1907, lxxix.)

Leonurus. *Leonurus Cardiaca* L. *Motherwort*. *Agripaume*, *Cardiaire*, Fr. *Herzespänn*, *Wolfstrapp*, G.—An aromatic perennial labiate herb, growing wild in this country in waste places, around dwellings, etc., whose infusion or decoction is sometimes used in amenorrhœa and sudden suppression of the lochia.

Lepargyrea. *Shepherdia argentea* Nutt. *Buffalo Berry*. *Bull Berry*. *Grains de Boeuf*, Fr.—The acidulous fruit of this plant, of the Fam. *Eleagnaceae*, produced in great profusion in the region of the upper Missouri, is largely used as an article of food. According to Henry Trimble, it contains a little more acid than currants. (A. J. P., Dec., 1888.)

Leptandra. N. F. IV [U. S. P. VIII]. *Culver's Root*. *Culvers' Physic*. *Black Root*. *Racine de Leptandra*, ou de *Veronique de Virginie*, Fr. *Leptandra-Wurssel*, G.—"The dried rhizome and roots of *Veronica virginica* Linne (Fam. *Scrophulariaceae*), without the presence of more than 5 per cent. of stems or other foreign matter." N. F. *Veronica virginica*, commonly called *Culver's root*, or *Culver's physic*, is an herbaceous perennial, with a simple, erect stem, three or four feet high, smooth or downy, furnished with leaves in whorls, and terminating in a long spike of white flowers. The leaves, of which there are from four to seven in each whorl, are lanceolate, pointed, and minutely serrate, and stand on short foot-stalks. A variety was seen by Pursh with purple flowers, which was described and figured as a distinct species by Rafinesque, under the name of *L. purpurea*. The plant flowers in July and August. II; grows throughout the United States east of the Mississippi, affecting mountain meadows in the South and rich woods in the North, and is not unfrequently cultivated. The National Formulary describes *leptandra* as follows "Rhizome usually of horizontal growth, nearly cylindrical, somewhat branched; branches readily separable from the main rhizome, from 4 to 10 cm. in length and from 4 to 13 mm. in diameter; externally grayish-brown to dark reddish-brown, annulate from circular scars of bud-scales, upper surface with short stem remnants, occasionally with buds, and numerous circular stem-scars; from the under and lateral portions arise numerous coarse roots; fracture very tough and woody; internally, bark rather thin, dark brown and resinous, wood about the same thickness as the bark, light brown and porous, pith large, more or less hollow, the color being similar to that of the bark. Roots from 1 to 10 cm. in length and from 1 to 2 mm. in diameter; externally dark brown to purplish-brown, smooth and faintly longitudinally wrinkled; fracture short; internally with a thick, brownish-black bark and small, light brown central cylinder. Nearly

odorless; taste very bitter and acrid.

"The powder is brown to yellowish-brown; odor strong, penetrating; consisting of numerous irregular fragments, many of them being colored pink or violet upon the addition of hydrated chloral T.S.; starch grains numerous, mostly in the parenchymatous cells, the individual grains nearly spherical or more or less polygonal, and from 0.002 to 0.008 mm. in diameter; tracheae with spiral thick-enings or with simple or bordered pores; wood fibers with thick lignified walls, with simple pores or with bordered pores, resembling tracheids; fragments of parenchyma containing a light brown or brownish-black resin, the latter frequently closely coherent with the starch grains in the cells thus preventing the separation of the individual starch grains; mounted in hydrated chloral T.S., occasional elongated cells with a lemon yellow, oily substance are observed. Leptandra yields not more than 12 per cent. of ash." *N. F.* For a microscopical description of leptandra, by A. P. Breithaupt, see *A. J. P.*, 1897, 235.

Water and alcohol extract the virtues of the root. According to E. S. Wayne, of Cincinnati, it contains a peculiar crystalline principle, *leptandrin*, to which the virtues of the medicine may be ascribed. F. F. Mayer confirmed the presence of the crystalline principle, and classed it as a glucoside, but Power and Rogerson (*Tr. Chem. Soc.*, 1910, xcvi) were unable to find any such principle. The resinous matter obtained by making a tincture of the root and precipitating this with water has been improperly called leptandrin, and considered the active principle. Subsequently Wayne obtained from the root a saccharine principle having the properties of *mannite*. (*A. J. P.*, 1859, p. 557.) G. Steinmann (*A. J. P.*, 1887, p. 229) obtained pale lemon-yellow crystals of a peculiar agreeable odor and a very bitter taste. They were not precipitated from solution by Mayer's reagent or by tannin, and did not yield glucose on being boiled with diluted sulphuric acid.

The recent root is said to act violently as a cathartic, and sometimes as an emetic. In the dried state it is much milder, but less certain. The practitioners calling themselves eclectics consider it an excellent cholagogue, and use both the impure resin, which they call *leptandrin*, and the root itself as a substitute for mercurials. Rutherford, in his experiments upon dogs, found leptandrin to act rather feebly upon the liver. The powdered extract and fluidextract are recognized by the *N. F.* (see Part III). Dose, fifteen to sixty grains (1-3.9 Gm.); of the impure resin, two to four grains (0.13-0.26 Gm.).

Levisticum. *Radix Levistici*, P. G. *Liveche*, *Ache de Montague*, Fr. *Liebstockel*, G.—Several species of this umbelliferous genus are employed as domestic remedies. The stout perennial herb, *Levisticum officinale* (L.) Koch, or *lovage*, of the south of Europe, is extensively cultivated for its aromatic fruits. It is aromatic in all its parts, but only the roots and fruits are used. The fruits are small, ovate-oblong, somewhat flattened, curved, strongly ribbed and of a yellowish-brown color. Lovage is a stimulant aromatic, and has been employed as a carminative, diaphoretic, and emmenagogue. The best form for administration is that of infusion. The coloring principle has been isolated by M. J. Nickles, who gives it the name of *ligulin*, and

suggests an important application of it that may be made in testing drinking water. If a drop of its alcoholic or aqueous solution is allowed to fall into distilled water, it imparts to the liquid its own fine crimson-red color, which undergoes no change; but if limestone water be substituted, the red color disappears in a few seconds, and is followed by a beautiful blue, due to the alkalinity of the latter. (*J. P. C.*, 1859, 329.) The root of *Ligusticum sinense*, under the name of *kao-pen*, is largely used by the Chinese. In the Northwestern United States the large aromatic roots of *Ligusticum filicinum* S. Wats., *Osha Colorado cough-root*, are used to a considerable extent as stimulating expectorants. (See *A. J. P.*, 1890 and 1891.)

Lewisia. *Lewisia Rediviva* Pursh. *Spathum. Chita. Bitter Root.*—The roots of this plant, of the Fam. *Portulacaceae*, abundant in the Northwestern United States, are very widely used by the Indians as an article of food. For analysis and description, see *A. J. P.*, 1889.

Liatris. *L. spicata* (L.) Willd. *Gay-feather. Devil's Bite. Colic Root. Button Snakeroot.*—An indigenous perennial composite plant growing in natural meadows and moist grounds from Southern Ontario and Minnesota, southward. It has a tuberous root, and an erect annual stem, which terminates in a spike of beautiful, purple, compound flowers, appearing in August. The root is said by Schoepf to have a terebinthinate odor, and a warm, bitterish, terebinthinate taste; to be possessed of diuretic properties; and to be useful as a local application in gonorrhoea and sore throat. The leaves of the allied *Trilisa odoratissima*, (Walt.) Cass. (*Liatris odoratissimus* Willd.), or *Vanilla leaf*, are very largely employed in the Southern United States to flavor tobacco, and to preserve clothing, etc., from moths. As a preservative it is worthless. The agreeable odor is due to *coumarin*, $C_9H_6O_2$, which may be frequently noticed in crystals upon the surface of the smooth spatulate leaves. (*A. J. P.*, March, 1875; Sept., 1881; xlvii, 116; *N. R.*, 1882, 66.) The roots of *L. scariosa* Willd. (*Lacinaria scariosa* Hill) and *L. squarrosa* Willd. (*Lacinaria squarrosa* Hill) (*rattlesnake's master*) have been employed to cure the bite of the rattlesnake. According to Wm. P. C. Barton, all the tuberous-rooted species of *Liatris* are active diuretics.

Ligustrum. *L. vulgare* L. *Troene, Fr. Rain-weide, Hartriegel, G. Privet or Prim.*—A shrub of the Fam. *Oleaceae*, from four to ten feet in height, growing wild both in Europe and the United States, usually in hedges and by the roadside. The leaves, which have an astringent, bitter taste, and the flowers, which are small, snow-white, and of an agreeable odor, have been used in the form of decoction in sore throat and aphthous and scorbutic ulceration of the mouth. The berries are black, have a sweetish bitter taste, and are said to possess purgative properties, and to color the urine brown. They are sometimes used for dyeing. Death in a child between two and three years old is recorded by James Cheese (*P. J.*, 2d ser., viii, 607), as due to the eating of privet berries. The bark was analyzed by M. G. Poley, who found a peculiar substance, which he denominated *ligustrin*, insoluble in ether and absolute alcohol, but soluble in water and diluted alcohol. Strong sulphuric acid gives with *ligustrin* a deep indigo-blue color. Kromayer (*A. Pharm.* (2), cxviii, 19) proved that Poley's *ligustrin* was only impure *syringin*, $C_{19}H_{28}O_{10} + H_2O$. The large white crystals become anhydrous at 115° C. (239° F.), and fuse at 212° C. (413.6° F.). He found in

addition (see Kromayer, *A. Pharm.*, (2) ci, 281) mannite, sugar, muco-saccharine matter, starch, chlorophyll, bitter extractive, bitter resin, tannin, albumen, and salts. (*A. J. P.*, xii, 347.) Kromayer found besides the *syringin* a crystallized bitter principle, fusing at a little over 100° C. (212° F.), which he named *ligustron*.

Lilium. *Lilium canadidum* L. (Fam. *Liliaceae*.) *Common White Lily*.—This well-known plant is a native of Southern Europe from Corsica to Asia Minor, but has been long cultivated in gardens. The bulb, which consists of imbricated fleshy scales, is without odor, but has a peculiar, disagreeable, somewhat bitter, and mucilaginous taste. It contains much mucilage, and a small proportion of an acrid principle. In the recent state it is said to have been employed with advantage in *dropsy*. Vomiting, purging, drowsiness, etc., are said to have been produced in a little girl by the pollen of the *tiger lily*, *L., tigrinum* Andr. (Jeffries Wyman, *Am. J. M. S.*, 1863.)

LIMONIS CORTEX. U. S., Br.

LEMON PEEL Limon. Cort.

"The outer rind of the fresh ripe fruit of *Citrus medica Limonum* (Risso) Hooker filius (Fam. *Rutaceae*)." U. S. "Lemon Peel is the fresh outer part of the pericarp of the fruit of *Citrus medica*, Linn., var. β *Limonum*, Hook. f." Br.

Limonis Pericarpium; Ecorce (Zeste) de Citron, de Limon, *Fr. Cod.*; Cortex Citri Fructus, *P. G.*; Citronenachale, Limon-enachale *G.*; Scorza di Limone, *It.*

For some general remarks on the genus *Citrus*, see *Aurantii Cortex*.

Citrus medica, or lemon tree, closely resembles *Citrus Aurantium*, before described. The leaves, however, are larger, slightly indented at the edges, and stand upon footstalks which are destitute of the winged appendages that characterize the other species. The flowers, moreover, have a purplish tinge on their outer surface, and the fruit is different in appearance from the orange. There are several varieties of *Citrus medica*, which some botanists consider as distinct species, but which scarcely differ except in the character of their fruits. Those particularly deserving of notice are the citron, lemon, and lime.

1. In the citron, *C. medica genuina* (Bentley & Trimen, p. 53), the fruit is very large, sometimes six inches in length, ovoid, with a double rind, of which the outer layer is yellowish, thin, unequal, rugged, with innumerable vesicles tilled with essential oil; the inner is white, very

thick and spongy. It is divided in the interior into nine or ten loculi, filled with small oblong vesicles, which contain an acid juice precisely like that of the lemon, and used for the same purposes. The rind is applied to the preparation of conserves, to which it is adapted by its thickness. The fruit is called *cedrat* by the French.

2. The *lemon*, *C. medica*, var. *Limonum* (*Citrus Limonum* of Bisso) (Bentley & Trimen, p. 54) is smaller than the preceding, with a smoother and thinner rind, a pointed nipple-shaped summit, and a very juicy, acid pulp. In other respects it closely resembles the citron, to which, however, it is usually preferred in consequence of the greater abundance of its juice.

3. The *lime* is still smaller than the lemon, with a smoother and thinner rind, oval, rounded at the extremities, of a pale-yellow or greenish-yellow color, and abounding in a very acid juice, which renders it highly useful for the purposes to which the lemon is applied. It is the product of *C. medica acida*. According to E. M. Holmes the West India limes are much richer in acid than are those produced in the South of Europe; the juice of the spineless variety was found to contain 37.73 grains per ounce; the ordinary West India lime 36.15 grains per ounce; the Sicily lime 30.32 grains per ounce. Lime juice is recognized by the N. F. IV under the name *Succus Citri*.

The *Citrus medica*, like the orange-tree, is a native of Asia. It is now known to grow wild in Northern India, and was introduced into Europe from Persia or Media. It was first cultivated in Greece, afterwards in Italy, as early as the second century, and has now spread over the whole civilized world, being raised by artificial heat where the climate is too cold to admit of its exposure during winter to the open air.

Properties.—The exterior rind of the lemon has a fragrant odor, and a warm, aromatic bitter taste, somewhat similar to that of the orange, though less agreeable. It is usually found in narrow, thin bands, with very little of the spongy, white, inner layer adhering to it, and is officially described as follows: "The outer, lemon-yellow or dark yellow layer, recently separated by grating or paring and consisting of an epidermal layer, numerous parenchyma cells containing yellow chromoplastids, and large oil reservoirs' with globules of the volatile oil; odor highly fragrant, distinctive; taste pungent, aromatic. Under the microscope, sections of the rind, mounted in a fixed oil, show an

epidermal layer composed of small tabular cells, a hypodermal layer containing numerous plastids, a mesocarp with colorless, thin-walled parenchyma and large, elliptical oil reservoirs; parenchyma cells containing a layer of granular protoplasm adhering to the walls and occasionally membrane crystals of calcium oxalate, which are irregularly polygonal in shape, and from 0.015 to 0.025 mm. in diameter." *U. S.*

"Outer surface pale yellow and more or less rough; with only a small amount of the white spongy part of the pericarp on the inner surface; in transverse section numerous large oil-glands below the epidermis. Strong, characteristic and fragrant odor; taste aromatic and bitter." *Br.*

It contains a bitter principle, and yields, by expression or distillation, an essential oil, which is much used for its flavor. Both this and the rind itself are recognized in the Pharmacopoeias. (See *Oleum Limonis*.) When the white, spongy portion of the rind is boiled in water, and the decoction evaporated, crystals are deposited of a substance called *hesperidin*. This is a glucoside, and has the formula $C_{22}H_{26}O_{12}$, and is decomposed by diluted acids into *hesperetin*, $C_{16}H_{14}O_6$, and glucose, $C_6H_{12}O_6$. It turns dingy black when gently warmed with alcoholic solution of ferric chloride. It is bitter, but as it is found most largely in the spongy and comparatively tasteless part of the rind, it may be doubted whether it is entitled to be considered as the active bitter principle. (See *A. J. P.*, xxvi, 553.) Lemon peel yields its virtues to water, wine, and alcohol. E. G. Clayton (*An.*, xix, 134) calls attention to the distinction between lemon peel and orange peel when moistened by strong hydrochloric acid. Orange peel under these circumstances changes in color from a yellow to a rich dark green color, while lemon peel retains its hue or assumes a dingy yellowish-brown tint.

The German Pharmacopoeia under the title of *Cortex Citri Fructus* requires that the lemon peel be derived from the completely developed but not fully ripe fruits of *Citrus medica*, L.

Uses.—The rind of the lemon is sometimes used to qualify the taste and increase the power of stomachic infusions and tinctures.

Off. Prep.—*Tinctura Limonis Corticis*, *U. S.* (*Br.*); *Infusum Aurantii Compositum*, *Br.*; *Syrupus Limonis*, *Br.*

Linaria. *Linaria vulgaris* Hill. *Antirrhinum Linaria* L. *Common Toadflax. Butter and Eggs. Ramsted. Snapdragon. Linaire commune, Fr. Leinkraut, Flachskraut, Lowenmaul, G.*—This is a perennial herbaceous plant of the Fam. *Scrophulariaceae* very common in America, Europe, and Asia. It should be collected when in flower, dried quickly, and kept excluded from the air. When fresh it has a peculiar, heavy, disagreeable odor, which is in a great measure dissipated by drying. The taste is herbaceous, weakly saline, bitter, and slightly acrid. Its constituents are stated to be two glucosides, *linarin* and *pectolarin* (P. J., lxxix, p. 316), with limarosnin, linaracrin, antirrhinic, tannic and citric acid. This plant is said to be diuretic and cathartic, and has been used in dropsy, jaundice, and cutaneous eruptions. It is most conveniently employed in infusion. The fresh plant is sometimes applied, in the shape of poultice or fomentation, to hemorrhoids, and an ointment of the flowers has been employed for the same purpose, and also locally in diseases of the skin. The flowers are used in Germany as a yellow dye.

LINUM. U. S. (Br.)

LINSEED [Flaxseed]

"The ripe seeds of *Linum usitatissimum* Linne (Fam. *Linaceae*), without the presence or admixture of more than 3 per cent. of other seeds or foreign matter. Preserve it in tightly-closed containers and add a few drops of carbon tetrachloride or chloroform from time to time to prevent attack by insects." U. S. "Linseed consists of the dried ripe seeds of *Linum usitatissimum*, Linn." "

Lini Semina, Br.; Semence de Lin, *Fr. Cod.*; Grains de Lin, *Fr.*; Semen Lini, *P. G.*; Leinsamen, Flachssamen, *G.*; Lino, Semi di Lino, *It.*; Lino (Semilla de), *Linaza, Sp.*

Off. Prep.—Lini Semina Contusa, *Br.*; Species Emollientes, *N. F.*

Linum catharticum L. *Purging Flax.*—Purging flax is an European annual of the Fam. *Linaceae*, six to eight inches high. The whole plant is very bitter and somewhat acrid, and imparts its virtues to water, which acquires a yellow color. It appears to owe its activity to a peculiar drastic principle, which has received the name of Unin, and which is afforded most largely by the plant after the flower has fallen. Schroeder (*N. R. Pharm.*, xi, 11) obtained it in lustrous, white, silky crystals, which are neutral in reaction and have a strong persistent bitter taste in alcoholic solution. Purging flax has enjoyed some reputation in Europe as a gentle cathartic, useful in *muscular rheumatism, catarrhal affections, and dropsy* with disease of the liver. Dose, of the extract, from four to eight grains (0.26-0.5 Gm.); of the powder, one drachm (3.9 Gm.).

LINI SEMINA CONTUSA. Br.

CRUSHED LINSEED

"Crushed Linseed is Linseed reduced to a coarse powder. It should be recently prepared."

Linum Contusum, Br. 1898; Crushed Flaxseed.

Common *flax* is an annual plant, with an erect, slender, round stem, about two feet in height, branching at top, and, like all other parts of the plant, entirely smooth. The leaves are small, lanceolate, acute, entire, of a pale-green color, sessile, and scattered alternately over the stem and branches. The flowers are terminal, and of a delicate-blue color. The calyx is persistent, and composed of five ovate, sharp.. pointed, three-nerved leaflets, which are membranous on their border. The petals are five, obovate, striated, minutely scalloped at their extremities, and spread into funnel-shaped blossoms. The filaments are also five, united at the base, and the germ, which is ovate, supports five slender styles, terminating in obtuse stigmas. The fruit is a globular capsule, about the size of a small pea, having the persistent calyx at the base, crowned with a sharp spine, and containing ten seeds in distinct cells. This highly valuable plant, now almost everywhere cultivated, is said by some to have been originally derived from Egypt, by others from the great elevated plain of Central Asia. It flowers in June and July, and ripens its seed in August.

The flax plant was cultivated for its fiber by the American colonists soon after the landing of Columbus. Soon thereafter it was grown for its seed and already in 1792 the United States exported nearly 300,000" bushels of flaxseed. Very early the linseed oil industry was developed in the United States and in 1810 there were nearly 300 linseed oil mills in the 14 states, more than half of them being in Pennsylvania. It is estimated that at the present time 12,000,000 bushels of seed are crushed annually for the oil. "The annual crop of flaxseed in the United States approximates 30,000,000 bushels. A large quantity of seed is annually exported as well as oil-cake, the latter being extensively used as a cattle food.

Properties.—The official description of flax-seed is as follows: "Ovate or oblong-lanceolate, flattened, obliquely pointed at one end, from 3 to 5 mm. in length; externally chestnut-brown, very smooth and shiny, the raphe extending as a distinct, light-yellow ridge along one edge; easily cut with the finger-nail; internally olive-green; oily; odor slight; taste mucilaginous and oily. Under the microscope, transverse sections of Linseed when mounted in hydrated chloral T.S. show an epidermis with a mucilaginous layer from 0.01 to 0.03 mm. in thickness, covered by a very thin layer of cutin which is often more or less broken; two layers of parenchyma which overlie a continuous ring of stone cells having yellowish, porous walls and rather large lumina; a pigment layer, the cells having a reddish-brown content; an endosperm consisting of from 6 to 10 rows of cells surrounding the two large plano-convex cotyledons; the cells of both the endosperm and the cotyledons contain a fixed oil and aleurone grains, the latter being from 0.003 to 0.02 mm. in diameter." *U. S.*

"Seeds small, brown, glossy, nearly flat; from about four to six millimetres long; ovate, somewhat obliquely pointed; surface glabrous and minutely pitted. Internally yellowish-white, with a narrow oily endosperm and two large oily cotyledons. Epidermal cells filled with mucilage which swells and dissolves in water. No odor; taste mucilaginous, oily." *Br.*

The linseeds in commerce have been divided by E. M. Hohnes into two groups. The first group, characterized by the seeds being of sufficient size for six or seven to weigh a grain, contains Bombay, Bold Calcutta, Sicilian, and Ionian seed; in the group of small seeds (10 to 12 to the grain) are English, Dutch, Russian, and ordinary Calcutta varieties. An important practical point noticed by Holmes is that much of the drug of commerce is adulterated with weed seeds, which are nearly always smaller than the linseeds, and can therefore be separated by the sieve. When linseed meal is to be made for medicinal use, this separation should always be insisted upon, as many of the weed seeds are from Cruciferae, and are irritating. For detailed information as to varieties of linseed, weed seeds, etc., the reader is referred to Holmes's paper. (*P. J.*, July, 1881; also *N. R.*, 1881.)

The ground seeds are found in commerce under the name of *flaxseed meal*. This is of a dark-gray color, highly oleaginous, and when mixed with hot water forms a soft adhesive mass, much employed for luting by

practical chemists. "The powder of flaxseed is lemon-yellow or light brown, consisting chiefly of large, oily globules and irregular fragments of endosperm and seed-coat; the seed-coat is characterized by the tabular pigment cells filled with a reddish-brown, insoluble content and the somewhat elongated stone cells with yellowish walls; mounts made from material from which the fixed oil has been removed show aleurone grains from 0.003 to 0.02 mm. in diameter, both free and in the cells of the endosperm and embryo. *Linseed Meal* or *Flaxseed Meal* is light olive-brown with reddish-brown fragments; the latter being very coarse and the cellular tissues are the same as those of the powder. Powdered Linseed or Flaxseed and Linseed Meal or Flaxseed Meal must be free from any unpleasant or rancid odor. The powder, upon extraction with purified petroleum benzin, yields not less than 30 per cent. of a fixed oil, at least 98 per cent. of which is saponifiable. Boil 1 Gm. of the fat-free Linseed or Flaxseed Powder or Meal, with 50 mls of water, cool and filter; the filtrate gives not more than a faint blue color, on the addition of iodine T.S. Linseed yields not more than 6 per cent. of ash." U. S.

Crushed flaxseed is "a coarse, brownish-yellow powder, with readily visible fragments of the brown seed-coats. Bland, not pungent or rancid, odor when mixed with warm water, Yields not less than 30 per cent. of oil when exhausted by carbon disulphide; the oil thus obtained responds to the tests described under. 'Oleum Lini'; the residual powder exhibits no starch grains when examined under the microscope. Ash not more than 5 per cent." Br.

The average composition of linseed oil cake is thus given by Schaedler (*Technologie der Fette und Oele*, 1883): moisture, 10.56 per cent.; oil, 9.83 per cent.; non-nitrogenous fiber, 44.61 per cent.; ash, 6.5 per cent.; proteid matter, 28.5 per cent.

Much of the linseed meal of commerce is simply cake meal, which was, indeed, official in the former Br. Ph., but such meal is unfit for medicinal use, not only because it contains very little oil, but also because the oil which is in it has, through rupture of the cells and partial expression, been so exposed to the air as to become rancid. Linseed meal is sometimes adulterated with corn meal, or other meals containing starch, whose presence is at once revealed by the iodine test. It is sometimes found in the market adulterated with petroleum or other mineral oil, doubtless made by powerfully pressing the pure linseed meal and substituting for the linseed oil the less expensive product, petroleum. (A.

J. P., 1902, 31.)

The absolute value of a sample of crushed linseed can be determined by analysis. It should contain from 25 to 35 per cent. of oil, not more than 8 or 8.5 per cent. of husk, and less than 8 per cent. of ash. The following test is said to be sufficient for practical purposes: "Put half an ounce of the meal into a glass vessel, pour six ounces of boiling water over it, stir well, and allow it to stand for twelve hours. If first-class, it should absorb all the water, and show a thin scum of white glutinous liquid on the top, which will adhere closely to a glass rod or a wooden pencil dipped into it. If the meal does not absorb nearly all the water, it is of inferior quality. The amount of inferiority must be judged by the amount of water not absorbed, and by the character of the fluid on the top of the solution. If it is thin and non-glutinous, the meal is of inferior quality."

Meyer found in linseed fixed oil, wax, resin, extractive, tannin, gum, nitrogenous mucilage, starch, albumen, gluten, and various salts. Meurein could find no starch, but detected phosphates, which had escaped the notice of Meyer. (*J. P. C.*, 3e ser., xx, 97.) For some years there has been a discussion concerning the reaction for starch which is sometimes ascertained in commercial flaxseed. Apparently starch grains are not usually present, although it is stated that they may occur in appreciable quantities in the unripe seed. (*Ph. Ztg.*, li, p. 658.) Certain tissues of the seed coat beneath the mucilaginous epidermis may give a starch reaction, and it is stated that even the cells may contain starch. (*Proc. A. Ph. A.*, 1907, lv, p. 326.) Their investing coat abounds in a peculiar gummy matter or mucilage, which is readily imparted to hot water, forming a thick viscid fluid, that lets fall white flakes upon the addition of alcohol, and affords a copious dense precipitate with lead subacetate. The viscid mucilage of linseed cannot be filtered until it has been boiled. It contains in the dry state more than 10 per cent. of mineral substances; when freed from these and dried at 110° C. (230° F.), it has, like althcea mucilage, the formula C₁₂H₂₀O₁₀. The seeds by exhaustion with cold or warm water afford about 15 per cent. of this mucilage. By boiling with nitric acid, it yields crystals of mucic acid; by diluted mineral acids, it is broken up into dextrogyrate gum, sugar, and cellulose. (Kirchner and Tollens, *Ann. Ch. Ph.*, clxxv, 215.) For further information on the histology and pharmacognosy of the flaxseed, see Winton and Moeller, "The Microscopy of Vegetable Foods;" Kate B. Winton, *Bot. Gaz.*, lvii, p. 2445; Collin, *J. P. C.*, 1909, xxix, p. 369.

Jorissen and Hairs (*Drogues Simples*, t. ii, 685) obtained from the young plant a gluco-side, to which they gave the name of linamarin, which crystallizes in colorless needles, melting at 134° C. (273.2° F.), without odor, but possesses a fresh and bitter taste. It differs from amygdalin in not being decomposed by emulsin, but diluted acids decompose it into sugar, hydrocyanic acid, and a third product which is volatile and possesses certain of the characters of the acetones. No benzaldehyde is formed. Linseed contains about 4 per cent. of nitrogen, corresponding to about 25 per cent. of proteid substances. After expression of the oil these substances remain in the cake, so that the latter contains 5 per cent. of nitrogen and constitutes a very important article for feeding cattle and is termed *cake meal*. The interior of the seed, or nucleus, is rich in a peculiar oil, which is separated by expression, and extensively employed in the arts on account of its drying properties. (See *Oleum Lini*.)

Uses.—Flaxseed is demulcent and emollient. The mucilage obtained by infusing the entire seeds in boiling water, in the proportion of half an ounce to the pint, is much and very advantageously employed in *catarrh*, *dysentery*, *nephritic* and *calculous complaints*, *strangury*, and other inflammatory affections of the mucous membrane of the lungs, intestines, and urinary passages. The whole seed is occasionally given in tablespoonful doses as a laxative. By decoction, water extracts a portion of the oleaginous matter, which renders the mucilage less fit for administration by the mouth, but superior as a laxative enema. The meal mixed with hot water forms an excellent emollient poultice.

Lippia.—A number of the species of this genus (Fam. *Verbenaceae*) contain aromatic oils, and several have been used in popular medicine. The *L. citriodora*, H. B. K., yield verbena oil, and is commonly known as *Lemon verbena*. From the *L. mexicana*, Podwissotzki (*Proc. A. Ph. A.*, 1886) separated an essential oil somewhat resembling that of fennel, as well as a camphor-like substance which he named lippioil. According to Maisch (*A. J. P.*, xxlvii, p. 330), however, the plant used by Podwissotzki was probably the *Cedronella mexicana* (Bentli.). Power and Tutin (*A. Pharm.*, 1907, ccxiv, p. 337) found in the *L. scaberrima* (Sender), a native of South Africa, where it is popularly known as *Beukess boss*, an essential oil somewhat resembling lavender in its odor, a peculiar crystalline substance, which they named *lippianol*, having the qualities of a mono-hydric alcohol, and a number of other substances not peculiar to the plant.

Liquidambar. *Liquidambar Styraciflua*, L. *Sweet Gum.*—An indigenous tree (Fam. *Hamamelidaceae*), growing in different parts of the United States from Connecticut to Florida, and flourishing also in Mexico and Central America, where, as well as in our

Southern States, it sometimes attains a great magnitude. In warm latitudes a balsamic juice flows from its trunk when wounded. This has attracted some attention in Europe, where it is known by the name of *liquidambar* or *copalm balsam*, and is sometimes, though erroneously, called liquid storax. It is not afforded by the trees which grow in the Middle Atlantic States, but is obtained in the Western States bordering on the Ohio, and southward as far as Central America. It is a liquid of the consistence of thin honey, more or less transparent, of a yellowish color, of a peculiar, agreeable, balsamic odor, and a bitter, warm, and acrid taste. By cold it becomes thicker and less transparent. It concretes also by time, assuming a darker color. It is sometimes collected in the form of tears, produced by the spontaneous concretion of the exuded juice. According to Bonastre, it contains a colorless volatile oil, a semi-concrete substance which rises in distillation and is separated from the water by ether, a minute proportion of benzoic acid, a yellow coloring substance, an oleoresin, and a peculiar principle, insoluble in water and cold alcohol, for which Bonastre proposed the name of *styracin*. The styracin of Bonastre has since been found to be *cinnamyi cinnamate*, (C₉H₉) C₉H₇O₂, which is found together with the ethyl, benzyl, and other esters of cinnamic acid. Examined by W. P. Creecy, of Mississippi, it was found to contain cinnamic acid as the prominent acid ingredient, besides a volatile, odorous principle melting at 65° C. (149° F.), and smelling of vanillin, and 30 per cent. of a hard resin (according to W. von Miller, *storesin*, C₃₆H₅₅(OH)₃). If the storesin be repeatedly extracted with diluted potassium hydroxide solution, it is separated into *a-storesin*, which is amorphous and melts at from 160° to 168° C. (320°-334.4° F.), and *β-storesin*, which forms white flocks melting at from 140° to 145° C. (384°-393° P.). Of these, the *β*-resin is first extracted, while the residue is nearly pure *a*-resin. The volatile oil mentioned above contains a hydrocarbon, *styrol*, *styrene* or *cinnamene*, C₈H₈, which changes on heating into the polymeric *metastyrol*, a colorless, transparent solid. The results of W. L. Harrison, confirmed by Maisch (*A. J. P.*, xlvii, 160, 165), seem to prove that the American drug is identical with storax, except in containing no water mechanically mixed with it.

Another product is said to be obtained from the same tree by boiling the young branches in water, and skimming off the fluid which rises to the surface. It is of thicker consistence and darker color than the preceding, is nearly opaque, and abounds in impurities. This also has been confounded with liquid storax, which it resembles in properties, though derived from a different species of *Liquidambar*. It is said to be used in Texas in coughs. (Gammage, *N. O. M. S. J.*, xii, 836.) For an account of the collection of American storax, see *Ph. Rund.*, 1895, 57.

Liquidambar may be employed for the same purpose as storax, and is so used in the Southern United States, but it is almost unknown in the Northern States. The concrete juice is said to be chewed in the Western States in order to sweeten the breath. The bark of the tree is used with asserted great advantage in the Southern and Western States in *diarrhea* and *dysentery*, especially in children. It is taken in the form of syrup, which may be prepared from the bark in the same manner as the syrup of wild cherry bark, according to the U. S. Pharmacopoeia. The dose is a fluidounce (30 mils) for an adult, repeated after each stool. (*Ann. J. M. S., N. S.*, xxxii, 126.)

Liquidambar Altingia (*Altingia excelsa*), a tree which inhabits a very wide region in Southern Asia, yields a storax-like substance varying in color from white to red. (See *P. J.*, viii, 243.) According to Tschirch and van Itallie, it differs from storax in the presence of benzoic and cinnamic aldehydes, the absence of ether and the small quantities of cinnamic acid in it. *Liquidambar storesin* is said also to be known in Eastern markets.

Liriodendron. *Liriodendron Tulipifera* L. *Tulip Tree. American Tulip-poplar Tree.* (Fam. *Magnoliaceae*). *White Tulip Bark. Ecorce de Tulipier, Fr. Tulpenbaumrinde, G.*—The tulip poplar is a large tree which is abundant in rich soil in the forests from Southern Ontario to Wisconsin and extending into the Southern States, the timber being commonly known as Poplar or White Wood. Its formerly official bark was taken for use indiscriminately from the root, trunk, and branches, though that of the root is thought to be the most active. Deprived of the periderm, it is yellowish-white, the bark of the root being somewhat darker than that of the stem or branches. It is very light and brittle, of a feeble, rather disagreeable odor, strongest in the fresh bark, and of a bitter, pungent, and aromatic taste. These properties are weakened by age, and we have found specimens of the bark, long kept in the shops, almost insipid. Emmet believed the active principle to be the substance discovered by him and named *liriodendrin*. It is white, crystallizable, brittle, insoluble in water, soluble in alcohol and ether, fusible at 82.2° C. (180°F.), volatilizable and partly decomposed at 132.2° G. (270° F.), of a slightly aromatic odor, and a bitter, warm, pungent taste. It does not unite either with acids or alkalies, and the latter precipitate it from the infusion of the bark by combining with the matter which renders it soluble in water. Water precipitates it from its alcoholic solution. It is obtained by macerating the root in alcohol, boiling the tincture with magnesia until it assumes an olive-green color, then filtering, concentrating by distillation until the liquid becomes turbid, and finally precipitating the *liriodendrin* by the addition of cold water. (*A. J. P.*, iii, 5.) J. U. Lloyd believes that the active principle is the alkaloid *tulipiferine*, discovered by him in 1886, and this, according to Bartholow, appears to possess toxic properties. (*Ph. Rund.*, 1886, 169.) The virtues of the bark are extracted by water and alcohol, but are injured by long boiling.

Liriodendron is a stimulant tonic, with diaphoretic properties, and has been used in chronic *rheumatism* and *dyspepsia*. Dose, of bark in powder, from half a drachm to two drachms (2.0-7.7 Gm.); of saturated tincture, a fluidrachm (3.75 mils).

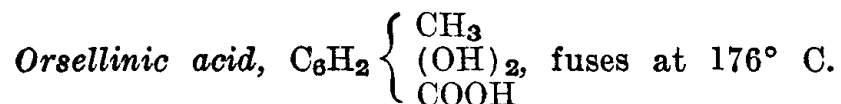
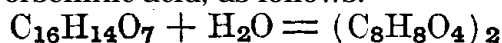
Lithospermum. *Lithospermum officinale* L. *Common Gromwell. Miliun Solis.*—A European perennial, also found along roadsides and pastures of Canada and the northern United States, of the Fam. *Boraginaceae*, the seeds of which are ovate, of a grayish-white or pearl color, shining, rather larger than millet seeds, and of a stony hardness, from which the generic name of the plant originated. They were formerly used as stimulant diuretics, but are nearly inert.

Lithraea. *Lithraea venenosa* Miers. (Fam. *Anacardiaceae*).—The leaves of this Chilean plant are said to act upon the skin in a manner similar to *Rhus toxicodendron*,

and to contain a resin and an ethereal oil. The tincture of the fresh leaves has been used as a counter-irritant.

Litmus. *Lacmus. Turnsole. Tournesol. Lacca Coerulea. Lacca Musica. Laquebleu*, Fr. *Lackmus*, G.—Three purple or blue coloring substances are known in commerce, obtained from lichenous plants. They are called severally *litmus*, *orchil*, and *cudbear*. *Litmus* is yielded by numerous species of lichens which, under the French name of orseille, are brought into commerce from the coasts of Sweden and Norway; from the Alps, the Pyrenees, and other European mountains; from the European and African coasts of the Mediterranean; from the Canaries, Madeira, and various other rocky islands, especially from Mozambique, Madagascar, and Angola, and from California. The species of lichens concerned represent various genera; at present the two most important of the lichens are said to be the *Rocella Montagnei* of Mozambique and the *Dendrographa leucophoea* of California. In the north of Europe *Lecanora tartarea* Ach., or Tartarean moss, and on the Mediterranean coasts the *Rocella tinctoria* Ach., or *orchilla weed*, at one time furnished the great bulk of the orseille of commerce. The chromogenous ethers which constitute the coloring matter of the lichens may be readily detected in situ by reagents. (*P. J.*, Nov. 19, 1904.) In some of the lichens these coloring principles are chiefly situated in the cortex; in others they are especially abundant in the gonidial layer.

The principles in these plants upon which their valuable properties depend are themselves colorless, and yield coloring substances by the reaction of water, air, and ammonia. They are generally acids or acid anhydrides, and are named *lecanoric*, *orsellic*, *erythric*, etc., according to their origin. *Lecanoric (diorsellinic)* acid, $C_{16}H_{14}O_7$, the original constituent of most of these plants, when boiled with water or alkaline solutions, is changed into orsellinic acid, as follows:



(348.8° F.), and decomposes into orcin, $C_6H_3(CH_3)(OH)_2$, and CO_2 . The same decomposition is readily effected by distillation with milk of lime. Orcin combines with ammonia gas to form $C_8H_8O_2.NH_3$, the solution of which exposed to the air becomes colored reddish by the formation of *orcein*, $C_7H_7NO_3$. This latter compound forms the basis of the commercial *orseille* extract (*orchil* or *archil*).

Kane described a deep red crystalline substance, *erythrolitmin*, and a brownish-red coloring principle, *azolitmin*, $C_7H_7NO_4$. This latter is considered as the distinctive coloring matter of the commercial litmus, and is now found in commerce under that name and is used as an indicator. It is nearly insoluble in cold water or benzene, but dissolves in alcohol with red, and in ether with yellow color. It appears to have the characters of a weak acid, the salts of which are blue and the potassium and calcium compounds of which exist in litmus.

To test the value of the plants as dye-stuffs, they may be macerated in a weak

solution of ammonia, »r a solution of calcium hypochlorite may be added to their alcoholic tincture. In the former case a rich violet-red color is produced; in the latter, a deep blood-red color appears, but soon fades,

Lacmus or *litmus* is prepared chiefly if not exclusively in Holland. The process consists in macerating the coarsely powdered lichens, in wooden vessels under shelter, for several weeks, with occasional agitation, in a mixture of urine, lime and potash or soda. A fermentation ensues, and the mass, becoming first red and ultimately blue, is, after the last change, removed, mixed with calcareous or silicious matter to give it consistence, and with indigo to deepen the color, and then introduced into small molds, where it hardens. It is said that ammonia may be substituted for urine in the manufacture of litmus, but that the reactions necessary for the production of the coloring matter of the litmus are due to the action of the enzyme which is found in the lichens. Litmus occurs in rectangular cakes, from a quarter of an inch to an inch in length, light, friable, finely granular, of an indigo-blue or deep violet color. It has the combined odor of indigo and violets, tinges the saliva a deep blue, and is somewhat pungent and saline to the taste. From most vegetable blues it differs in not being rendered green by alkalies. It is reddened by acids, and restored to its original blue color by alkalies. For a method of ^purifying commercial litmus by Foerster, see *Nat. Drug.*, 1904, 460.

Its chief use in pharmacy is as an indicator. For this purpose it is employed either in infusion or in the form of litmus paper. The infusion, formerly called *tincture of litmus*, may be made in the proportion of one part of litmus to twenty of distilled water, and two parts of alcohol may be added to preserve it. *Litmus paper* is prepared by first forming a strong clear infusion with one part of litmus to four of water, and dipping slips of white unsized paper into it, or applying it by a brush to one surface only of the paper. The paper should then be carefully dried, and kept in well-stoppered vessels, from which the light is excluded. It should have a uniform blue or slightly purple color, neither very light nor very dark. As a test for alkalies the paper may be stained with an infusion of litmus previously reddened by an acid, care being taken to avoid all excess. By gas light it is said that the change of color cannot be determined by the eye exactly, as the blue of litmus becomes mauve; but this may be obviated by watching the process through a green glass, by which the faintest trace of blue becomes discernible.^ (P. J., 2d ser., vi, 479.) For the official method of preparing litmus paper, see Tests, Teat Solutions, etc., PART III.

Orchil, or *archil*, as prepared in England, is in the form of a thickish liquid, of a deep reddish-purple color, but varying in the tint, being in one variety redder than in another. The odor is ammoniacal. It is made by macerating lichens in a covered wooden vessel, with an ammoniacal liquor, either consisting of stale urine and lime, or prepared by distilling an impure salt of ammonia with lime and water. (Pereira.) For details as to the method of preparation, see *Chem. News*, 1874, 143. It is occasionally adulterated with the extracts of colored woods, as logwood, sappan-wood, etc. A mode of detecting these adulterations is given by F. Leeshing in the *Chem. Gaz.* of June 1, 1855, 219. A sulphonated derivative of orchil is much used in coloring food-stuffs under the name of "vegetable red."

Cudbear is a purplish-red powder procured in the same manner as orchil; but the mixture, after the development of the color, is dried and pulverized.

The point in which the preparation of these coloring substances differs from that of litmus appears to be, that potassium or sodium hydroxide is added, in the latter, to the ammoniacal liquid used. Orchil and cudbear are employed as dye-stuffs and for coloring purposes, and sometimes, in like manner with litmus, as indicators (see *Cudbear*). For chemical constituents of lichens, see *A. J. P.*, 1898, 455.

LOBELIA. U. S., Br.

LOBELIA Lobel.

"The dried leaves and flowering tops of *Lobelia inflata* Linne (Fam. *Lobeliaceae*), without the presence or admixture of more than 10 per cent. of stems or other foreign matter." U. S. "Lobelia is the dried flowering herb of *Lobelia inflata*, Linn." *Br.*

Indian or Wild Tobacco, Asthma-weed, Puke-weed, Gag-root, Vomitwort, Bladder Pod, Eyebright; Lobelie enflée, *Fr. Cod.*; Herba Lobelia, *P. G.*; Lobelienkraut, *G.*; Lobelia, *It.*

Lobelia inflata, often called *Indian tobacco*, is an annual or biennial indigenous plant, usually a foot or more in height, with a fibrous root, and a solitary, erect, angular, very hairy stem, much branched about midway, but rising considerably above the summits of the highest branches. The leaves are scattered, or alternate, petiolate, the upper sessile, ovate, or oblong, about two inches (5 cm.) long, irregularly toothed, pubescent, pale green. The flowers are numerous, small, disposed in leafy terminal racemes, and upon short axillary footstalks. The calyx is five-toothed and much inflated in fruit. The corolla, which is of a delicate blue, has a labiate border, with the upper lip divided into two, the lower into three segments. The united anthers are curved, and enclose the stigma. The fruit is an oval, striated, inflated capsule, crowned with the persistent calyx, and containing, in two cells, numerous very small, oblong, reticulated brown seeds.

Lobelia inflata is a very common -weed, growing in the roadsides and in neglected fields throughout the Eastern United States and Canada. Its flowers begin to appear towards the end of July, and continue to expand in succession until the occurrence of frost. All parts of it are medicinal, but, according to Eberle, the root and inflated capsules are most powerful. The plant should be collected in August

[The balance of the Lobelia text is missing]

Lobeline Sulphate.—This occurs as very deliquescent yellow friable pieces soluble in water and alcohol. It is asserted to be a very valuable anti-spasmodic drug, being of especial use in the treatment of *asthma*. Its incompatibilities are the same as those of alkaloids in general and it is a very active poison, emetics and tannin followed by systemic stimulants being the antidote. Dose, one-third to one-half grain (0.02-0.03 Gm.).

Loco Plants. Crazy Weeds.—These are plants growing in the far Western States, the eating of which by horses and cattle is believed to produce loss of flesh, disordered vision, delirium, convulsive movements, or stupor and death. The chief local plants are *Aragallus Lamberti*, commonly known as *rattleweed* or *white loco*, extending from Alaska southward. A plant of more limited range is the *purple loco*, *woolly loco* or *Texas loco* (*Astragalus mollissimus* Torr.). There are quite a number of other plants causing heavy losses to stock men of the West.

Isaac Ott found a plant, which he believed to be *A. mollissimus*, to act as a violent spinal poison and mydriatic (*N. R.*, Aug., 1882), and, according to Carl Ruedi, the decoction produces in the rabbit great hilarity, excitement, and even ferocity, and contains an alkaloid, *locoine*, and an acid. (*Tr. Col. State Med. Soc.*, 1895.) On the other hand, O'Brien, of the State Agricultural College of Colorado, was not able to obtain any active chemical substance from six U. S. species of the genus, including the two previously mentioned, while in a very careful study of a plant which was neither in flower nor in seed, but whose identification as *A. mollissimus* was clear, H. C. Wood found that it was not poisonous to rabbits or dogs, a result which has been confirmed by Ingersoll (*Proc. A. Ph. A.*, 1890) and O'Brien (*Bulletin 25, Agricultural Experiment Station of Colorado*) and others. It would appear that *A. mollissimus* is not a poisonous plant. Other species of the genus, especially *A. Hornii* A. Gray, *A. Bigelovii* A. Gray, and *A. caryocarpus* Ker., Gawl, have had poisonous properties attributed to them, and in the fruit of the last-mentioned species G. B. Frankforter believes he has demonstrated the presence of an alkaloid. In 1908 Crawford brought forward the interesting theory that the poisonous effects of the loco weed were due to barium, but Alsberg and Black (*Bull. 246, U. S. Bureau of Plant Industry, 1912*) have shown that many other plants in the same localities contain equal quantities of barium, but do not produce the characteristic symptoms, and that the barium is in such an insoluble form as to render improbable that it would be absorbed in the intestinal tract. There can be no doubt that domestic animals are destroyed in the West in very large numbers from an affection which is known as "loco," and hundreds of thousands of dollars have been spent in bounties by the State of Colorado for the extirpation of the supposed poisonous astragalus. It is probable that many of the deaths attributed to loco have been from other causes. Thus, Ingersoll of the Colorado State Agricultural College, found in a large number of loosed sheep masses of *Taenia expansa*, which he believed to be the cause of death. It is a probable explanation that the phenomena of loco disease are due to the fermentation of an astragalus or other plant in the intestines of the animals, and the production of one or more poisons which are

absorbed and produce narcotic symptoms. If this be correct the loco disease is parallel in its etiology and nature to the lathyrismus of Europe. See *Lathyrus sativus*; also *N. Y. M. J.*, 1889, xlix. Similar effects are produced in horses by the pods of the mesquite (*Prosopis juliflora* DC.), when eaten too freely.

According to Haeckel (*Die naturlichen Pfiansen Familien*), the Russian grass *Stipa capillata* L. frequently kills sheep, not, however, by a direct poisonous action, but by its glumes working through the skin into the vital organs; and *Stipa Vaseyi*, which is said in some parts of New Mexico and Texas to be known by the name of "sleepy grass," is believed by some ranchers to be the cause of loco disease. Lescohier (*M. R.*, 1911, xx, p. 273) finds that the sleepy grass is an active respiratory poison, and also has some depressant action upon the heart muscle. He suggests that the apparent narcosis produced by the injection of it into the lower animals, is due to partial asphyxiation. This explanation, however, seems improbable in light of the symptoms which are reported in animals which have eaten the grass. Gillespie (*B. M. J.*, 1908, ii, p. 1059) reports that the drug is not only a narcotic, but also a diuretic and sudorific.

Lolium. *Lolium temulentum* L. *Darnel. Bearded Darnel. Ivraie, Fr. Lolch, Taumelkorn, G.*—This grass, which has spread over the world wherever wheat is cultivated, is rarely found in the United States. It owes its importance to its growing especially with wheat, so that its ground seeds are eaten in the flour. From ancient times its seeds have been believed to produce an intoxication similar to that of alcohol; hence its specific Latin name and the French name, *Ivraie*. In the sweetish seeds, P. Antze (*A. J. P.*, 1891, 568) believed that he found a solid alkaloid, *temulentine*, and a volatile one, *loliine*; but Hofmeister (*A. J. P.*, 1892, 611) determined that the volatile alkaloid was an impure ammonia, while the *temulentine* was a mixture which contained a nitrogenous acid and an uncrystallizable alkaloid, *temuline*, of which the hydrochloride has the formula $C_7H_{12}N_2O \cdot 2HCl$.

It is alleged that *lolium* seeds produce vertigo, dizziness, headache, somnolence, and general intoxication in man, as well as in dogs, sheep and horses, while they are innocuous to hogs, cows, and poultry. Riviere and Maiziere (*J. P. C.*, 1863, 280) have recorded death as occurring from the use of bread containing large amounts of darnel. P. Antze found that both *loliine* and *temulentine* are poisonous, causing violent gastro-intestinal irritation, dyspnea, and general depression. (*Cb. G. T.*, 1891.) M. P. Guerin believes the poisonous properties of darnel are due to the presence of a fungus. (*Morots Journ. de Bot.*, 1898.)

Lonchocarpus. *Lonchocarpus violaceus* (Jacq.) H. B. K. *Stinkwood*.—The wood of this papilionaceous tree is said to be used by the natives of Surinam as a fish poison. (*Ph. Cb.*, xxxix, 282.)

Lonicera. *Lonicera Caprifolium*, L. Honeysuckle. "American" or Italian Woodbine. (Fam. *Caprifoliaceae*.)—The flowers of the common honeysuckle are sometimes used in perfumery, and a syrup of the fruit has been commended in asthma. The fruit of all the species of *Lonicera* is said to be emetic and cathartic (Merat and De Lens), and that of *L. xylosteum* L. to have caused serious poisoning. (*J. P. C.*, 4e ser., xviii, 65.)

Lotus. *Lotus arabicus* L.—According to W. R. Dunstan and T. A. Henry, the leaves of this leguminous plant contain a yellow crystalline glucoaide, *lotusin*, $C_{22}H_{19}NO_{10}$, and an enzyme, *lotase*, by which lotusin is converted into prussic acid and a yellow substance, *lotoflavin*. (*Proc. Roy. Soc.*, Ixvii, 224.)

Lucuma.—This Brazilian genus of the fam. *Sapotaceae* yields a number of species, which are used in Brazil as medicines or articles of diet. For an account of them, see *Ph. Rund.*, 1888. See also *Monesia*.

Luffa. *Luffa cylindrica* (L.) Rom. *Vegetable Sponge. Wash-rag Sponge. Gourd Towel.*—A cucurbitaceous genus, indigenous to Arabia and Egypt, furnishing a gourd-like fruit, which presents upon the removal of the epidermis a durable skeleton of interwoven woody fibers, which are used in place of sponge. Reinhard J. Weber has furnished the following description of *Luffa cylindrica* as grown in this country: It is a large climbing vine, with a thin but very tough light green, succulent stem, attaining a length of from 10 to 30 feet. The leaves are alternate and palmately-lobed, of a light green color, and almost destitute of taste. The flowers are monoecious, petals five, united below into a bell-shaped corolla; anthers cohering in a mass; ovary two-celled, style slender, stigmas three. The fruit is elliptical-ovate, fleshy and dehiscent, with a green epidermis, longitudinally marked with black ridges, varying from ten to fifteen in number; under each of these ridges is found a tough, woody fiber. The seeds are numerous and almost flat, broadly-ovate, three-eighths of an inch long. (*A. J. P.*, 1884, 6.) The fruit of *L. echinata* Roxb., of India, is a violent irritant poison, from which C. J. H. Warden has separated a principle allied to, if not identical with, *colocynthitin*. (*P. J.*, June, 1890.)

Lupinus. *Lupinus albus* L. *Lupin. Lupin*, Fr. *Feigbohne, Wolfsbohne*, Gr.—A plant belonging to the *Leguminosae*, and a native of Europe and Western Asia, which is sometimes cultivated in our gardens. Other species are also met with—*L. hirsutus* L., *L. luteus* L., *L. polyphyllus* Lindl., *L. densiflorus* Benth. The last two are indigenous to the Pacific slope and the West. The bitter principle *lupinin*, $C_{29}H_{32}O_{16}$, is a glucoside, and its solution in alkalis is of a dark brownish-yellow color. On boiling with dilute acids it is decomposed into *lupigenin*, $C_{17}H_{12}O_6$, and a fermentable, dextro-rotatory glucose. The bruised seeds of white lupin, after soaking in water, are sometimes used as an external application to *ulcers*, etc., and internally are said to be anthelmintic, diuretic, and emmenagogue. An instance has been recorded where a decoction used as an injection in the rectum caused symptoms which suggested a poisonous character for the drug. An alkaloid, *lupanine*, $C_{15}H_{24}ON_2$, has also been discovered in *L. angustifolium*. It is a pale, yellow, syrupy fluid of an intensely bitter taste and showing a green fluorescence. Two alkaloids, *lupinine*, $C_{21}H_{40}O_2N_2$, and *lupinidine*, $C_8H_{15}O_2N$, have been isolated from the seeds of *Lupinus luteus* and *L. niger*, the former a crystalline powder and the latter a syrupy liquid. Steiger (*J. Soc. Chem. Ind.*, 1886, 385) has also studied a carbohydrate analogous to dextrin, which Baeyer and Eichborn discovered in *Lupinus luteus*. He finds that it is not changed by yeast, that

nitric acid converts it into mucic acid, and that diluted sulphuric or hydrochloric acid converts it into galactose.

According to Schwartz (W. K. R., 1906) the seeds of the *Lupinus arabis* contain *calcium-anhydro-oxydiaminephosphate*, to which he has given the name of *magolan* and which is a useful remedy in *diabetes mellitus*. It occurs in crystals which yield a green precipitate with copper acetate. The dose of magolan is three grains (0.2 Gm.), several times daily.

Lycium. *Lycium halimifolium* Mill. *Matrimony Vine*. (Fam. *Solanaceae*)—Different species have been used in various parts of the world for supposed medicinal virtues. *Lycium vulgare*, which is indigenous in the south of Europe and in Asia, is a thorny shrub, with long flexible branches, and is cultivated for hedges and arbors. Husemann and Marme found in the leaves and stem an alkaloid, *lycine*, $C_5H_{11}O_2N$. (A. J. P., 1864, 226.) It is very deliquescent, and is soluble in both water and alcohol, but nearly insoluble in ether. It is crystallizable, of a sharp but not bitter taste, and forms crystallizable salts with the acids. Husemann believes that lycine does not exist in the plant, but is formed during the process of extraction, and also that it is identical with *betaine*, $C_5H_{11}NO_2$, the alkaloid obtained from beet juice by Scheibler, and with the oxyneurine of Liebreich. (A. J. P., xlvii, 209.) E. Schmidt found in *Lycium vulgare* traces of mydriatic alkaloids, resembling those of belladonna. (*Ap. Ztg.*, 1890, 511.) The young shoots of one of the species of *Lycium* are eaten in Spain as asparagus, and its leaves as salad, and the aborigines of Colombia used another species against *erysipelas*. The leaves of *L. vulgare*, as well as the fruit, are said to be used by the physicians of Japan. (Merat and. De Lens.)

LYCOPODIUM. U. S.

LYCOPODIUM Lycopod.

“The spores of *Lycopodium clavatum* Linne (Fam. *Lycopodiaceae*), without the presence or admixture of more than 2 per cent. of impurities.” U. S.

Club Moss, Stag's horn. Semen Lycopodii, Pulvis Lycopodii, Sulphur Vegetabile; Vegetable Sulphur; Lycopode, *Fr. Cod.*; Souire vegetal, *Fr.*; Lycopodium, *P. G.*; Barlappsarnen, Streupulver, Hexenmehl, Blitzpulvar, *G.*; Licopodio, *It., Sp.*

Lycopodium clavatum, commonly called club moss, has a trailing, branching- stem, several feet long, and thickly beset with linear-awl-shaped, flat, ribless, smooth leaves, tipped with a fine bristle, curved upward, and of a light green color. The fructification is in terminal spikes, single or in pairs, with crowded ovate, entire, pointed scales,

bearing in the axil a transversely oval sporangia which splits nearly to the base and contains the narrow reticulate spores. The plant is a native of Europe, Asia, and America, being especially common in the dry woods northward.

The spores are collected in Switzerland and Germany. Lycopodium is " a light yellow, very mobile powder, nearly inodorous and tasteless. It is not wetted by water but floats upon it; when boiled with water it sinks; when thrown into a flame it burns with a quick flash. Under the microscope, the spores of Lycopodium are spherical tetrahedrons, from 0.025 to 0.04 mm. in diameter; in section they vary from plano-convex to triangular, the outer wall or exosporium being extended in the form of slight irregular projections, giving the surface of the spore a reticulate appearance, the reticulations being polygonal and formed of straight sides; when viewed so that the rounded surface of the spores is on the under side, the upper surface is characterized by a distinct, triangular marking, being the edges of the three straight surfaces, extending from the center of the Spores to near the outer edge. Lycopodium shows very few, if any, pollen grains of species of Pine, the latter being from 0.04 to 0.07 mm. in diameter, and consisting of three parts, in which a central, convex, generative cell separates the two spherical cells or wings which are blackish, due to the inclusion of air. Lycopodium yields not more than 3 per cent. of ash." *U. S.*

Fluckiger by thoroughly comminuting the spores of lycopodium with sand, obtained 47 per cent. of a bland oil of bright yellow color and sp. gr. 0.925, which does not congeal even at -15° C. (5° F.). A. Barkowski obtained from the spores of Lycopodium 48.5 per cent. of a neutral non-drying oil, very similar to almond oil. This oil contains 2 per cent. of a fatty acid called *lycopodic acid* ($C_{18}H_{36}O_4$), 80 per cent. of oleic acid, a minute quantity of a vegetable cholesterin similar to that obtained by Hesse from Calabar beans, 8.2 per cent. of glycerin and 3 per cent. of arachidic, palmitic and stearic acids. The lycopodic acid crystallizes in silky needles, it is doubly refracting like quartz, and appears to be isomeric with dioxystearic acid. (*D. C.*, 1891, 155; see also *A. Pharm.*, 1908, 246.) Stenhouse found volatile bases to be present in very small amount. The ash amounts to 4 per cent. It contains alumina and 1 per cent. of phosphoric acid, and is not alkaline. (*Pharmacographia*, 2d ed., 732.) Lycopodium is sometimes admixed with pine pollen which is probably to be looked upon as an accidental contamination. In the same way, it may contain small quantities of talcum and starch. It is

sometimes adulterated with a resinous compound made from rosin, ferruginous earths, shellac, sulphur, turmeric, talcum, dextrin or the cereal starches.

In Nashville, Tenn., a specimen came into the possession of Benj. Lillard which was found to contain one-half of its bulk of dextrin. (*Ch. Ph.*, Sept., 1873.) Folleto recommends two reactions to detect pollen: one by adding to a syrupy solution of zinc chloride, potassium iodide and iodine to saturation; the pollen is colored yellow by this reagent, lycopodium is not colored; the other reagent is methyl-green, which colors pollen green, but does not color lycopodium. (*Ph. Centralh.*, 1896, 527.)

Uses.—Lycopodium is used as an absorbent application to *excoriated surfaces*, especially those which occur in the folds of the skin in infants. In pharmacy it answers the purpose of facilitating the rolling of the pilular mass, and of preventing the adhesion of the pills when formed. The moss itself has been esteemed diuretic and antispasmodic; its decoction has been employed in *rheumatism, diseases of the lungs and kidneys*, and in the removal of *plica Polonica*, but it has fallen into complete desuetude. One of the ingenious uses for lycopodium in microscopy is to mix a little of it with an unknown powder or on a slide on which a mount is made. The spores are easily recognizable and distinguishable from other elements and give an excellent idea of the approximate size of the elements which are being observed, as the spores are almost uniformly 40 microns in size.

Lycopodium Saururus Lain. *Piligan*.—In this Brazilian lycopod Adrian has found an actively poisonous alkaloid, piliganine. (*C. R. A. S.*, June, 1886; see also *B. G. T.*, cxi, 174.)

Lycopus. U. S. 1870. *Lycopus virginicus* L. *Lycope de Virginie*, Fr. *Virginischer Wolfsfuss*, G.—The *bugle-weed* is a labiate which grows throughout the greater part of the Eastern United States. The whole herb is used. Jos. L. Weil found 0.41 per cent. of fat melting at 50° C. (122° F.), 0.68 per cent. of a granular wax melting at 70° C. (158° F.), 0.43 per cent. of a cryatallizable resin soluble in ether, a crystallizable glucoside, and a small quantity of gallic acid and tannin. (*A. J. P.*, 1890, 72.) It has a peculiar odor and a nauseous slightly bitter taste, which it imparts to boiling water.

Lycopus europoeus L., a native of Europe, growing in waste places from Massachusetts to Virginia, is said to be frequently collected and sold for *L. virginicus*. The former may be distinguished by its acutely quadrangular stem, its Farrow lanceolate leaves, of which the lower are somewhat pinnatifid, its more crowded flowers, and the acute segments of its calyx, armed with short spines. It has been

employed in Europe as a substitute for quinine.

According to A. W. Ives, the bugle-weed is a mild narcotic and an astringent, useful in pulmonic and other *hemorrhages*. Dose of decoction (one ounce to one pint of boiling water), from one to four fluidounces (30-120 mils).

Lycoris. *Lycoris radiata* Herb. (Fam. *Amaryllidaceae*.)—According to Morishima (*A. E. P. P.*, 40), this plant -contains two alkaloids, *lycorine*, $C_{32}H_{32}N_2O_9$, which occurs in large colorless poly-hedric crystals, and is physiologically very active, resembling emetine in its action, and *sekisa-nine*, $C_{34}H_{34}N_2O_9$, which occurs in colorless, anhydrous columns and is quite inactive physiologically.

Lythrum. *L. Salicaria* L. *Spiked Loosestrife*. *Purple Willow-herb*. *Salicaire*, Fr. *Rother Weiderich*, G.—This is an elegant perennial plant of the fam. *Lythraceae*, a native of Europe, but naturalized from Quebec to Delaware. The dried herb is inodorous, and has an herbaceous, somewhat astringent taste. It has been used as a demulcent astringent in diarrhea and chronic dysentery. The dose of the powdered herb is about a drachm two or three times a day. A decoction of the root, prepared by boiling an ounce in a pint of water, may be given in the dose of two fluidounces (60 mils).

The Dispensatory of the United States of America Twentieth Edition (1918)

Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Mace. *Macis.* *N. F. IV.*—"The arillode of the seed of *Myristica fragrans* Houttuyn (Fam. *Myristicaceae*)." *N. F. IV.* Mace was official in the U. S. Pharmacopoeia 1890, but was omitted in subsequent editions. It has very properly been admitted to the National Formulary IV. It is described as follows: "In narrow bands, 25 mm. or more in length, somewhat branched and lobed above, united into broader bands; yellowish to brownish-orange, and oily. Odor fragrant; taste warm and aromatic.

"The powder is orange-buff to orange-brown. Mounted in water and examined microscopically, the powder exhibits elongated epidermal cells; parenchyma containing very small amyloextrin granules, which are colored red-brown by iodine T.S.; large oil cells the contents of which are not greatly changed in color on the addition of alkali.

"Powdered false Mace or Bombay Mace is yellow-brown to deep-brown in color and deficient in odor and taste. When mounted in water and examined microscopically it exhibits flattened, thick-walled epidermal cells and oil cells much more numerous than in true Mace and containing an orange-red resinous substance which is dissolved by alkalies forming a blood-red liquid.

"Moisten Mace with hydrochloric acid; no greenish color is produced (difference from and absence of the *arillode of Myristica malabarica* Lamarck or *Bombay Mace*).

"Add potassium chromate T.S. to an alcoholic extract of Mace (1 in 10); the precipitate formed is yellow and does not change to red on standing, nor does the solution develop a red coloration (difference from and absence of *Bombay Mace*).

"Saturate a piece of filter paper with an alcoholic tincture of Mace (1 in 10), and add one drop of potassium hydroxide T.S.; no blood-red coloration is produced (difference from and absence of *Bombay Mace*).

"Mace yields not less than 8 per cent. of volatile ether extract, and not less than 20 per cent. nor more than 30 per cent. of non-volatile ether extract.

"Mace yields not more than 3 per cent. of ash which is almost completely soluble in hydrochloric acid-" *N. F. IV.* Mace is inferior when it is brittle, less than usually

divided, whitish or pale yellow, or with little taste and odor. The presence of starch granules or other microscopic particles different from those spoken of in powdered mace is proof of adulteration. Mace contains from 7 to 9 per cent. of a volatile oil, the greater portion of which consists of *pinene*, along with which is some *myristicin*, $C_{12}H_{14}O_3$. Wallach separated two odorous fixed oils; one yellow, soluble in ether, insoluble in boiling alcohol; the other red, soluble in alcohol and ether in every proportion.

Mackay Bean.—This is the seed of *Entadascandens* Benth. (Fam. *Leguminosae*), of Queensland, which has the reputation in the colony of being strongly poisonous, and in which John Moss found saponin. (*P. J.*, vol. xviii, 242.)

Magnolia. U. S. 1880. *Magnolia Bark.*—Three species of *magnolia*, were formerly official as follows: *Magnoliavirginiana* L., *Small or LaurelMagnolia*, *M. acuminata* L. or *Cucumber-tree*, and *M. tripetala* L., commonly known as *Umbrella-tree* (Fam. *Magnoliaceae*). In the latter Wallace Procter found in the fruit a neutral crystalline principle, *magnolin*. When pure, this is without odor and has at first little taste, in consequence of its insolubility in the liquids of the mouth, but after a time produces an irritant effect on the fauces. It is nearly insoluble in cold, but slightly soluble in hot water, very soluble in alcohol or ether. Procter considered it analogous to the liriodendrin obtained by Emmet, but quite distinct. It has been also found in other species. (See *A. J. P.*, 1872, 145; also Lloyd's paper in *Ph. Rund.*, 1866, 224.) W. F. Rawlins (*A. J. P.*, 1889, 7) obtained from the leaves of *M. glauca* a small quantity of a volatile oil of bright green color, with an odor resembling fennel or anise, but more pleasant. From the ethereal solution of this oil small crystals deposited. Indications were also obtained of a bitter glucosidal principle.

The bark and fruit of all the species of *Magnolia* are possessed of similar medicinal properties; but the bark only was official, and that of the root has been thought to be most efficient. "The bark from young wood is quilled or curved, thin, externally orange-brown and glossy, or light gray, with scattered warts and somewhat fissured, internally whitish or pale brownish and smooth; fracture short, in the inner layer somewhat fibrous; inodorous; taste somewhat astringent, pungent, and bitter. The bark of old wood, deprived of the cork, is whitish or brownish, fibrous, and less pungent." U. S., 1880. The aromatic property, which resides in a volatile principle, is diminished by desiccation, and entirely lost when the bark is long kept. The bitterness, however, remains. The bark is destitute of astringency.

Magnolia is a gently stimulant aromatic tonic and diaphoretic. It has been used in *malaria* and in *rheumatism*. The dose of the recently dried bark in powder is from half a drachm to a drachm (2.0-3.9 Gm.), frequently repeated.

Malambo or Matias Bark.—A bark received from South America by Alex. Ure, under the name of *matias bark*, was found to have the characters of the *malambo bark*, which is held in high esteem in Colombia, where it is produced. According to H. Karsten, it is derived from a hitherto undescribed species of *Croton*, which he names *Croton Malambo* Karst. (Fam. *Euphorbiaceae*). (See *Florae Colombiae Terrarumque*

adjacentium Specimina Selecta.) This is a small tree or shrub, growing on the coast of Venezuela and Colombia. (*P. J.*, 1859, 321.) It has an aromatic odor and a bitter, pungent taste, and yields these properties to water and alcohol. Its active ingredients appear to be a volatile oil and a bitter extractive matter. According to Mackay, it has been used successfully in intermittents, convalescence from continued fevers, hemicrania, dyspepsia, and other cases in which tonic remedies are useful, and also as an adjuvant to diuretics. It is probably nothing more than an aromatic tonic. Ure has administered it with good effect as a substitute for Peruvian bark. (*P. J.*, iii, 169.)

Under the name of *Winter's bark*, a considerable quantity of malambo bark was at one time imported into the United States from South America.

Mallow Leaves. *N. F. IV. Malvae Folia. Malva sylvestris L. Common Mallow. Flores Malvae Folia Malvae, P. G. High Mallow. Cheese Cake Flower or Pancake Plant.*—It is described by the *N. F.* as the "the dried leaves of *Malvasylvestris* Linne and of *Malva rotundifolia* Linne (Fam. *Malvaceae*). Reject leaves showing brown fungous growths of *Puccinia Malvacearum* Montagne." *N. F.* This is a perennial, herbaceous, European plant of the Fam. *Malvaceae*. Almost all the species of the genus are possessed of the same properties. *M. rotundifolia*, L., known as *cheeses*, one of the most common, as well as *M. sylvestris*, are both used in medicine. The leaves often show a fungus growth." Leaves of *Malvasylvestris*, petiolate with petioles up to 10 cm. in length, orbicular or reniform, slightly truncate or cordate at the base, from 10 to 11 cm. in length, and from 15 to 20 cm. in width, with three to seven shallow, angular or rounded lobes, venation palmate, margins crenate-dentate, pubescent on both sides. Leaves of *Malvarotundifolia*, with petioles up to 20 cm. in length, orbicular up to 8 cm. in width, base deeply cordate, five to seven shallow rounded lobes, venation palmate, margins with rounded blunt teeth, pubescence more scant than in *M. sylvestris*. Intermixed with the leaves are frequently found dark purple flowers and glabrous reticulated carpels (*M. sylvestris*) or pale bluish flowers and pubescent rounded carpels (*M. rotundifolia*). Inodorous; on chewing it becomes very mucilaginous, taste bland. When examined under the microscope, sections show an epidermis containing mucilage cells; numerous stomata, on both surfaces, each with three or four neighboring cells; trichomes of three distinct types, small, short-stalked glandular hairs, single, large, one-celled curved hairs with thick walls and compound or stellate hairs in groups of two- to six-cells (the latter especially numerous in *M. sylvestris*); palisade tissue of one or two rows of cells, the mesophyll of three or four rows; the parenchyma containing calcium oxalate in rosette crystals and numerous mucilage cells which are distributed in the tissue of the veins; veins with collateral bundles. The powder is light green and, when examined under the microscope, exhibits the characteristic hairs, mucilage cells, epidermis with stomata, and rosette crystals of calcium oxalate. Mallow Leaves yield not more than 16 per cent. of ash." *N. F.* The herb and flowers have a weak, herbaceous, slimy taste, without odor. They abound in mucilage, which they readily impart to water, and the solution is precipitated by lead acetate. The infusion and tincture of the flowers are blue, and have been used as indicators, being reddened by the acids and rendered green by alkalis. The roots and seeds also are mucilaginous. Common mallow is emollient and demulcent. The infusion and decoction are sometimes employed in *catarrh*, *dysentery*, and *nephritis*

complaints, and are applicable to all other cases which call for the use of mucilaginous liquids.

Malouetia. *Malouetianitida* Spruce. *Gauchamaca*. (Fam. *Apocynaceae*.)—This plant, of Venezuela, contains an alkaloid, *guachamacine*, which Kobert believes to be identical with *curarine*. (*A. J. P.*, 1885, 560.)

Manaca. *VegetableMercury*.—This is a portion of the root and stem of *Brumfelsia Hopeana* Benth. (*Franciscea uniflora* PohL), a Brazilian plant belonging to the Fam. *Solanaceae*. It occurs in pieces from a few inches to one foot in length, and about one-half inch in diameter, very tough and woody, with a yellowish center and a dark, very thin outer bark. The stem portion has a very small yellowish pith. H. B. Parsons (*Am. Chem. J.*, vol. i, No. 6) came to the conclusion that it contains no alkaloid, but E. Lenardson (*In. Dis.*, Dorpat, 1884) asserts that he has found in it an alkaloid, *manacine*, besides a peculiar fluorescent substance supposed to be identical with *gelseminic acid*. Some investigators report failure to find any alkaloidal principles. E. P. Bruer (T. Q., 1882), as the result of experiments made upon the lower animals arrived at the conclusion that manaca acts upon the spinal cord, first stimulating, and then abolishing, the activity of the motor centers, the action being shared in by the respiratory centers. All the glands, especially the kidneys, were stimulated by it. In large doses he found it to produce in man lassitude, perspiration, and loose, greenish alvine discharges. Manaca has been very strongly recommended in the treatment of chronic or subacute *rheumatism* and *syphilis*. The dose of the fluidextract is from ten to thirty minims (0.6-1.8 mils) three times a day.

Mandragora. *Mandragora autumnalis* Bertol. *Mandrake*. *Mandragora*. (Fam. *Solanaceae*.)—A perennial, European plant, with spindle-shaped root, which is often forked beneath, and is therefore compared, in shape, to the human figure. In former times this root was supposed to possess magical virtues, especially when collected at certain times, and was used as an amulet to promote fecundity, etc., and the superstition is still cherished in some parts of Europe. The plant is a poisonous narcotic, somewhat similar in its properties to belladonna, to which it is botanically allied. See a paper by Ekert for the history of this drug. (*S. W. P.*, 1913, 425.) Crouzel isolated an alkaloid, *mandragorine*, which he found similar in properties to atropine. (*P. J.*, 1885, 1067.) It has since been more thoroughly studied by F. B. Ahrens. (*Ber. d. Chem. Ges.*, 1889, 2159-2161.) Mandragorine is colorless, inodorous, deliquescent, melts at from 77° to 79° C. (170.6°-174.2° F.), and has the formula $C_{17}H_{23}NO_3$. It seems to be iso-meric with atropine, but is not converted into it by alkalis. The sulphate and the hydrochloride are crystalline and deliquescent. A second alkaloid in much smaller amount was also extracted, of which the gold and platinum double chlorides were formed. Both alkaloids had a mydriatic action. It was much used by the ancients as a narcotic, and as an anesthetic agent before surgical operations. (*J. P. C.*; xv, 290.) Morion or death-ioine, said to have been administered previous to the torture, was made from it. Its physiological action has been partially investigated by B. W. Richardson. (*B. F. M. R.*, 1874, 242.)

Mangosteen.—The pericarp of the fruit of the *Garcinia Mangostana* L. (Fam.

Guttiferae). It is sometimes substituted for bael fruit (see *Belae Fructus*, Br., Part I). It is an active astringent, and has been used as such locally in various catarrhs, and also in *diarrhea* and in *leucorrhoea*. Ambrose has used the toasted and pulverized rind of *mangosteen* in the treatment of tropical *dysentery* with asserted benefit. He gives doses of one drachm (4 Gm.) every two hours. The activity of the drug appears to reside in the neutral principle mangostin. Dose, of fluidextract, from half to one fluidrachm (1.8-3.75 mils).

MANNA. U. S.

MANNA

"The dried saccharine exudation of *Fraxinus Ornus* Linne (Fam. *Oleaceae*)." U. S.

Manne, *Fr. Cod.*; Manna, *P. G., It.*; Mana, *Sp.*

Manna is said to be obtained from several other trees besides *Fraxinus Ornus*, among which *F. rotundifolia*, *F. excelsior*, and *F. parviflora* have been particularly designated. Many saccharine substances, generally exudations from plants, have, from their resemblance to this substance, obtained the name of manna, and attracted more or less attention from writers. The term " manna " has been applied to certain substances which have no relation to true manna, notably to the lichen *Lecanora esculenta*, which at times has suddenly fallen like rain over immense tracts of country, from Persia to the African Sahara. It occurs in the form of small roundish lumps, from the size of a pin's head to that of a pea, yellowish or grayish externally and whitish within, hard, inodorous, and insipid. It has been affirmed that this lichen does not contain starch, but it is really used as an article of food, and good bread is said to have been made out of it. (*Nature*, Jan., 1891.) It is probable that it is the manna of Scripture.

The proper false mannas, exudations from various trees, are best considered under the headings of the countries which yield them:

European False Manna, or *Briancon Manna*, an exudation from the common European larch (*Larix europaea*, or *Pinus Larix*), differs chemically from ordinary manna in containing no mannite. Berthelot found in it a peculiar sugar, which he named *melezitose*. (See *A. J. P.*, 1859, p. 61.) To this the formula $C_{18}H_{32}O_{16}+2H_2O$ is given showing that

it belongs to the class of the saccharides.

American False Manna.—A substance resembling manna, of a sweet, slightly bitter and terebinthinate taste, and actively purgative, exudes from incisions in *Pinus lambertiana*, of Oregon, and was used by the natives. Berthelot has extracted from this product a peculiar saccharine principle, which he calls *pinite*. It is very sweet, but does not undergo the vinous fermentation. (See *A. J. P.*, xxviii, 157.) Pinite was for a long time classed among the sugars, but the latest researches seem to show that it is a hexahydric phenol derived from hexahydro-benzene. The formula is $C_{17}H_{14}O_6$, and it is a methyl derivative of inosite.

California Manna, or Father Picolo's Manna. —Proust (*Ann. d. Chim.*, 1806, 145) alludes to a manna mentioned by Father Picolo as being deposited on a species of grass in California. J. U. Lloyd (*A. J. P.*, 1897, 337) believes Picolo's manna to be a saccharine deposit, caused by aphides on *Phragmites communis*. It is apparently still collected by the Indians.

African False Mannas.—*Turkish Manna* is a sweet product obtained from *Echinops persica* Fisch., and is obtained by treating the cocoons of a coleopterous insect (*Larinus maculatus*) with hot water, filtering and crystallizing the sugar. From it Berthelot obtained a new variety of sugar, *trehalose*, $C_{12}H_{22}O_{11}+2H_2O$. (*Gaz. Med. de Paris*, 1857.) *Pinus Cedrus*, of Mount Lebanon, yields a similar product, which has some repute in Syria as a remedy in *phthisis*. (*P. J.*, xiii, 411.) In the neighborhood of Diar-bekir, in Asiatic Turkey, a saccharine substance, known as *Diarbekir manna*, is found on the leaves of dwarf oaks, from which it appears to be exuded. (*P. J.*, Nov., 1862, p. 546.) The manna of the oak of Kurdistan, spoken of by Fliickiger, is probably the same as that of Diarbekir, which may be its entrepot. According to Fliickiger, this consists chiefly (90 per cent.) of a crystallizable sugar. It deviates to the right the plane of polarized light, and reduces in the cold the solution of copper oxide in soda and glycerin. This manna contains a mucilage, but no cane sugar or dextrin. (*J. P. C.*, April, 1873, p. 335.) *Quercus Vallonea* Kotschy, and *Q. persica* Jaub. et Spach, yield "oak manna," through insect agency, while certain species of *Echinops* (probably *E. persica* Fisch.) yield the singular manna-like substance that is known as *Trehala* in Syria, and as *Shukkar Tigal* in India. *Pyrus glabra* yields a manna which is collected by the people of Luristan, in Persia. It has long been known that *Salix fragilis* and probably other species of

willow yield to the Persians a manna-like exudation. According to Raby (*L'Union Pharm.*, May, 1889), there are two varieties, *chirkhest* and *bidenguebin*, which contain respectively, according to the analysis of Ludwig, *chirkhestite* (C₆H₁₄O₆), allied to sorbite, and *bidenguebinose* (C₁₂H₂₂O₁₁), allied to melezitose. "Whether these mannas are really distinct from those sold in the Indian bazaars as coming from Afghanistan and Persia seems uncertain. Of these bazaar mannas the most important is the *Shirkoit* or *Oriental manna*. By Haussknecht it is referred to *Atraphaxis spinosa*; but J. E. T. Atchison states that it is yielded by the *Cotoneaster nummularia* Fisch. et Mey., a tall, stout shrub, whose smaller branches in July become covered with an exudation, which is eaten as a sweetmeat, and exported in quantity to Russia and India. The second variety, *Taranjabin*, is yielded by the camelthorn, *Alhagi Camelorum* Fisch., in Persia and Afghanistan, and probably by *Alhagi Maurorum* of De Candolle, a leguminous thorny shrub abundant in India—if indeed the two species be distinct. According to A. Villiers, it* is nearly pure melezitose. (*P. J.*, 1876, 3d ser., vii, 917.) Another kind of manna is *Gazangabin*, or *Gazanjabin*, yielded by *Tamarix gallica* Linn., var. *mannifera*; a fourth kind is obtained from the *Salsola faetida* DC. (*P. J.*, Dec. 11, 1886, 467.) The *tamarisk* of Northern Africa (*Tamarix gallica* Ehr.), which produces the small *tamarisk galls* of Mogador, containing 40 per cent. of tannic acid (*A. J. P.*, 1878, p. 27; also *N. R.*, 1877, p. 41), according to Burckhardt also gives origin to a species of manna that is used by the Bedouin Arabs near Mount Sinai with their food. This substance, however, according to Mitscherlich, contains no mannite, but consists wholly of mucilaginous sugar. Berthelot found a manna from Sinai to consist of 55 per cent. of cane sugar, 25 of levulose and glucose, and 20 of dextrin and analogous substances. (*Ann. Ch. Phys.*, Ixvii.)

Persian Manna, or *Gez*, has been identified (*C. D.*, 1894, 790) as being derived from *Astragalus anisacanthus*, and is found in the districts of Khonsar, Feridan and Chahar Mahal, and Ispahan. In the form of sweetmeat, having the appearance of flour, it is sent all over Persia and much esteemed.

Australian Mannas.—A manna-like exudation on the *Eucalyptus viminalis* Labill., growing in New South Wales, contains a saccharine matter called *melitose*, different in properties from mannite and from all the varieties of sugar, though isomeric with glucose. It is susceptible of the vinous fermentation. (See *A. J. P.*, xxviii, 157.) Lerp is produced

upon the leaves of *Eucalyptus dumosa*, when very small, and sometimes appears spread over large extents of country like a kind of snow. The natives use it for food. It is a complex body, containing an unfermentable sugar, *eucalin*, gum, starch, inulin, and lignin. (*J. P. C.*, xvi, 240.) It is said to be a secretion from an insect, formed into minute cells, each of which is the abode of one of the insects. (See *A. J. P.*, 1862, p. 547.) *Myoporum platycarpum* R. Br., the *sandalwood* or *dogwood-tree* of Australia, exudes an exceedingly sweet and pleasant manna, which is much used as an article of food. The product is identical with the official manna, containing nearly 90 per cent. of mannite. F. W. Passmore obtained from *Eucalyptus Gunnii* Hook., a sugar termed *melitriose*. (*P. J.*, 1891, 718.)

New South Wales Manna.—According to R. T. Baker (*Journ. and Proc. Boy. Soc. New South Wales*, xxx, 1897), this manna is produced in the form of nodules at the nodes of the stems of the blue grass *Andropogon annulatus*. It contains numerous crystals of mannite, amounting, according to the analysis of H. G. Smith, to 50 per cent.

Fraxinus Ornus, or the *European flowering ash* is a tree of moderate height, usually from twenty to twenty-five feet, very branching, with opposite, petiolate, pinnate leaves, composed of three, or four pairs of leaflets, and an odd one at the end. The leaflets are oval, acuminate, obtusely serrate, about an inch and a half in length, smooth, of a bright green color, and supported on short footstalks. The flowers are white, and usually expand with the leaves. They grow in close panicles at the extremities of the young branches, and have a very short calyx with four teeth, and four linear-lanceolate petals.

Fraxinus Ornus is native of Sicily, Calabria, and Apulia, and is cultivated in Sicily. It yields manna after the eighth year, and continues to yield it for ten or twelve years, when it is usually cut down and young sprouts are allowed to grow up from the root. (Stettner, *A. Pharm.*, liii, 194.) During the hot months the juice exudes spontaneously from the bark, and concretes upon its surface, but, as the exudation is slow, it is customary to facilitate the process by making deep longitudinal incisions on one side of the trunk. In the following season these are repeated on the other side, and thus alternately for the whole period during which the tree yields manna, extending sometimes, it is said, to thirty or even forty years. Straw or chips are frequently placed so as to receive the juice, which concretes upon them. The manna varies

in its character according to the mode of collection, the nature of the season, and the period of the year at which the exudation takes place. That procured in Sicily is said to be the best. Daniel Hanbury travelled through the old manna region, and satisfied himself that the collection of manna for commercial purposes is confined almost exclusively to Sicily. (*P. J.*, Nov., 1872, 421.) For information on manna collection in Sicily, see notes by J. S. Ward. (*P. J.*, 1893, 381;) For an interesting description of California mannas by J. U. Lloyd, particularly *Piccolo's manna*, see *A. J. P.*, 1897, 329.

In commerce three varieties are distinguishable :

1. FLAKE MANNA, or *manna canulata* (cannellata), is the purest variety, and is chiefly obtained from Palermo. It exudes spontaneously, or from incisions, during the hottest and dry-est weather in July and August. According to Stettner, it is furnished by the upper incisions upon the trunk, while the lower incisions yield the inferior varieties. It is in irregular, unequal pieces, often several inches' long, resembling stalactites, rough, light, porous, brittle, whitish or yellowish-white, and frequently concave on the surface by which they were attached to the trunk, and which is often soiled by impurities, sometimes by adherent fragments of the bark. When broken, these pieces exhibit a crystalline or granular structure. This variety is sometimes in small fragments, generally less than an inch in length.

2. COMMON MANNA—*manna communis*, or the *manne en sorte* of French pharmacy—is next in quality, and is collected in Sicily in September and the beginning of October, when the heat of the weather has begun to moderate. The juice does not now concrete so readily, and a portion, falling on the ground at the root of the tree, becomes more or less mixed with impurities, and forms imperfectly solid masses, which require to be further dried in the sun. Common manna consists of whitish or yellowish fragments, similar to the pieces of flake manna, but much smaller, mixed with a soft, viscid, uncrystallized brownish matter, identical with fat manna.

3. FAT MANNA, or *Manna (pinguis) sordida*, is collected in the latter part of October and November, when the weather is cooler and rains are more common. The juice is now still less disposed to concrete, and flowing down the trunk is received in a small excavation at its base. As found in commerce, it is in the form of a soft, viscous mass, containing

few crystalline fragments, of a brown or yellowish-brown color, and full of impurities. The U. S. Pharmacopoeia directs that such manna should be rejected.

Fictitious Manna.—Attempts have been made to counterfeit manna, but the facility of detection renders such frauds unprofitable, and they are not often practised. R. P. Thomas described (*A.J.P.*, xxiv) a sophisticated manna which differed from the genuine drug both in sensible and in chemical properties, not even containing mannite. Baume describes a method in which common manna is purified so as to resemble flake manna. It consists in dissolving common manna in a little water, allowing the liquid to settle, decanting it in order to separate the impurities, then inspissating it so that it will congeal on cooling, and immersing threads in the inspissated liquid, several times successively, in the manner practised by candle makers. It may be still further purified by the use of animal charcoal. Thus prepared, it contains less mannite than flake manna, and less of the nauseous principle, but is said not to operate less effectively as a laxative. A fictitious manna is described by Edmond Histed (*P. J.*, April, 1870) as having been taken from Paris to London, which bears a close resemblance to flake manna, for which it might be mistaken upon a hasty notice. The resemblance was, moreover, increased by the fact that it contains man-nite, of which Histed obtained 40 per cent., while fine natural flake manna yielded him 70 per cent. Closely examined, it is found to differ essentially from genuine flake manna, showing no crystals of mannite when broken, not having the taste and smell characteristic of good manna, and, besides, being cleaner, lighter-colored, more solid, and making a clearer solution in water. (See *A. J. P.*, 1870.) This may have been a specimen of artificial flake manna, prepared from the inferior or common manna.

Properties.—Manna is officially described as « ^ irregular, more or less elongated, flattened, 3-sided pieces; externally yellowish-white; friable, somewhat waxy; internally nearly white, porous and crystalline in appearance; odor slight, but characteristic; taste sweet, slightly Bitter and faintly acrid. Manna also occurs in irregular masses, consisting in part of brittle or soft, resin-like fragments; from yellowish-white to yellowish-gray in color. The quantity of the yellowish-white fragments must not be less than 40 per cent. of the whole. Add 5 Gm. of Manna. to 100 mils of alcohol, heat to boiling and filter; on cooling, the filtrate rapidly deposits crystals of mannite." U. S.

Manna has a slight, peculiar odor, and a sweet taste, which in the impure kinds is also very nauseous, but in the finest flake manna scarcely so much so as to be disagreeable. Its sp. gr. is 0.834. It melts with heat, and takes fire, burning with a blue flame. When pure it is soluble in three parts of cold and in its own weight of boiling water. From a boiling saturated aqueous solution it separates in partially crystalline masses on cooling. Alcohol also dissolves it. Boiling alcohol will dissolve 15 parts of manna, and upon cooling deposit beautiful crystals of mannite.

Ebert (*Zeit. Oest. Apoth. Ver.*, xlvii, p. 427) has contributed a very able paper, containing citations of all the literature up to 1908, regarding the origin and pharmacognosy of the different varieties of manna. Probably the most comprehensive monograph on the ash manna is that of Tschirch in his large work entitled "*Handbuch der Pharmakognosie.*" Band II, p. 103.

Fourcroy and Vauquelin found manna to consist of (1) a peculiar sweet principle, *mannite*, which constitutes 75 per cent.; (2) a variety of sugar; (3) a yellow nauseous matter, upon which the purgative property is thought chiefly to depend; and (4) a little mucilage. Leuchtweiss obtained from 105 parts of manna, 11.6 of water, 0.4 of insoluble matter, 9.1 of sugar, 42.6 of mannite, 40.0 of a mixture of mucilaginous matter containing mannite, resin, organic acid, and a nitrogenous substance, and 1.3 of ashes. In *manna canellata in fragmentis* he found 37.6 per cent. of mannite, and in *manna Calabrina* 32 per cent. (*Pflanzenstoffe*, 2d ed., p. 180.) Buignet discovered in manna a considerable proportion of dextrin. He appears to have been led to this discovery by observing a very energetic dextrogyrate power in flake manna, which could not be owing to the saccharine matter it contained, because the same power continued after all the sugar had been destroyed by fermentation. Dextrin forms about one-fifth part of flake manna, and a much larger part of the inferior kinds. Tanret (*Bul. Soc. Ch.*, 1902, p. 947) finds manna to contain several new carbohydrates and reports the composition as follows: mannitol, 40 to 55 per cent.; levulose, 2.5 to 3.4 per cent.; dextrose, 2.2 to 3.0 per cent.; manneotetrose ($C_{24}H_{42}O_{21} + 4H_2O$), 12 to 16 per cent.; manneotriose ($C_{18}H_{32}O_{16}$), 6 to 16 per cent., with small amounts of resin and ash.

Fluckiger found in all samples of mannite examined a small amount of a dextrogyrate mucilage, which is precipitated by neutral lead acetate,

and yields mucic acid when boiled with strong nitric acid. The greenish color of certain pieces of manna is produced by *fraxin*, $C_{16}H_{18}O_{10}$, a glucoside closely resembling *aesculin*. Fraxin crystallizes in colorless prisms, easily soluble in hot water and in alcohol, and has a faintly astringent and bitter taste. By diluted acids it is resolved into *fraxetin*, $C_{10}H_8O_5$, and *glucose*, $C_6H_{12}O_6$. Even its diluted solutions are fluorescent. (*Pharmacographia*, 2d ed.)

Mannite (*mannitol*) is white, inodorous, crystallizable in semi-transparent needles, of a sweetish taste, soluble in five parts of cold water, scarcely soluble in cold alcohol, but readily dissolved by that liquid when hot, and deposited when it cools. Its composition is $C_6H_{14}O_6$, and it is considered as belonging to the class of *hexatomic alcohols*. If mixed with chalk and cream-cheese and kept for some weeks at the temperature of $40^{\circ} C.$ ($104^{\circ} F.$), it yields alcohol largely, with the disengagement of carbonic acid and hydrogen and the production of lactic acid. No fungus is produced, as in the ordinary fermentation of sugar. (Berthelot, *J. P. C.*, xxx.) With lime, barium and strontium oxides, it forms definite compounds, soluble in water, and precipitable from their aqueous solutions by alcohol. (*Ibid.*, Jan., 1860.) It does not reduce an alkaline solution of copper oxide; and a test of its purity is thus presented. (*A. J. P.*, Jan., 1861, p. 26.) It is optically inactive except after the addition of borax. It is then found to be dextrorotatory. Emil Fischer has shown that there are three mannites obtainable; the ordinary mannite is the dextrorotatory variety, and is always obtained in the reduction of α -mannose with sodium amalgam; a levorotatory variety is obtained! by the reduction of *l*-mannose; and an inactive mannite is obtained from the inactive mannose. These three physical isomers differ slightly in their fusing points and crystalline form. The native variety may be obtained by boiling manna in alcohol, allowing the solution to cool, and redissolving the crystalline precipitate; pure mannite is now deposited. Another method is to dissolve flake manna in water, precipitate by solution of lead subacetate, filter, throw down the excess of lead by sulphuric acid, evaporate the solution, and mix with alcohol. On cooling", the mannite is deposited. (Bonsall, *A. Pharm.*, cxxxiv, 70.) This principle has been found in numerous vegetables. It is said to be gently laxative in the dose of from one to two ounces (31-62 Gm.).

Manna, when long kept, acquires a deeper color, softens, and ultimately

deliquesces into a liquid, which on the addition of yeast, undergoes the vinous fermentation. This is probably owing to its conversion into sugar by the absorption of enough oxygen to cause it to pass over into some variety of glucose or fermentable sugar. That which is driest resists this change the longest. It is said that manna recently gathered is less purgative than it afterwards becomes.

Uses.—Manna is a gentle laxative, usually operating mildly, but in some cases producing flatulence and pain. It is usually prescribed with other purgatives, particularly senna, rhubarb, magnesia, and the neutral salts, the taste of which it conceals, while it adds to the purgative effect. It is usually given dissolved in water or some aromatic infusion; but the best flake manna may be administered in substance. Manna forms a combination with iron, which it preserves against oxidation. (See *P. J.*, March, 1873.) Under the name of *dulcinol* a mixture of mannite and common salt has been recommended by Sternberg (*D. M. W.*, 1906, p. 1707) as a sweetening agent in *diabetes*.

Dose, half to one ounce (15.5-31 Gm.).

Off. Prep.—*Infusum Sennae Compositum*, *U. S.*; *Syrupus Mannae*, *N. F.*

Manzanillo. *Manchineel. Hippomane Mancinella* L.—According to A. Betancourt, the milky juice of this euphorbiaceous tree, growing in the West Indies, is a violent irritant, acting as a vesicant when applied to the skin, and when taken internally in doses of twenty drops causing a fatal gastro-enteritis. In doses of two drops it acts as a powerful and very certain cathartic; it is also diuretic. In Cuba it has much repute in tetanus. (*L.M.R.*, Feb., 1889.)

Maranta. *Arrowroot. Arrowroot Starch.* (Fam. *Marantaceae*.)—Under this name the *U. S. Pharmacopoeia*, 1870, recognized the fecula or starch obtained from the rhizome of *M. arundinacea*, L.

The arrowroot plant is a native of the West Indies, where it is largely cultivated for the sake of its fleshy, irregularly cylindrical rhizomes whose cells are gorged with starch granules. It is cultivated also in the East Indies, Ceylon, Sierra Leone, and south of Africa, and formerly in our Southern States, especially Georgia and Florida. The plant is easily propagated by cuttings of the root. An analysis by Macdonald (*J. Soc. Chem. Ind.*, 1887, 336) gives the following as the composition of the St. Vincent root: Starch, 27.07 per cent.; fiber, 2.82; fat, 0.26; albumen, 1.56; sugar, gum, etc., 4.10; ash, 1.23; water, 62.96; total, 100.00. An analysis of the arrowroot starch from the same locality by Macdonald gave: Starch, 83.70 per cent.; fiber, 0.04; fat, 0.07; sugar, gum, etc., 0.18; ash and sand, 0.14; water, 15.8.7; total, 100.00. The fecula is

prepared in the following manner. The rhizomes are dug up when a year old, washed, and then beaten into a pulp, which is thrown into water, and agitated so as to separate the amylaceous from the fibrous portion. The tissues are removed by the hand, and the starch remains suspended in the water, to which it gives a milky color. The milky fluid is strained through coarse linen, and allowed to stand that the starch may subside, which is then washed with a fresh portion of water, and afterwards dried in the sun.

The *Bermuda arrowroot* was formerly the most highly esteemed, but the production of it in the island has almost ceased. The Bermuda arrowroot of the American, and probably largely also of the English, markets, is of various sources, the name seemingly being applied to any superior product. For a list of other sources of arrowroot of commerce during different periods, see *U. S. D.*, 19th ed., p. 1561.

Attempts have been made to substitute finely prepared potato starch for arrowroot, and there is no doubt that, in nutritive properties it is quite equal, but patients complain of an unpleasant taste of the potato which it is likely to retain. Arrowroot is in the form of a light, white powder, or of small pulverulent masses, without odor or taste. It is firm to the touch when pressed between the fingers, and produces a faint creaking sound when rubbed. It is a pure starch, corresponding in chemical properties with that of wheat and the potato. It is liable to become musty, and should then be rejected. The odor and taste are the best criteria of its quality. It should be perfectly free from odor and unpleasant flavor.

The microscope offers the best means of distinguishing the different varieties of fecula sold as arrowroot, or used for its adulteration. The granules of *Maranta arrowroot* are rarely oblong, somewhat ovate-oblong, or irregularly convex, from 10 to 70 microns in diameter, with very fine lamellae, a circular hilum which is fissured in a linear or stellate manner. (Pereira.)

Arrowroot affords a light, very mild, and easily digested article of diet, well adapted for the sick and convalescent, and peculiarly suited, from its demulcent properties, to bowel complaints. It is prepared by dissolving it in hot water or hot milk, with either of which it forms a pearly, gelatinous solution, and, if in sufficient quantity, a jelly-like mass on cooling. A tablespoonful will communicate sufficient consistence to a pint of water. It should first be formed into a perfectly smooth paste with a little cold water or milk, and the boiling water then gradually added with brisk agitation. The preparation may be rendered more palatable by lemon juice and sugar, or by wine and spices.

Marrubium. *Hoarhound. Horehound. Herba Marrubii. Marrube Blanc, Fr. Cod. Andornkraut, Weisser Andorn, G. Marrubio, It., Sp.*— Under the title of *marrubium* the U. S. P. formerly recognized "The dried leaves and flowering tops of *Marrubium vulgare* Linne (Fam. *Labiatae*)." *U.S. VIII. Whitehoarhound* has a perennial, fibrous root, and numerous annual stems, which are quadrangular, erect, very downy, and from twelve to eighteen inches high. The leaves are about 2.5 cm. long, roundish-ovate, dentate or deeply serrate, obtuse, wrinkled, veined, downy above, hoary on the

under surface, and supported in pairs on strong foot-stalks. The flowers are white, and in crowded axillary woolly whorls. It contains a volatile oil, resin, tannin, lignin, and a bitter principle called marrubiin by Mein. This marrubiin is slightly soluble in cold water, crystallizes from alcohol in prismatic and from ether in tabular crystals, is not precipitated by tannin, and has a very bitter and somewhat acrid taste. The fusing point of the crystals is 160° C. (320° F.), according to Kromayer. Marrubiin was afterwards obtained by Harms (*A. Pharm.*, cxvi, 141), by Hertel (*A. J. P.*, June, 1890), and by Morrison (*A. J. P.*, July, 1890). It has also been studied by Matusow (*A. J. P.*, 1897, 201). He gives to it the formula $C_{30}H_{43}O_6$, and states the melting point of the purified substance to be from 154° to 155° C. (309.2°-311° F.). According to him, it is not a glucoside.

Hoarhound is tonic, and in large doses laxative. It was formerly considered a valuable deobstruent, and was recommended in *chronic hepatitis*, and various *cachectic affections*, but it exerts no specific influence over any of them, and has passed mainly from the hands of physicians into domestic use, where it is used in the form of a confection for *sore throat*. It is employed occasionally in *bronchitis* with copious expectoration. The infusion, made in the proportion of an ounce of the herb to a pint of boiling water, may be given in wine-glassful doses. Geo. M. Beringer gives the following process for *Syrup of Hoarhound*: Hoarhound in No. 20 powder, 200 Gm.; sugar, 750 Gm.; glycerin, 125 mls; water, a sufficient quantity to make 1000 mls.

Mix the glycerin with 375 mls of water and moisten the drug thoroughly with sufficient of the mixture, then pack lightly in a percolator and add enough menstruum to saturate and leave a layer above the drug and macerate for twenty-four hours. Then percolate slowly, using the balance of the menstruum and then warm water till extracted. Reserve the first 500 mls of percolate and evaporate the remainder to 100 mls, then add the reserve and dissolve the sugar in the liquid, using a slight heat if necessary. When cold add sufficient water to make the preparation measure 1000 mls and strain. Syrup of hoarhound so made is clear, brown in color and possesses the characteristic bitter and aromatic taste of the drug and after keeping for more than six months has shown not the least tendency to change. (*Proc. N. J. Pharm. Assoc.*, 1909, 45-46.)

Dose, thirty grains to a drachm (2.0-3.9 Gm.).

Massoi Bark. *Lawang*.—In Eastern commerce certain aromatic barks occur under the name of massoi barks. Of these, three are believed by F. Hekmeyer to be the products respectively of *Cinnamomum xanthoneurum* Blume, *Cinnamomum Burmanni* Blume (*C. Kianis* Nees), and *Massoja aromatica* Becc. (*Sassafras goesianum* Teijsm. and Binn.), all of the Fam. *Lauraceae*. For a description of these barks, by E. M. Holmes, see *P. J.*, 1888, 465. The *massoi bark* which comes from New Guinea, and from which Messrs. Schimmel have distilled an oil resembling that of nutmeg and cloves, probably has a different origin from the true massoi bark which has a coconut-like odor. (*Y. B. P.*, 1912, 473.)

Mastic. *Mastiche*. *N. F. IV (U. S. VIII)*. *Mastich*. *Mastisc*. *Mastic*, Fr. *Resina Mastiche*,

G. *Almaciga, Mastic*, Sp. *Sakes*, Turk. *Arah*, Arab. —" A concrete resinous exudation from *Pistacia Lentiscus* Linne (Fam. *Anacardiaceae*)." *N. F. IV*. Mastic was deleted from the U. S. P. VIII because the official pill of aloes and mastic was dropped; the National Formulary IV has, however, admitted mastic and the pills containing it. The mastic tree, which is also called *lentisk* or *lentiscus*, is a shrub or small tree, seldom more than twelve feet in height, much branched towards the top, and furnished with petiolate, abruptly pinnate leaves. The flowers are dioecious, and very small. The tree is a native of the countries bordering upon the Mediterranean. The fruit yields by expression a fixed oil, of a deep green color, and liquid at about 32.3° C. (90° F.), which the Arabs of North Africa use both as an article of diet and for light. A resinous exudation from the stem and branches is the official part, but it does not appear to be collected in all places where the tree flourishes. Under the name of *Bombay mastic* there occur in India masses of oleoresin said to be derived from the *Pistacia Terebinthus*, having the general appearance of true mastic with a deeper color, but lacking fragrance, and dissolving in hot alcohol. For an account of the collection of mastic from *P. Terebinthus* growing in the island of Cyprus, see *C. D.*, 1897, 273.

Mastic is obtained chiefly from the island of Scio, or Chios, in the Grecian Archipelago, where the tree is cultivated for this product. Incisions are made in the trunk and principal branches, from which the juice slowly exudes, and either hardens in tears upon the bark, or drops on the ground, where it is received upon cloths or the bare earth, and concretes in irregular masses. The tears are most esteemed, and are the only form recognized by the N. F. They are of various sizes, oval or roundish, often compressed, smooth, semi-transparent, of a pale-yellow color, of a shining fracture, friable, and usually covered with a whitish powder, occasioned by their friction against each other. They are brittle, but become plastic when chewed. The masses consist of yellowish agglutinated tears, with others of a darker color and less translucent, and often fragments of wood, bark, or earthy matter intermingled.

The N. F. describes it as " in subglobular, lenticular, elongated or pear-shaped tears, about 3 mm. in diameter, pale yellow or greenish-yellow, transparent, having a glass-like lustre, the surface sometimes very slightly dusty; brittle, becoming plastic when chewed; odor slight, balsamic; taste mild, terebinthinate. Mastic is completely soluble in ether and almost completely soluble in alcohol. The acid number, determined as directed by the U. S. P. (Test No. 10, Part III), is not less than 65." *N. F. IV*.

According to J. Leon Soubeiran the valuable tears are produced by spontaneous exudation from the branches. But the greater part of the resin comes from longitudinal incisions in the stem, made with a knife, close together, and extending from the root to the branches. In fifteen or twenty days the resin has concreted, and is collected in little panniers of white paper or cotton cloth. (*Proc. A. Ph. A.*, 1897, 563.)

Mastic is nearly inodorous, unless rubbed or heated, when it becomes fragrant. Its taste is weak, but agreeably terebinthinate, and, after long chewing, very slightly acrid. It is at first friable 'undw the teeth, but soon becomes soft and ductile, and acquires a white, opaque appearance. Its sp. gr. is 1.074. It is fusible and inflammable by heat. Alcohol dissolves about 90 per cent. of it, leaving a viscid

substance which becomes brittle when dried, and for which the name of *masticin* or *betaresin of mastiche* has been proposed. This substance, though not dissolved by alcohol, softens and swells up in it, as gluten does in water. Hiasiwetz gives $C_{20}H_{31}O$ as the formula of the resin. The portion dissolved by the alcohol is called by Johnston *alpha resin of mastiche* or *mastichic acid* because of its acid properties, and has the formula $C_{20}H_{32}O_2$. (*Handwörterbuch der Chemie*, iv, p. 280.) Mastic is wholly soluble in ether, chloroform, and oil of turpentine, scarcely soluble in the fixed oils, and insoluble in water. It consists chiefly of resin, with *masticin*, and a volatile oil. Fluckiger, through Schimmel & Co., of Leipsic, ascertained that this volatile oil is present in mastic to the extent of 2 per cent. He found it to be a terpene of the composition $C_{10}H_{16}$. Schimmel & Co. (*Schim. Rep.*, April, 1897) state that mastic resin yields from 0.9 to 2.5 per cent. of a powerful balsamic essential oil of the same odor as the raw material, a sp. gr. of from 0.855 to 0.87 at 15° C. (59° F.), and an optical rotation (100-mm. tube) of from +22° to +27°. Tschirch and Reutter (*A. Pharm.*, 1904, 104) examined mastic carefully; they found approximately 42 per cent. of free resin acids. These are: the isomeric α - and β -masticinic acids, $C_{23}H_{36}O_4$, masticolic acid, $C_{23}H_{36}O_4$ (slight amount), amorphous α -masticonic acid, $C_{32}H_{48}O_4$ (20 per cent.), and β -masticonic acid, $C_{32}H_{48}O_4$ (18 per cent.). Besides this, mastic contains 30 per cent. α -masticoresin, $C_{35}H_{56}O_4$, soluble in alcohol; 20 per cent. of β -masticoresin (*masticin*), insoluble in alcohol, and 2 per cent. of an ethereal oil, possessing a pale yellow color and a somewhat camphoraceous odor. Finally, there is also a bitter principle, which could not be isolated in pure form. For a chemical investigation of Egyptian mastic by Eeutter, see *S. W. P.*, 1913, 537. Mastic is occasionally adulterated with olibanum, sandarach, and other resinous bodies, and, in seasons of scarcity, with sea salt.

Mastic was formerly thought to possess properties analogous to those of the turpentines, and was used in *debility of the stomach*, *hemoptysis from ulcerations*, *leucorrhœa*, *chronic diarrhœa*. etc., but its virtues were overrated, and it is at present scarcely ever given internally. In the East, however, an aqueous infusion is said to be still used in *cholera infantum*, and the Greek employ cataplasms made by mixing it with bread and red wine, which they apply to the lower abdomen. (Landerer.) It is sometimes employed temporarily to fill the cavities of carious teeth, for which purpose it is well fitted by its softness. In Turkey it is habitually chewed by the women, under the impression that it sweetens the breath and preserves the gums and teeth. Dissolved in alcohol or oil of turpentine, it forms a brilliant varnish. A solution made by macerating half an ounce of mastic and fifteen grains of caoutchouc in two fluidounces of chloroform, and filtering in closed vessels, forms a valuable varnish for microscopic work. The following mode of applying it to carious teeth has been recommended. Dissolve four parts of mastic in one of ether, in a bottle well stoppered. With the solution thus formed, which is yellow and of an oily consistence, saturate a small piece of cotton of the size of the carious cavity, and, having well cleansed and dried the cavity, introduce the cotton, without painful pressure, so as to fill it exactly. The resin attaches itself to the diseased surface of the tooth, which it protects from the air, and from the food taken into the mouth. Dose, thirty grains (2 Gm.). It has been highly recommended by various surgeons as a dressing for wounds. Its use is chiefly for the purpose of preventing bacteria upon the surrounding skin

getting into the wound. Voos (*M. M. W.*, 1911) paints the skin up to the edges of the wound without previous washing, with a solution of mastic in benzol and then cleanses the wound in the ordinary manner and applies an aseptic dressing. A special solution for this purpose is upon the market under the name of *mastisol*. Another formula for *mastic varnish* which has been used is 20 Gm. of mastic, 30 mils of chloroform, and 1 mil of linseed oil.

Matico. *N. F. IV (U. S. P. VIII). Matico Leaves. Feuilles de Matico*, Fr. Cod. *Maticoblatter*, G.—"The dried leaves of *Piper angustifolium* Ruiz et Pavon (Fam. *Piperaceae*), without the presence of more than 5 per cent. of stems, flower spikes, or other foreign matter." 2V. F. IV. The genus *Piper*, according to Engler and Pranti, includes nearly six hundred species, which are distributed throughout the tropics of the Old and New World, being particularly numerous in tropical America and of relatively less number in Africa.

Piper angustifolium is a shrub with a jointed stem about twelve feet in height. The plant is a native of Peru, where the fruit, under the name of *thoho-thoho*, is employed in the same manner as cubeb. This species is also found in other parts of South America. The commercial drug matico is furnished, according to G. Dethan and E. Bertault (*J. P. C.*, 1897, 537), by two varieties of *Piper angustifolium*—viz., *a-cordulatum* (*Artanthe elongata* Miq.), and *β-ossanum*, which differ somewhat in the shape of the leaves. The former has the leaves larger, shorter, and broader, with an oblique cordate base. The midrib of *a-cordulatum* is much less convex below than in the other variety. In 1864 Bentley (*P. J.*, Jan., 1864) described a *false matico* from Central America believed to be yielded by the *Piper aduncum* L. It is distinguished by the want of the reticulations on the upper and the down on the under surface which characterize true matico. (See also Thorns, *Arbeiten a. d. Pharm. Institut d. Universitat*, Berlin, 1910, p. 70.)

The drug is described in the N. F. as: "Usually in compressed, matted masses with leaves more or less broken; leaves sub-sessile, lanceolate, from 10 to 20 cm. in length and from 2 to 5 cm. in breadth; summit tapering and acute; base slightly unequal, cordate; margin finely crenulate; upper surface dark green, tessellated; lower surface pale green, reticulate with prominent yellowish-brown midrib and veins forming small quadrangular meshed clothed with matted pubescence. Odor distinct, aromatic; taste pungent, pepper-like. Sections, when examined under the microscope, exhibit the epidermis of the upper side composed of regular polygonal cells and of the lower side of somewhat irregular and undulate cells, especially where covering the veins; numerous stomata with large neighboring cells on the lower side; the hypodermis of one row and palisade cells in two or three rows; mesophyll loose, spongy tissue; midrib in cross section oval, outer layer of thick-walled cork cells; secretion cells filled with yellow oil; upper surface with papillae and few bristly hairs; hairs of the lower surface of two kinds, the one six to ten cells in length, pointed, bent and matted, having thick walls and astriate cuticle; the other bristle hairs of one stem cell and a head cell; calcium oxalate crystals few in parenchyma tissue of the venation, in the form of raphides or monoclinic prisms. The powder is greenish-yellow and, when examined under the microscope, exhibits the characteristic hairs, polygonal epidermal cells, and secretion

cells of the leaf. Matico yields not more than 18 per cent. of ash."

Fluckiger found it to contain 2.7 per cent. of the volatile oil, which was slightly dextrogyrate and boiling in large part at 180° to 200° C. (356°-392° P.). In the winter-time it deposited large crystals of a camphor, according to Kugler (A. J. P., 1884, 477). Schimmel & Co. (Schim. Rep., Oct., 1898, p. 37) and Thorns (A. J. P., 1904, p. 584) state that the newer matico oils do not contain this camphor but contain asarol (propenyl-trimethyltrioxybenzene). Matico also affords, according to Marcotte, a crystallizable acid named artanthic acid, with some tannin. (*Pharmacographia*, 2d ed., p. 590.)

Matico is said to be employed in Peru in arresting *hemorrhages* and as a local application to ulcers, and has been used in European practice in the treatment of diseases of the genito-urinary organs, such as those for which cubeb is commonly prescribed. It has also been praised as a remedy in *dysentery* and *diarrhea* and especially as a local hemostatic, in which it probably acts in part mechanically in the same manner as does agaric. The powder is sometimes used, but the fluidextract (see Part III), is preferable for internal administration. Dose, forty-five to seventy-five grains (3-5 Gm.).

MATRICARIA. U. S.

MATRICARIA *Matricar.* [German Chamomile Wild Chamomile]

"The dried flower-heads of *Matricaria Chamomilla* Linne (Fam. *Compositae*), without the presence or admixture of more than 5 per cent. of stems or foreign matter. Preserve it in tightly-closed containers and guard against attack by insects." *U. S.*

Flores Chamomillae Vulgaris; Horse Gowan, Dog's Camovyne; Camomille commune (d'Allemagne), *Fr. Cod.*; Flores Chamomillae, *P.G.*; Kamillen, Kamillenblumen, *G.*; Camomilla comune, *It.*; Manzanilla (Flor de), *Sp.*

Matricaria Chamomilla is an annual plant, with a branching stem a foot or two in height, bearing alternate leaves, the lower being tri-pinnate, the upper bipinnate or simply pinnate, and all of them very green, and nearly or quite smooth. The leaflets are linear and very small. The flower-heads appear singly at the ends of the stem and branches. The bracts of the involucre are obtuse, green in the middle, and whitish, membranous, and translucent at the margin. The ray-florets are pistillate white, at first spreading, and ultimately reflected. The disk is of a deep yellow color, at first flat, but in the end convex, and in some cases somewhat conical. The plant is a native of Europe

and western Asia, and is occasionally cultivated in our gardens. It is also naturalized in North America and Australia. Mitlacher gives the results of methods of cultivating *matricaria* in *Zeit. Oest. Apoth. Ver.*, 1, p. 410. Meyer has suggested (*Pharm. Zeit.*, Iviii, p. 790) the practicability of scientifically collecting *matricaria* from the wild grown plants. All parts of it are active, but the flowers only are official. These are gathered from May to August, shrink in drying, so that they are scarcely half as large as in their recent state. Those found in commerce are imported from Germany.

Properties.—*Matricaria* is officially described as follows: " Flower-heads composed of a few white ray-florets and numerous yellow disk-florets on conical, more or less hollow receptacles, the latter being from 3 to 10 mm. in breadth; disk-flowers tubular, perfect, and without a pappus; ray-flowers from 10 to 20, pistillate, corolla white, 3-toothed and 4-veined, usually reflexed; involucre hemispherical, composed of from 20 to 30 imbricated, oblanceolate, and pubescent scales; peduncles light green to brownish-green, longitudinally furrowed, more or less twisted and attaining a length of 2.5 cm.; achenes somewhat obovoid and faintly 3-to 5-ribbed; pappus none, or only a slight membranous crown; odor pleasant, aromatic; taste aromatic and bitter. *Matricaria* yields not more than 13 per cent. of ash." *U. S.*

"The similar flower-heads of *Anthemis arvensis* L., and *Maruta Cotula* De Candolle (Fam. Compositae), have conical, solid, and chaffy receptacles." *U. S.* VIII.

In addition to the above it is sometimes admixed with the flower-heads of other European species of *Anthemis*. Sometimes the flower-heads of the common daisy (*Chrysanthemum Leucanthemum* L.) as well as other species of *Chrysanthemum* are present in the drug of commerce.

The dried flowers of *matricaria* are considerably smaller than those of common chamomile, and exhibit a larger proportion of the disk-florets compared with those of the ray. They have a strong, peculiar, rather unpleasant odor, and a disagreeable, bitter taste. Their active constituents are volatile oil and bitter extractive, which are readily taken up by water and alcohol. The oil, which is obtained by distillation with water, is thick, somewhat tenacious, of a fine deep blue color becoming green and brown by age, and almost opaque in mass. Though supposed by Gerhardt to be identical with the oil of chamomile

(*Anthemis nobilis*), it has been shown to be distinct. (*P. J.*, Feb., 1862, p. 429.) It congeals at -20° C. (-4° F.), has the sp. gr. 0.93, and contains a terpene, $C_{10}H_{16}$, and a colorless oil, $C_{10}H_{16}O$. *Schimmel & Co.'s Report* for April, 1897, states that the German chamomile oil contains a paraffin hydrocarbon, which was obtained as a snowy white solid melting at 53° to 54° C. (127.4° - 129.2° F.). The blue color is due to a volatile principle called *azulene* by Pie'sse, and *caerulein* by Gladstone and others; also found in oil of absinthe, yarrow and some other blue volatile oils. This, when distilled with potassium, yields a terpene, $(C_{10}H_{16})_3$, and with phosphoric oxide a hydrocarbon, $C_{10}H_{14}$. (Kachler, *Ber. d. Chem. Ges.*, iv, 36.)

Uses.—*Matricaria* is a mild tonic, very similar to chamomile in medicinal properties, and, like it, in very large doses an emetic. It is considered also in Europe to be antispasmodic and anthelmintic. It is much employed in Germany, but in this country scarcely at all, unless by German practitioners. It may be given for the same purposes and in the same manner as chamomile.

Dose, half an ounce (15.5 Gm.).

Off. Prep.—Species Emollientes, *N. F.*

Medeola. *Medeola virginiana* L. (*Gyromia virginiana* L.) *Indian Cucumber.*—An indigenous perennial herb of the Fam. *Liliaceae*, growing in all parts of the United States. The tuber, which in shape and flavor bears a strong resemblance to a small cucumber, is said by Pursh to be eaten by the Indians, and by Barton to be useful as a diuretic in *dropsies*.

MEL.

U. S. HONEY

"A saccharine secretion deposited in the honey-comb by the bee, *Apis mellifera* Linne (Fam. *Apidae*)." *U. S.*

Miel, *Fr. Cod*; Mel, *P. G.*; Honig, *G.*; Miele, *It.*; Miel, *Sp.*

From the nectaries of various flowers the bee and other insects extract a

thin, aqueous fluid, nearly without flavor and insipidly sweet, usually known as nectar. As honey is made out of this substance it is very much affected by the character of the nectar, so that the nature of the plants which predominate in the vicinity of the hive is a matter of great importance to the bee culturist, not only in regard to the flavor of the honey which is yielded, but even to its freedom from poisonous qualities, cases having been reported from time to time of poisoning produced by the eating of honey which had not been tampered with after extraction from the hive. In the United States honey made by the bee from the flowers of the Mountain Laurel (*Kalmia*) is especially poisonous. See *N. J. M. K.*, 1852, 46; "*Poisonous Honey*," by L. F. Kebler, *Proc. A. Ph. A.*, 1896, 167; H. Bley, *Ph. Ztg.*, Nov., 1885. The latter states that *Datura Stramonium* and *Gelsemium* are for honey making especially dangerous plants. The nectar when taken in by the bee is chemically changed by secretions from glands in the head and thorax, levulose, dextrose, and rarely sucrose being formed. The finest honey is that which is allowed to drain from the comb. If obtained from hives that have never swarmed, it is called *virgin honey*. An inferior kind is procured by submitting the comb to pressure, and if heat be employed previous to expression, the product is still more impure. The honey which is most highly esteemed is that made from the nectar of the white clover blossom. Equally valuable is the honey derived from raspberry blossoms and bass-wood flowers. The honey made late in the summer from the flowers of the buckwheat is darker in color. The largest producer of honey in the United States is California. The United States is said to be the greatest honey producing region on the globe, the annual production being between 60,000,000 and 75,000,000 pounds annually. Nearly 2,000,000 pounds of wax are also produced in this country.

Propolis is a resinous substance, deposited by bees at the base of the hive, and in other parts which require protection from the outer air, of a nature entirely different from that of wax or honey, and supposed to be intended for the protection of the comb from injurious agencies. H. O. Hitchcock (*Chicago Med. Journ.*, 1867) considers it one of the best remedies in *diarrhea* and *dysentery*. It is of a dark reddish or yellowish-brown color, of a shining fracture, an aromatic taste and odor, quite insoluble in water, nearly so in ether, but readily dissolved by alcohol and solution of potassium hydroxide. Hitchcock used a tincture (two drachms of propolis and four fluidounces of alcohol) in doses of from thirty minims to a fluidrachm (1.8-3.75 mls).

Bee bread is the name given to a material found in some of the cells of the comb, consisting mainly of the pollen of plants. (Chicago Med. Examiner, Sept., 1865.) Jas. S. Whitmire found that in the dose of a drachm (3.9 Gm.) three times a day it caused great increase of the urinary secretion. No disagreeable effects followed its use, except a slight flatulency and looseness of the bowels. It is entirely palatable and inoffensive to the stomach. (A. J. P., 1866.)

Eucalyptus Honey, or Black Honey.—This honey, a detailed description of which may be found in *U. S. D.*, 16th ed., appears to have been not a natural but a sophisticated article.

In the recent state honey is fluid, but on being kept it is apt to form a crystalline deposit, and to be ultimately converted into a soft granular mass. In commerce it is found of every consistence, from that of a viscid liquid, like thin syrup or oil, to that of lard or soft suet. Its color is sometimes white, but usually yellowish, and occasionally of a brownish or reddish tinge. It has a peculiar agreeable odor, varying somewhat with the flowers from which it was collected, and a very sweet, feebly aromatic taste, which is followed by a slight prickling or sense of acidity in the fauces. Cold water dissolves it readily, alcohol with less facility. "Honey is a thick, syrupy liquid of a light yellowish or yellowish-brown color, translucent when fresh, but gradually becoming opaque and crystalline; having a characteristic odor, and a sweet, faintly acrid taste. It is slightly acid to litmus and is laevorotatory. Dilute Honey with twice its weight of water; the resulting liquid is only moderately turbid, not stringy, and has a specific gravity of not less than 1.099 at 25° C. (77° F.) (corresponding to a specific gravity of not less than 1.370 for the original Honey). Incinerate about 1 Gm. of Honey, accurately weighed, in a platinum crucible, in small portions at a time; not more than 0.3 per cent. of ash remains. Separate portions of 5 mls each of a filtered aqueous solution of Honey (1 in 5) acidified with nitric acid, are not rendered more than slightly opalescent by the addition of a few drops of silver nitrate T.S. (*chlorides*), nor more than slightly cloudy by a few drops of barium chloride T.S. (*sulphates*). Boil about 2 Gm. of Honey with 10 mls of distilled water; the resulting solution, when cold, is not rendered blue, green or reddish on the addition of iodine T.S. (*starch or dextrins*). The color of an aqueous solution of Honey (1 in 2) is not changed at once when mixed with an equal volume of ammonia water (*foreign coloring matter*) ; 5 mls of an aqueous solution of Honey (1 in

2) does not at once acquire a red or rose color on the addition of a few drops of hydrochloric acid (*azo dyes*). A solution of 10 Gm. of Honey in 50 mls of distilled water requires not more than 0.5 mil of normal potassium hydroxide V.S. for neutralization, phenolphthalein T.S. being used as indicator. Triturate about 1 Gm. of Honey with 20 mls of ether in a mortar, filter it into a porcelain dish or crucible, allow the filtrate to evaporate and add to the residue one drop of resorcinol T.S. At most only a pink color may be produced, which disappears in half a minute, but not an orange, "cherry, or brown-red color (*artificial or added invert sugar*).” U. S.

It is essentially a strong aqueous solution of mixed dextrose and levulose, amounting generally to from 70 to 80 per cent. According to Win. A. Selser, who separated wax from honey on a large scale, the proportion of wax in the honey comb averages 1 per cent.; from 1500 pounds he obtained 14¹/₄ pounds of wax by actual experiment. (*A. J. P.*, 1904, 267.)

A large number of samples of genuine honey analyzed in 1897 for the Department of Inland Revenue, Canada (*Bull.* 47), showed the following variations:

Direct polarization, -2.4 to -19.
Invert polarization, -10.2 to -28.
Sucrose (by Clerget), 0.5 to 7.64 per cent.
Invert sugar, 60.37 to 78.8 per cent.
Water, 12 to 33 per cent.
Ash, 0.03 to 0.50 per cent.

Neufeld in *Der Nahrungsmittelchemiker als Sachverständiger*, Berlin, 1907, p. 275, gives the following limits for pure honey of European origin:

Water	.....	8.30	to	33.59	per cent.
Protein	.....	0.03	to	2.67	per cent.
Invert sugar	....	49.59	to	93.96	per cent.
Sucrose	.....	0.10	to	10.12	per cent.
Dextrin	.....	0.99	to	9.70	per cent.
Formic acid	...	0.03	to	0.21	per cent.
Ash	.....	0.02	to	0.68	per cent.

Browne has published a comprehensive article on American honey (*U. S. Dept. Agric., Bur. of Chem., Bull.* 110, 1908) of which the tabular analyses are given in Leach, *Food Inspection and Analysis*, 3d ed., p. 635.

The *honey sugar* may be obtained by treating granular honey with a small quantity of alcohol, which, when expressed, takes along with it the other ingredients, leaving the crystals nearly untouched. The same object may be attained by melting the honey, saturating its acid with calcium carbonate, filtering the liquid, then setting it aside to crystallize, and washing the crystals with alcohol. Inferior honey usually contains a large proportion of uncrystallizable sugar and vegetable acid. Diluted with water, honey undergoes the vinous fermentation. In warm weather, honey, itself, if not very pure, sometimes ferments, acquiring a pungent taste and deeper color. The presence of dextrin in pure honey seems to be established. G. L. Spencer (*A. J. P.*, 1895, 27) has found as much as 4 per cent. of dextrin, and Haenie (*Zeit. An. Chem.*, xiv, 99) has found that honey from *Coniferae* always contains dextrin. Kunmann and Hilger (*A. J. P.*, 1896, 570) state that dextrin is present in all honey, whether dextro-rotatory or laevo-rotatory, and claim to have identified it as achroo-dextrin. Miillenhoff believes that the honey is preserved in the sealed cells of the comb by the secretion with it of a minute quantity of formic acid, and has found by experiment that the addition of one part of 25 per cent. formic acid is sufficient to keep permanently 250 parts of honey, but in this' connection it should be remembered that the absence of contact with the air would account for the preservation of honey in the comb. Starch is said to be occasionally added to the inferior kinds to give them a white appearance. The adulteration may be detected by adding water, which dissolves the honey and leaves the starch at the bottom of the vessel. Dilution with water may be suspected from the greater thinness of the honey and its want of disposition to crystallize.

Honey is sometimes adulterated with artificial glucose. This cannot be detected by the official tests with certainty, but the safest method is to employ the polariscope. (See Leach, "*Food Adulteration and Analysis.*")

According to Oscar Haenie, glucose can also be detected by first dialyzing thoroughly and then polarizing, under which circumstance, if glucose be present, rotation to the right occurs; if the honey be pure the light is not affected. Undialyzed honey ordinarily polarizes to the left, but unadulterated conifer honeys are dextrogyrate. (*P. J.*, xxi.)

Honey has been frequently adulterated with artificial invert sugar. This is best detected by the official method given above.

Uses.—Honey possesses the same medicinal properties as sugar, but is more disposed to affect the bowels. Though largely consumed as an article of food, it is seldom employed medicinally, except as a vehicle. Its taste and demulcent qualities render it a useful addition to gargles, and it is sometimes employed as an application to foul ulcers.

Off. Prep.—Mel Depuratum, *U. S., Br.*

MEL DEPURATUM. U. S., Br.

CLARIFIED HONEY Mel Depurat. [Mel Despumatum, U. S. 1890]

"Purified Honey is honey of commerce melted and strained, the specific gravity, if necessary, being adjusted to 1.36 by the addition of Distilled Water." *Br.*

Purified Honey; Mellite simple, *Fr. Cod.*; Miel despume, *Fr.*; Mel depuratum, *P. G.*; Gereinigter Honig, *G.*; Miele depurate, *It.*; Miel depurada, *Sp.*

"Honey, a convenient quantity, Distilled Water, Glycerin, each, a sufficient quantity. Weigh the honey in a tared dish, mix it intimately with two per cent. of paper pulp, which has been previously reduced to shreds, thoroughly washed and soaked in water, and then strongly expressed and again shredded. Then heat on a water bath at a temperature not exceeding 70° C. (158° F.), and carefully remove the scum which rises to the surface. Add enough distilled water to make up the loss incurred by evaporation, strain, and mix the strained liquid with five per cent. of its weight of glycerine" *U. S.*

The U. S. method of clarifying honey was new as far as the Pharmacopoeia was concerned in 1890. Paper-pulp is very effective as a clarifying agent, and the glycerin offers some protection to the honey against change. Honey may be made brilliant by hot nitration through paper. (See *Remington's Practice of Pharmacy*, "Hot Filtration.")

Honey, by the heat of the water bath, becomes so fluid that the wax and other lighter impurities which it contains rise to the surface and may be skimmed off, while the heavier substances which may have

been accidentally or fraudulently added, such as sand or other earth, sink to the bottom. It is officially required that " Clarified Honey, diluted with twice its weight of water, has a specific gravity of not less than 1.095 at 25° C. (77° F.); in other respects it conforms to the tests for purity under *Mel.*" *U. S.*

A neat method of separating is described in *N. R.*, Feb., 1880. It is as follows: "Pour the honey into a perfectly clean cylindrical vessel, with straight sides, rather narrow, and having a small lip at the open margin, and heat the vessel on a water-bath. When the water is hot, pour enough honey into the vessel to fill it to within about 1 inch of the edge, and allow it to remain at rest in the water-bath, at a moderate heat, for about one hour. During this time, most of the impurities will rise to the top, while some others may sink to the bottom. Now remove the vessel very carefully from the water-bath, and pour on top of the hot honey, very gently, a sufficient amount of cold water to fill the vessel completely. This will cause all the impurities floating on the honey to rise at once to the top of the cold water, where they will often solidify to a tough skin or cake, which may be taken off without difficulty. Then pour off the water through the lip, remove the last remnants, if necessary, by means of blotting paper, and filter the honey through a piece of well-washed, wetted, and dense white flannel. The resulting product—if the honey be pure— will be very brilliant." The French Codex directs one part of honey to be diluted with one part of distilled water. The specific gravity of this solution should be not less than 1.300.

(For other processes of purifying honey, see 14th edition of this work, p. 1321, also 19th ed., p. 775, and *A. J. P.*, 1877, p. 19; also 1879, pp. 193, 598; and 1880, p. 132.) Heugel's method is to mix two pounds each of honey and water with a half-ounce of magnesium carbonate, frequently agitate for two or three hours, filter through doubled white filtering paper, boil slowly, remove the scum carefully, and evaporate upon a steam bath to a syrupy consistence. Dieterich recommends the following process: Mix the honey with sufficient water (the amount depending on the consistence), heat for about seven hours on a water bath, and clarify it with 5 per cent. of its weight of powdered talc, neutralize, if necessary, with magnesium carbonate; allow to deposit, filter, add a few drops of acetic acid, and evaporate to the proper specific gravity. (*Ph. Ztg.*, 93, 712.)

The British Pharm. describes it as " a syrupy, translucent, pale yellowish liquid. Aromatic odor; taste at first sweet, afterwards faintly acrid. Specific gravity 1.36. *Optical rotation* at 15.5° C. (60° F.) of a solution in water, containing 25 grammes in 100 millilitres, decolorised by filtration with animal charcoal, in a tube 200 millimetres long, between 0° and - 5° C. (32° and 23° F.); 5 millilitres of the same solution when mixed with 15 millilitres of absolute alcohol do not become more than faintly opalescent (absence of starch sugar). When 2 grammes are dissolved in 20 millilitres of boiling water and cooled, the solution does not become blue on the addition of one drop of *N/10 solution of iodine* (absence of starch). Ash not more than 0.25 per cent.; solution of the ash in water is not alkaline to litmus, and when acidified with *nitric acid* yields not more than a very faint opalescence with *solution of barium chloride*, or with *solution of silver nitrate* (limit of sulphates and of chlorides) ." *Br.*

Honey clarified with calcium carbonate and animal charcoal, or as in the first process described, is as clear and colorless as syrup made with sugar, but still retains a peculiar flavor. It is less disposed to ferment than crude honey, and is said not to be so liable to produce griping pain when swallowed.

Dose, one to four fluidrachms (3.75-15 mils).

Off. Prep.—*Confectio Piperis, Br.; Mel Boracis, Br.; Mel Rosae, U. S.; Oxymel, Br.; Confectio Rosae, N. F.; Mel Sodii Boratis, N. F.*

MEL ROSAE. U. S.

HONEY OF ROSE

Mellitum Rosatum; Mellite de Rose rouge, *Fr. Cod.*; Miel Rosat, *Fr.*; Mel Rosatum, *P. G.*; Rosenhonig, *G.*; Miele rosato, *It.*; Miel de rosas, *Sp.*

"Fluidextract of Rose, *one hundred and twenty mils* [or 4 fluidounces, 28 minims]; Clarified Honey, a sufficient quantity to make *one thousand grammes* [or 35 ounces av., 120 grains]. Mix the fluidextract of rose in a tared vessel' with enough clarified honey to make the product weigh one thousand grammes [or 35 ounces av., 120 grains]." *U. S.*

Though one of the official preparations in the London and Edinburgh Pharmacopoeias, the Honey of Rose has been dropped in the British. The U. S. formula is based on that of Grahame. (See *A. J. P.*, 1859, p. 443.) As is well known, honey of rose deposits honey sugar upon standing even but a short time. Touflet (*Ph. Centralh.*, xxxvi, 307) obviates this precipitation in the following manner: Take of Powdered Rose Leaves, 25 parts; Alcohol, sp. gr. 0.875, 75 parts; Honey, 80 parts; Sugar, 34 parts. Percolate the rose leaves with the alcohol, filter and distil off the filtrate to 40 parts. To this add the honey and sugar, and bring to the boiling-point. Honey of rose forms a pleasant addition to the gargles employed in *inflammation* and *ulceration* of the *mouth* and *throat*.

Dose, one fluidrachm (3.75 mils).

Off. Prep.—Mel Rosae et Sodii Boratis, *N. F.*

Melaleuca (Cajuputi).—Under the names of *gomenol* and *Niaouli* oil there has been put upon the market a volatile oil obtained from the leaves of *Melaleuca Leucadendron* L. and the var. *minor* Smith, myrtaceous trees growing in upper India, the islands of the Indian Ocean and Australia. Its sp. gr. is 0.922, and its rotatory power plus 0.420. Its odor and taste are said to resemble those of camphor and peppermint. The chief constituent of the oil (66 per cent.) is cineol, and in addition to this is a crystallized terpineol, $C_{10}H_{18}O$, and the valeric ester of the same. These together make up 30 per cent. additional. (Gilde-meister and Hoffman, *Aetherische Oele*, p. 686.) It has been recommended in the chronic catarrhs of the pulmonary mucous membrane, and especially in whooping cough. It may be given by the mouth or exhibited in the form of intramuscular injections being diluted with from four to ten parts of a sterilized fixed oil to one part of volatile oil. The hypodermic dose of a 10 per cent. solution is two and one-half fluidrachms to one-half fluidounce (9.3-15 mils). The injections should be practised every other day. Gomenol has been used by Brimont (*PressMed.*, 1910, p. 800) as a vermifuge in *ankylostomiasis*, in doses of five minims (0.3 mil).

Melan.—Under the name of *melan*, there has been introduced a dark-brown, oily fluid which is stated to be a preparation of *Melilotuscoeruleus*. It is used as a local application to ulcers and bzirns.

Melastoma. *Melastoma Ackermanni.*—This Colombian plant of the Fam. *Melastomaceae* is used in South America as an anti-neuralgic. Its abundant essential oil resembles methyl salicylate, if indeed it be not identical with it. (See *N. R.*, Aug. and Sept., 1883.)

Melilotus. *N. F. IV. Yellow Melilot. Yellow Sweet Clover. Berba Meliloti, Yellow Sweet*

Clover, G.—"The dried leaves and flowering tops of *Melilotus officinalis* (Linne) Lamarck (Fam. *Leguminosae*)." *N. F.* An annual or biennial plant of the Fam. *Leguminosae*, indigenous in Europe, and growing also in this country. The plant, when in flower, has a peculiar sweet odor, which, by drying, becomes stronger and more agreeable, somewhat like that of the tonka bean. The *N. F.* describes it as follows: "Stems mostly less than 3 dm. in length, slender, straight, mostly simple, often leafy below, terminating in long slender racemes, the younger portions very finely pubescent; leaves glabrous or nearly so; petiolate, trifoliate, stipulate, the stipules subulate, entire, the leaflets from 1 to 3 cm. in length, varying from narrowly oblong to oval or occasionally broader above the middle, rounded, truncate, or slightly notched at the summit, sharply serrate; racemes 1 dm. or less in length, many flowered, the flowers yellow, from 5 to 6 mm. in length; calyx bell-shaped, the fine, nearly equal lobes shorter than the tube, corolla papilionaceous, the keel shorter than the other petals, which are about equal; legumes reflexed, from 2.5. to 3.5 mm. in length, obovate, wrinkled, one-seeded. Odor aromatic, tonka-like; taste sweetish, slightly pungent and bitter. Melilot yields not more than 10 per cent of ash." *N. F.* This similarity is accounted for by the fact that *coumarin*, $C_9H_6O_2$, the chief constituent of tonka beans, is present in melilot, combined with *melilotic acid*, $C_9H_{10}O_3$, and *coumaric acid*, $C_9H_8O_3$, of which latter acid *coumarin* is the anhydride. *M. alba* Desv. is a more robust species, distinguished by its white flowers. Melilot is practically inert.

Melissa. *U. S. 1890. Melissa. Balm.*—Under this name were formerly recognized by the U. S. P. the leaves and topa of *Melissa officinalis* L. (Fam. *Labiatae*), or the ordinary balm of Southern Europe, which has become naturalized in this country. Balm contains some tannic acid, and a yellowish, highly flavored essential oil which, however, is present in such small quantities that the plant has practically no remedial value. The allied *Satureja Calamintha* (L.) Scheele, var. *Sylvatica* Brig., is said to contain sufficient aromatic volatile oil to be of possible commercial interest.

Under the name of *oil of lemon balm* or *oil of balm* the essential oil of melissa has been used as a diaphoretic in doses of from one to three minims (0.06 to 0.2 mil). This oil is a yellow liquid with a specific gravity of 0.9 to 0.925. Its most important constituent is citral.

Menispermum. *U. S. 1890. Yellow Parilla. Canadian Moonseed. Texas Sarsaparilla.*—"The rhizome and roots of *Menispermum canadense* Linne (fam. *Menispermaceae*)." *U. S.*, 1890.

M. canadense L.—This is a woody, climbing plant, which grows from Western Quebec and New England southward. It is specifically characterized by its peltate, three to seven-lobed leaves, its small clusters of greenish-yellow flowers, and its somewhat kidney-shaped, glaucous fruit, which is ripened in September. *Menispermum* was officially described as follows: "Rhizome 5 to 6 dm. long, 5 mm. thick, brown or yellowish-brown, somewhat knotty, finely wrinkled longitudinally and beset with numerous thin, rather brittle roots; fracture tough, woody; internally yellowish, the bark rather thick, the wood-rays broad, porous, and longest on the lower side; pith

distinct. Nearly inodorous; taste bitter." *U. S.* 1890. Maisch proved the presence of a white alkaloid, and of a small quantity of berberine. The former reacts with the usual alkaloidal precipitants, is not very soluble in water, but soluble in alcohol and ether. H. L. Barber (*A. J. P.*, 1884, p. 401) obtained the white amorphous alkaloid above referred to, for which Maisch proposed the name *menispine*. Starch was also found in the root. (*A. J. P.*, 1863, p. 301.) H. M. Gordin states that berberine is not present in *menispermum*. [*Proc. A. Ph. A.*, 1909.] *Menispermum* has been used as a substitute for sarsaparilla but is probably inert. A fluidextract made with a menstruum of 2 parts of alcohol and one part of water was recognized by the *U. S. P.*, 1890; dose one-half to one fluidrachm (1.8-3.75 mils).

Mentha Aquatica.—Under the name of *poco oil*, the volatile oil of this plant, which is a native of China, is used in the Island of Java as a popular remedy for *headache*, and also in *cholera*,

MENTHA PIPERITA. U. S.

PEPPERMINT *Menth. Pip.*

"The dried leaves and flowering tops of *Mentha piperita* Linne (Fam. *Labiatae*)." *U. S.*

Brandy Mint; Menthe poivrée, *Fr. Cod.*; Folia Menthae Piperitae, *P. G.*; Pfefferminzblätter, Pfeffermunze, *G.*; Menta piperita, *It., Sp.*

The genus *Mentha* comprises at least fifteen species, of which there are also a great many varieties. Some of the mints have been in use for culinary and medicinal purposes since antiquity, but no well defined distinction is made as to just what plants were employed. It is stated that *M. piperita* L. (1753), also Smith (1800)—the most important member of this genus, was long ago cultivated by the Egyptians. It is mentioned in the Icelandic Pharmacopoeia of the thirteenth century. Peppermint is now grown in considerable amounts in Europe, North America, and Eastern Asia. It is also found growing wild in ether parts of the world, as South America and Australia. The oldest existing peppermint district is in the neighborhood of Mitcham (Surrey), England. In some parts of the United States, especially in Michigan, the western part of New York, Ohio and Indiana, it is largely cultivated. On the continent of Europe other species of *Mentha* (particularly *M. arvensis*) grow with *M. piperita*, deteriorating the product. In America other plants (as *Erigeron canadensis* and *Erechthites hieracifolia*) cause the same trouble. Besides *M. piperita* other species are cultivated, as some Asiatic varieties of *M. arvensis*, *M. spicata*, *M. longifolia* (var. *undulata*), *M. gentilis*, *M.*

dalmatica, and *M. Pulegium*. Miss Henkel reviews the situation regarding the cultivation of peppermint in the United States and describes the three kinds of mint grown for the production of peppermint oil: *Mentha piperita* L.; *Mentha piperita vulgaris* Sole, and *Mentha piperita officinalis* Sole. (*Bul. Bur. Plant Ind., U. S. Dept. Agric.*, No. 90, 1906.) A comprehensive article on the cultivation of peppermint in Japan is that by Inouye in *Schim. Rep.*, November, 1908, p. 199. Peppermint has recently been successfully grown in Wisconsin. (*Paint, Oil and Drug Rev.*, xlv, p. 18.) The cultivation of peppermint is a growing industry on the reclaimed lands of Louisiana. (*Spatula*, xvii, p. 18.) Great interest recently has been taken in the cultivation of peppermint in Germany. (See Thorns in *B. P. G.*, xx, p. 244; *Arb. Pharm. Inst. Univ. Berl.*, viii, p. 93.) Mitlacher reports on the cultivation of peppermint in Austria and outlines methods for its culture on a large scale. (*Ph. Post*, xlv, p. 215; *Zeit. Oest. Apoth. Ver.*, 1, p. 422.) It has been repeatedly pointed out that the essential oil-bearing plants of the Labiates are very capricious and constantly changing character with change of soil and climate. For an account of the cultivation of peppermint in Russia, see *Proc. A. Ph. A.*, 1902, 831.

Peppermint is a perennial herbaceous plant, producing creeping stolons. The stems are quadrangular, channelled, purplish, somewhat hairy and branching towards the top. The leaves are opposite, petiolate, ovate, sharply serrate, pointed, smoother on the upper than on the under surface, and of a dark green color, which is paler beneath. The flowers are small, purple, and in terminal obtuse spikes, interrupted below, and cymosely arranged. Late in the season, the growth of the lateral lower branches often gives to the inflorescence the appearance of a corymb. The calyx is tubular, often purplish, furrowed, glabrous below, and five-toothed, the teeth being hirsute. The corolla is purplish, tubular, with its border divided into four segments, of which the uppermost is broadest, and notched at its summit. The four short stamens are concealed within the tube of the corolla; the style projects beyond it, and terminates in a bifid stigma. The plant should be cut for medicinal use in dry weather, in August, about the period of the expansion of the flowers. John C. Umney points out differences between white and black peppermint, in *P. J.*, 1896, 123. For a paper on the histology of powdered peppermint by Smith Ely Jelliffe, see *D. C.*, 1899, 252.

Properties.—It is officially described as follows : “Leaves more or less crumpled and frequently detached from the stems; stems quadrangular,

from 1 to 2 mm. in diameter, glabrous except for a few scattered deflexed hairs; leaves when entire ovate-oblong to oblong-lanceolate, petioles from 4 to 15 mm. in length, slightly pubescent, laminae from 1 to 9 cm. in length, acute and sharply serrate, light green to purplish-brown, upper surfaces nearly glabrous, lower surfaces glandular hairy, especially on the veins; flower-whorls in oblong or oval spikes which are usually compact, or somewhat interrupted at the base, from 1 to 1.5 cm. in breadth, rounded at the summit, and in fruit attaining a length of from 3 to 7 cm.; bracts oblong-lanceolate, very acuminate, 7 mm. in length; calyx tubular, equally 5-toothed, pubescent and glandular-punctate, often dark purple in color; corolla tubular-campanulate, 4-cleft, about 3 mm. in length and often light purple; stamens 4, short and equal; nutlets ellipsoidal, about 0.5 mm. in diameter, blackish-brown; odor aromatic, characteristic; taste aromatic, pungent, followed by a cooling sensation in the mouth." *U. S.*

The morphology of *Mentha piperita* and other species of *Mentha* are discussed by Eriksson in *B. P. G.*, xviii, p. 244. The herb, both in the recent and in the dried state, has a peculiar, penetrating, grateful odor. Peppermint is quite frequently contaminated with spearmint and in one instance the leaves of belladonna were found. The latter, while no doubt accidental, shows the necessity for the examination of crude drug's generally. (*Pharm. Prax.*, iv, p. 38.) There is sometimes difficulty in distinguishing between the leaves of *M. piperita* and those of *M. spicata*. According to Joseph Schrenk, crystals can always be found in the glandular hairs of the peppermint, but are absent in those of the spearmint. The crystals are doubly refractive, and so transparent that sometimes a polariscope is necessary for their easy detection. These crystals have been thought to be menthol, but they seem not to dissolve in alcohol, and are probably hesperidin.

The medicinal properties depend on a volatile oil, of which from 1 to 1.25 per cent. can be obtained from the herb. The leaves are said to contain a little tannic acid. The virtues of the herb are imparted to water, and more readily to alcohol.

Uses.—Peppermint is an aromatic stimulant, much used to allay nausea, relieve spasmodic pains of the stomach and bowels, expel flatus, or cover the taste or qualify the nauseating or griping effects of other medicines. The medicine is rarely used in infusion. (See *Oleum Menthae Piperitae*.)

Dose, one drachm (3.9 Gm.).

Off. Prep.—Spiritus Menthas Piperitise, U. S.

Mentha Pulegium L.—*European Pennyroyal. Pouliot oommun, Fr. Polei, G. Pulegium vulgare* Mill.—"This European labiate yields an oil which is known in England as the *oil of pennyroyal*, and must not be confounded with the American oil of the same name. The oil, which is also known as the *oil of poley*, has been examined by Beckmann and Pleiasner (*Arm. Ch. Ph.*, 262, 1), who discovered as the most important constituent pulegone, $C_{10}H_{16}O$, an unsaturated ketone, which makes up 80 per cent. of the oil. It boils under a pressure of 60 mm. at from 54.5° to 55° C. (130° - 131° P.), turns the plane of polarization to the right, and has a, sp. gr. 0.9323 at 0° C. (32° F.). It forms crystalline compounds with hydroxylamine and with hydrogen bromide. When reduced by sodium in ethereal solution pulegone is changed into menthol. Pulegone is most abundant in the Spanish oil, and less abundant in American and Algerian oils. (See also Wallach, *Ann. Ch. Ph.*, 272, 122, and Semmler, *Ber. d. Chem. Ges.*, 25, 3515.) Schimmel states that the oil is sometimes adulterated with eucalyptus oil. (*Schim. Rep.*, 1908, 67.) It is stated (*B. M. J.*, March, 1890) that the oil is largely used for the purpose of producing abortion, and is popularly believed to be safer and more certain than the other volatile oils. Taylor denies, however, that the oil is an abortifacient and it appears to be demonstrated that it is capable of causing fatty degeneration. (See *S. Jb.*, cclxvii, p. 230.)

MENTHA VIRIDIS. U. S.

SPEARMINT Menth. Vir.

"The dried leave's and flowering tops of *Mentha spicata* Linne (*Mentha viridis* Linne) (Fam. *Labiatae*)." *U.S.*

Herba Menthae Acutae (vel Romanae); Brown, Lamb, Garden, or Mackerel Mint; Menthe verte, *Fr. Cod.*; Menthe romaine, Baume vert, Menthe a epi, *Fr.*; Grune Munze, Romische Minze, *G.*

Spearmint, sometimes called simply mint, differs from *M. piperita* chiefly in having sessile, or nearly sessile, oblong or ovate-lanceolate, unequally serrate leaves; elongated, interrupted, paniced spikes; setaceous bracts; and stamens longer than the tube of the corolla. It is a native of Europe and Asia, and naturalized in waste places from Nova Scotia and Ontario to Minnesota and Kansas in the West and Florida in the South United States. It is also cultivated for domestic use and for the sake of its oil. Its flowering season is August. Spearmint is officially

described as "leaves more or less crumpled and mixed with a large proportion of the light brown or purplish-colored stems, occasionally with their characteristic opposite branches; stems distinctly quadrangular, from 1 to 3 mm. in width, nearly glabrous; leaves when entire ovate-lanceolate, unequally serrate', nearly sessile or with a petiole less than 5 mm. in length, of a bright green color and somewhat glandular-hairy on the under surface; flowers arranged in opposite clusters and in more or less interrupted or crowded lanceolate, nearly acute spikes; bracts linear-lanceolate, subulate, from 7 to 10 mm. in length, subtending the flower clusters; calyx tubular, 5-toothed, glandular punctate and somewhat pubescent near the teeth; corolla nearly white or light brown; stamens extending beyond the corolla tube; odor slightly pungent, characteristic; taste aromatic, characteristic but not followed by a cooling sensation in the mouth." *U. S.*

Spearmint was cultivated in the Convent gardens of the ninth century. It is largely used as a domestic and popular flavor in foods, chewing gum, and confectionery. The plant is widely cultivated, and Schimmel and Co. present a review of its cultivation in Michigan, Indiana and New York in their *Schim. Rep.*, October, 1910, p. 131. Recently experiments have been conducted in Louisiana, and Phenis states the resulting oil to be of the highest grade. (*Paint, Oil, and Drug Review*, xlv, p. 27.) Successful experiments have also been conducted in Wisconsin. (*Ibid.*, xlv, p. 18.) Mitlacher has reported that *Mentha crispa* can be successfully grown in Austria. (*Ph. Post*, xlv, p. 215.)

Spearmint is sometimes admixed with peppermint. This is probably due to carelessness. The taste and odor of spearmint are retained for some time by the dried plant. They depend on a volatile oil. (See *Oleum Menthae Viridis*.)

Dose, one drachm (3.9 Gm.).

Off. Prep.—*Spiritus Menthae Viridis*, U. S.

Menyanthes. *N. F. IV. Buckbean. Marsh Trefoil. Bogebean. Water Shamrock. Folia Trifolii Fibrini.*—"The dried leaves of *Menyanthes trifoliata* Linne (Fam. *Gentianaceae*)." It is an ingredient in *Vinum Aurantii Compositum*, *N. F. IV*. This gentianaceous plant is a native both of Europe and North America, from Greenland to Alaska and south to Pennsylvania, Minnesota, and California. All parts of *menyanthes* are efficacious, but only the leaves are official.

It is described by the N. F. as "glabrous; petioles from 10 to 15 cm. in length, stout but soft and weak, the base more or less sheathed with broad, thin, and membranaceous, somewhat translucent stipules; blade ash-green, trifoliate; leaflets, sessile or very short-petioled from 5 to 8 cm. in length and usually about two-thirds as broad, obovate, blunt, entire or occasionally coarsely and unequally crenate. Odor slight but characteristic; taste decidedly bitter. Menyanthes yields not more than 10 per cent. of ash." N. F. Its virtues depend on a bitter principle denominated *menyanthin*, which may be obtained sufficiently pure for use by treating the spirituous extract of the plant with hydrated lead oxide, removing the lead by hydrosulphuric acid, filtering and evaporating the liquor, exhausting the residue with alcohol, and again evaporating with a gentle heat. It has a bitter taste, is soluble in alcohol and water, but not in pure ether, and is chemically neutral. Kromayer (1865) assigned to it the formula $C_{30}H_{46}O_{14}$, and stated that it breaks up on heating with diluted sulphuric acid into a fermentable sugar and *menyanthol*, a colorless, difficultly volatilizable oil, with an odor like that of bitter almond. K. Leuderich (A. Pharm., 1892, 38 and 48) has studied menyanthin, and gives it the formula $C_{33}H_{50}O_{14}$, and states that its decomposition products are a phenol-like body, menyanthol, $C_7H_{11}O_2$, a resinous product, and a left-rotatory sugar.

Vridevel (P. J., 1910, lxxxv, p. 465) has separated a second glucoside from menyanthes, to which he gives the name of *meliatin*. It is a crystalline body, with a melting point of $217^{\circ} C.$ ($422.6^{\circ} P.$).

With the ordinary properties of the bitter tonics, menyanthes unites a cathartic power; in large doses it may cause vomiting. The dose of the powdered leaves or root as a tonic is from twenty to thirty grains (1.3-2.0 Gm.); of an infusion, prepared with half an ounce to a pint of boiling water, from one to two fluidounces (30-60 mils); and of the extract, ten or fifteen grains (0.65-1.0 Gm.), to be repeated three or four times a day. A drachm of the powder, or four fluidounces of the strong decoction, generally purges, and often occasions vomiting.

Mercurialis. *Mercurialis annua* L. *Mercury Herb.* *French Mercury.*—An herbaceous European plant, of the Family of *Euphorbiaceae* which has been employed from the most ancient times as a purgative, diuretic, and emmenagogue. When boiled, it loses its acidity, and in this condition has been used as an emollient. Another species, *M. perennis* L., or *dog's mercury*, also a native of Europe, is poisonous. (Merat and De Lens.) Reichardt has discovered in *M. annua* a volatile alkaloid, which he named *mercurialine*. According to E. Schmidt (P. J., vol. x, 29), *mercurialine* is identical with *methyamine*, CH_3NH_2 , and is associated in the *mercurialis* with *trimethylamine*. It is a liquid of an oily appearance, narcotic odor, and alkaline reaction; boils at $140^{\circ} C.$ ($284^{\circ} F.$); forms salts with the acids; absorbs carbon dioxide; has a strong affinity for water; on exposure to the air it is changed into a resin of a buttery consistence, and is said to be poisonous to man; but Hugo Schuiz (A. E. P. P., April, 1886, 88) found that neither the fluid extract nor the herb given as food was capable of killing either the pig or the rabbit, and that four and a half grains (0.29 Gm.) of the mercurialine hypodermically injected had no effect. The urine is increased in quantity and colored reddish.

Mesembryanthemum. *Mesembryanthemum crystallinum* L. *Iceplant. Diamond Fig.*—A biennial plant of the Fam. *Aizoaceae*, a native of the south of Europe, now distributed, to the Canary Islands, Southern Africa, Australia and California. The stem and under surface of the leaves are covered with crystalline drops, which give the plant the appearance of being coated with ice. H. Mangon obtained as much as 43 per cent. of salts of potassium and sodium from the dried leaves. (A. J. P., 1863, 370.) The herb is without odor, and has a saline, somewhat nauseous taste. It is considered demulcent, diuretic, and has been used in *inflammations* of the *pulmonic* and *genito-urinary* mucous membrane.

Mesenna. *Musenna. Bisenna. Musena, Moucena*, Fr. *Musennarinde*, G.—Under these different names has been brought into notice, as a powerful tenifuge, the bark of an Abyssinian tree, *Albismia anthelmintica* Brongn. (Fam. Leguminosae). The bark is in flat pieces from five to ten inches long, smooth, slightly fissured, of a rusty gray color exteriorly, and pale yellow and fibrous within. It consists of four layers, one of which contains very large cells, with thick coats, and is supposed to be the active part. E. Caventou and Legendre found in the bark no alkaloid, but a peculiar, acid, acrid, resinous substance. The musennin of Theil is probably the same, although not as yet in a pure state. The Abyssinians employ the powdered bark, in the dose of about two ounces, suspended in water or other liquid, or mixed with flour in the form of bread, or made into a confection with honey, butter, etc. It is taken in the morning, three or four hours before breakfast, and no other precautions are used. It produces no pain nor any disturbance of the functions, not even purging actively. Fragments of the worm are voided the same evening, and the greater portion of it the next day.

MEZEREUM. U.S.

MEZEREUM [Mezereon]

"The dried bark of *Daphne Mezereum* Linne, *Daphne Gnidium* Linne, or of *Daphne Laureola* Linne (Fam. *Thymeleaceae*)." U. S.

Mezerei Cortex, *Br. 1898*; Mezereon Bark; Cortex Mezerei, Cortex Thymeleae (vel Coccognidii); Dwarf Bay, Wild Pepper, Spurge-flax, Spurge-olive, Magell; Mezereon ou Bois gentil, *Fr. Cod.*; Laureole, Thymelee, *Fr.*; Kellerhals, Seidelbastrinde, Kellerhalsrinde, *G.*; Mezereo, *It.*; Mecereon, *Sp.*

All the species of *Daphne* are possessed of active properties, but three only are official—*D. Mesereum*, *D. Laureola*, and *D. Gnidium*, all of which are recognized in the United States Pharm., and the last in the former French Codex, 1884.

1. *Daphne Mezereum* is a very hardy, low shrub, with a branching stem,

and a smooth, dark gray bark, very easily separable from the wood. The leaves spring from the ends of the branches, are deciduous, sessile, obovate-lanceolate, entire, smooth, and of a pale green color, somewhat glaucous beneath. They are preceded by the flowers, which appear very early in the spring, and sometimes bloom even amidst the snow. These are of a purple-rose color, rarely white, highly fragrant, and disposed in clusters, each consisting of two or three flowers, forming together a kind of spike at the upper part of the stem and branches. At the base of each cluster are deciduous floral leaves. The fruit is oval, shining, fleshy, of a bright red color, and contains a single round seed. Another variety produces white flowers and yellow fruit. This species of *Daphne* occurs throughout the forests of Europe, and extends in Western Asia from the Caucasus to the Altai. It is cultivated in Europe, and is occasionally found in our own gardens. *D. Mezereum* is locally naturalized from New York and Massachusetts to western Quebec and Ontario.

2. *Daphne Gnidium*.—In this species, called garou or sain-bois by the French, the leaves are linear-lanceolate, acute, entire, smooth, and irregularly but closely set upon the branches. The flowers are white, downy, odoriferous, and disposed in terminal paniced racemes. The fruit is globular, dry, at first green, but ultimately black. *D. Gnidium* grows in dry uncultivated places in the south of Europe, and flowers in June. Its bark, which in France is used indiscriminately with that of the former species, is of a deep purplish-brown color, and hairy in the younger portions. It appears to be equally as active, medicinally, as the other official species.

Besides the species above described, *Daphne Laureola*, or *spurge laurel*, is said to furnish a portion of mezereum of commerce, and is recognized by the U. S. Pharmacopoeia, but its product is inferior in acrimony, and consequently in medicinal activity.

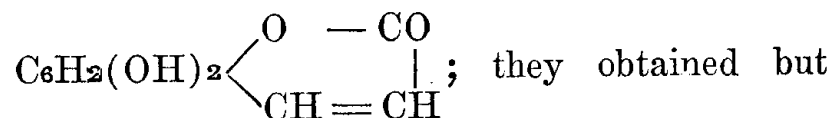
Properties.—The bark of the root was formerly directed, but the mezereum with which our markets are supplied is evidently the bark of the stem, and the Pharmacopoeias at present very properly direct the bark, without designating the part from which it must be taken. The official description is as follows: "In flexible, tough quilled pieces or somewhat flattened strips, attaining a length of 90 cm.; from 0.3 to 1 mm. in thickness; outer surface yellowish-or olive-brown (*D. Mezereum*) or purplish-brown (*D. Gnidium*) or purplish-gray (*D. Laureola*), smooth, numerous lenticels giving a transversely striated appearance

and occasionally with numerous, circular, brownish-black apothecia; outer corky layer easily separable from the middle bark which varies from light green to olive-brown and with more or less detached bast-fibers; inner surface yellowish-white, satiny lustrous, finely striate; fracture tough, fibrous, the inner bark lamellated; odor very-slight; taste at first slight, becoming gradually and increasingly pungent and acrid. Under the microscope, transverse sections of *Mezereum* show a rather thick cork composed of from 20 to 30 rows of cells, the outer being compressed and with yellowish-brown walls, and the inner more or less tabular with nearly colorless walls; a hypodermis of 3 to 5 rows of collenchymatous cells containing chloroplastids or a yellowish-green resinous substance; an inner bark consisting mostly of nearly colorless non-lignified bast-fibers occurring in loosely united groups, and a few starch-bearing medullary rays one cell in width. The powder is light grayish-brown; bast-fibers numerous, from 0.4 to 3 mm. in length and about 0.015 mm. in width, frequently more or less uneven or irregularly bent and considerably attenuated at the ends, the walls being from 0.001 to 0.005 mm. in thickness, colorless, non-lignified and free from pores; fragments of yellowish-brown cork cells and starch-bearing medullary rays; starch grains relatively few, mostly spherical or elliptical, occasionally 2- to 4-compound, the individual grains from 0.003 to 0.015 mm. in diameter." *U. S.*

British writers state that the bark of the root is the most active. The berries and leaves of the plant are also active, and the former have sometimes proved fatal to children who have eaten them. Pallas states that they are used as a purgative by the Russian peasants, and that thirty berries are required to act. French authors observe that fifteen are sufficient to kill. A tincture of them is used in Germany as a local application in *neuralgia*.

Vauquelin discovered a peculiar principle in the bark of *Daphne alpina*. This has subsequently been found in other species, and has received the name of daphnin. Gmelin and Bar found it in the bark of *D. Mezereum*, associated with wax, an acrid resin (*mezerein*), a yellow coloring matter, a reddish-brown extractive, and uncrystallizable and fermentable sugar, a gummy matter containing nitrogen, ligneous fiber, malic acid, and several malates. By J. B. Eng it has been discovered, together with a volatile oil, in the flowers of *D. Mezereum*. (*Wittstein's Viertelj.*, viii, 23.) *Daphnin* is in prismatic crystals, grouped together, colorless, transparent, brilliant, slightly soluble in cold water, very soluble in

boiling water and alcohol, without odor, and of a bitter, somewhat harsh taste. According to Zwenger (*Ann. Ch. Ph.*, 1860, cxv, 1) it is a glucosidal acid, being resolvable by sulphuric or hydrochloric acid into sugar, and a peculiar crystallizable principle called *daphnetin*, $C_9H_6O_4 + 2H_2O$. He gives for daphnin the formula $C_{15}H_{16}O_9 + 2H_2O$, the same as that of aesculin, of which it is, therefore, an isomer. W. Will and O. Jung (*A. J. P.*, 1885) have investigated daphnetin, which was shown in 1879 by Stunkel to be *dioxycoumarin*,



about one ounce of daphnetin from fifty pounds of extract of mezereum, and they proved that it has the same relation to pyrogallic acid that coumarin has to phenol, or umbelliferone to re-sorcinol. (For a method of preparing the glucoside daphnin, see *U. S. D.*, nineteenth edition, p. 781.) *Coccognin*, isolated in 1870 by Casselmann from the fruits of *D. Mezereum*, appears to be closely allied to, if not identical with, daphnin. By the dry distillation of an alcoholic extract of mezereum bark, Zwenger obtained *umbelliferone*, $C_9H_6O_3$.

Uses.—The recent bark applied to the skin produces inflammation followed by vesication, and has been popularly used as an epispastic, from time immemorial, in some of the southern countries of Europe. The dried bark, though less active, is possessed of a similar property, and is occasionally employed in France by regular practitioners for the purpose of forming issues. A small square piece, moistened with vinegar, is applied to the skin, and renewed twice a day until a blister is formed, and occasionally afterwards to keep up the discharge. It is slow in its operation, generally requiring from twenty-four to forty-eight hours to vesicate. The ointment was formerly used for maintaining the discharge from blistered surfaces, and may be applied advantageously to obstinate, ill-conditioned indolent *ulcers*. It was recognized by the U. S. 1880. (See *U. S. D.*, 19th ed., p. 781, for formula.)

An alcoholic extract has also been employed to communicate irritant properties to issue-peas. Internally administered, mezereum is a stimulant capable of being directed to the skin or kidneys, and in large doses likely to excite purging, nausea, and vomiting. In overdoses it produces the fatal effects of the acrid poisons, and a case of apparently severe narcotic effects has been recorded. (*Am. J. M. S.*, xxi.) It had at

one time much reputation as an alterative in *syphilis*, *chronic rheumatism*, etc., but is of no value as an internal remedy and is almost never administered save as an ingredient of the compound fluidextract of sarsaparilla.

Dose, ten grains (0.65 Gm.).

Off. Prep.—Fluidextractum Sarsaparillae Compositum, *U. S.*; Decoctum Sarsaparillae Compositum, *N. F.*; Fluidextractum Mezerei, *N. F.*; Linimentum Sinapis Compositum (from Fluidextract), *N. F.*

Michelia. *Michelianilagirica* Zenker. (Fam. *Magnoliaceae.*)—This tree, which is said to be abundant in the Neilgherry hills, India, yields an aromatic volatile oil, which has entered commerce. (*P.J.*, Jan., 1888.)

Micrampelis. *Micrampelis fabacea* (Naud.) Greene. (*Megarrhiza californica* Torr., *Echinocystis fabacea* Naud.) *Man Foot. Big Root. Gerba marra.* (Fam. *Cucurbitaceae.*)—J. P. Heaney has obtained a substance from this root of resinous character which he calls *megarrhizitin*, and another which he believes to be a glucoside and calls *megarrhizin*. It is said to be actively cathartic. (*A. J. P.*, 1876, 451.) A second glucoside was obtained by W. M. Young (*A. J. P.*, 1883, 195), to which the name of *megarrhin* was given. It resembles saponin, and possesses the property of dilating the pupil. Young also found two resins, one soluble in alcohol and the other soluble in ether.

Micromeria. *Micromeria Chamissonis* (Benth.) Greene. *Yerba Buena.*—This sweet scented labiate, which is popularly known as *yerba buena* is a trailing perennial, indigenous to the Pacific Coast. Power and Salway have obtained besides 0.16 per cent. of a volatile oil with a mint-like odor, two new alcohols, which they named *micromol*, and *micromeritol*, and a phenol, *xanthomicrol*. (*J. Am. C. S.*, 1908, 251.) The fluidextract prepared from this plant has been used popularly as an emmenagogue. Dose, one-half to two fluidrachms (1.8-7.5 mils).

Mitchella. *Mitchella repens* L. *Squaw Vine. Partridge Berry. Checkerberry. Winter Clover.* (Fam. *Rubiaceae.*)—This small, indigenous evergreen has been supposed to possess remedial properties, and is said to be employed, in decoction, by the Indian squaws, to facilitate parturition. It appears to be diuretic, tonic, and astringent, resembling in these respects the pipsissewa, for which it is often substituted. E. Breneiser (*A. J. P.*, 1887, 228) found it to contain some resin, wax, mucilage, dextrin, and what appeared to be saponin.

Momordica. *Momordica Balsamina* L. *Balsam Apple. Balsamina.* (Fam. *Cucurbitaceae.*)—An annual climbing East Indian plant, cultivated in our gardens for the sake of the ornamental fruit. The latter is ovate, attenuated towards each extremity, angular, warty, not unlike a cucumber in appearance, of a lively red or

orange-yellow color, easily falling when touched, and spontaneously separating into several pieces. A liniment formed by infusing the fruit, deprived of its seeds, in olive or almond oil, is applied to *chapped hands, burns, piles, prolapsus ani*, etc.; and the mashed fruit is sometimes used as a poultice. According to Descourtiz, two or three drachms taken internally will kill a dog. An extract prepared from it is said to be useful in *dropsy*. Dose, six to fifteen grains (0.4-1.0 Gm.).

Monarda. *Monarda punctata* L. *Horsemint. Menthe de Cheval*, Fr. *Pferdeminze*, Gr.—This is an indigenous perennial or biennial labiate, growing in light gravelly or sandy soils from New York to Texas and west to Wisconsin. The whole herb is employed. It has an aromatic odor, and a warm, pungent, bitterish taste, and abounds in a volatile oil, which may be separated by distillation with water. Herman J. M. Schroeter (*A. J. P.*, 1888, 120) found the oil to consist of a hydrocarbon, $O_{10}H_{16}$ (56 per cent.), thymol, $O_{10}H_{14}O$ (25 per cent.), and higher oxygenated compounds, $C_{10}H_{18}O$. Kremera (*Ph. Rev.*, 1896, 223) examined the oil from authentic specimens and found it to yield from 56 to 61 per cent. of a phenol (thymol). Horsemint is stimulant and carminative, but is seldom used in regular practice. In the state of infusion it is occasionally employed in families as a remedy for flatulent colic and sick stomach, and for other purposes to which the aromatic herbs are applied. *Monarda fistulosa* L., *wild bergamot, Oswego tea*, an active diuretic (see *Proc. A. Ph. A.*, 1895, 256; 1896, 238), contains, according to J. W. Brandel and E. Kremers, *hydrothymoquinone, thymoquinone*, besides *cymene, carvacrol* and *limonene* (*Ph. Rev.*, 19.) The oil of *Monardacitriodora* Cerv., or *prairie bergamot*, according to Brandel (*P. J.*, 53, 547), contains 65 per cent. of a phenol and 1.2 per cent. citral. See also *MidlandDruggist*, 1910, 526, and a paper by Nellie Wakeman in the *Proc. A. Ph. A.*, 1910, 979. For the composition of monarda oils see *Ph. Archiv.*, 1899, 73.

Monesia.—A South American vegetable extract, which is believed to be derived from the bark of *Lucumai glycyphloea* Mart. and Eichl. (Fam. *Sapotaceae*), a tree of moderate size, growing in the forests near Rio Janeiro and elsewhere in Brazil. (*J. P. C.*, 3e ser., vi, 63.) The bark, which has also entered commerce, is in pieces, some of which are three or six mm. thick, is very compact and heavy, of a deep brown or chocolate color, contrasting strongly with the grayish color of the epidermis when this remains, and of smooth fracture. The extract is of a dark brown almost black color, very brittle, the fracture neither very dull nor very shining, and of a taste at first sweet, then astringent, and ultimately acrid, the acidity being very persistent, and especially felt in the fauces. It is entirely soluble in water. The bark contains, according to Peckolt (*A. J. P.*, 1884, 626), *monesia-tannic acid*, which gives a black coloration with iron salts, gallic acid, *monesin*, an acrid, amorphous body, *lucumin*, a body crystallizing in silky needles, a bitter substance, glycyrrhizin, tartaric and citric acids, wax, etc. *Monesin*, which is considered as *identical with saponin*, $C_{32}H_{54}O_{18}$, was obtained by treating the bark or extract with alcohol, adding to the tincture an excess of calcium hydroxide in fine powder, filtering, evaporating the clear liquor to dryness, treating the residue with water and animal charcoal, filtering, and again evaporating to dryness. Thus procured it was in transparent, yellowish scales, which were easily pulverized, forming a white powder. It was uncrystallizable, readily soluble in alcohol and water, to the latter of which it gave the property of frothing, and

insoluble in ether. It had no power to saturate acids, was without odor, but had a slightly bitterish taste, followed by a decided and permanent acrimony in the posterior mouth and fauces. Monesia owes its activity prob. ably to this principle and to tannic acid.

Monesia is stomachic and feebly astringent, and has been used with asserted advantage in *diarrhea*, *hemoptysis*, *menorrhagia*, *scrofula*, *scurvy*, also as a local remedy in *leucorrhoea*, *ulcerations of the mouth and fauces*, and *ulcers*. It is applied to ulcers either by being sprinkled in powder upon the surface or in the form of ointment made with one part of the extract and seven parts of simple ointment. The dose of the extract is from two to half an inch to an inch in diameter, and several inches long. This is enclosed in a covering of silk or linen sewed firmly around it; and, when used, may be cut by a razor into transverse slices a few lines in thickness. By leaving a hole in the center of the cylinder, the combustion will be rendered more vigorous, and a deeper eschar produced.

Cauterization by fire has been used from time immemorial among savages, half-civilized, and intelligent communities, and is said to have been re-introduced into Europe by the early Portuguese navigators from the Far East. Though at one time much employed for the purposes of revulsion, this form of cauterization has fallen into complete desuetude. The details of its application are described in the 18th ed., *U. S. D.* The first sensation experienced is not disagreeable; but the operation becomes gradually more painful, and towards the close is for a short time very severe. The pain could probably be prevented by the use of cocaine.

Mongumo Bark.—For analysis of this Madagascar bark, which is said by E. M. Holmes to resemble the bark of *Ochrosia borbonica* J. F. Gmel (Fam. *Apocynaceae*), see *P. J.*, ix, 816. It was examined by Dragendorff, who found mongumic acid, resin, waxy substance, a glucoside soluble in water and alcohol, metarabic acid, fatty matter, calcium oxalate and a substance insoluble in alcohol and soluble in water.

Monsonia.—According to John Maberly (*L. L.*, Feb., 1897; July, 1898), certain South African plants belonging to the family of *Geraniaceae*, having large fleshy roots, are valuable remedies in the treatment of both acute and chronic dysentery; such are especially *Monsonia ovata* Cav. and *M. Burkeana* Planch., also certain *Pelargoniums*. Under the name of *t'Namie*, the natives of Namaqualand are said to use the root of *Pelargonium antidysentericum* Kostel. Maberly believes that the *Pelargoniums* are especially valuable in ulceration of the stomach and upper portions of the intestinal tract, and the *Monsonias* when the disease is low down in the intestines. The dose of monsonia is given as half an ounce (15.5 Gm.). It is believed that the plants are not poisonous. Dose, of the saturated tincture, from one to two fluidrachms (3.75-7.5 mls) every three or four hours.

Morinda.—From the wood of the *Morinda tinctoria* Roxb. (Fam. *Rubiaceae*), or *Indian Mulberry*, Anderson (*P. J.*, 1886) claimed to have obtained a glucoside *morindin*, which yielded on hydrolysis *trihydroxy-methyl-anthraquinone*. Oesterle (*A. Pharm.*, 1907, ccxiv), however, was unable to find this glucoside, but did obtain a

monomethyl-ether-tri-oxymethyl-anthra-quinone, $C_{16}H_{12}O_5$. *M. umbellata* L., *M. citrifolia* L., and the *M. longiflora* G. Don., all yield anthraquinone derivatives. (See Barrowcliff and Tutin, *Trans. British Chem. Soc.*, 1907.) These plants are used by the African aborigines as remedial agents, but there is no reliable evidence of their therapeutic value.

Moxa. *Moxa*, Fr. *Brenncylinder*, Gr.—These are small combustible masses used to produce an eschar by being burned in contact with the skin. In Japan and China they are made from the leaves or the downy hairs on the leaves and stems of one or more species of *Artemisia*. *A. chinensis* L. and *A. indica* Willd. (*A. vulgaris* L.) were indicated by the Dublin College; but Lindley states that it is the *A. moxa* of De Candolle which is employed. A similar *moxa* has been made in France, by a similar process, from the leaves of *A. vulgaris*. According to Percy, the dried stem of the ordinary sunflower may be used for moxa. Artificial moxas may be made by the following processes: One pound of cotton is introduced into a vessel containing two ounces of potassium nitrate dissolved in half a gallon of water, and a moderate heat applied till all the liquid is evaporated. The cotton, when perfectly dry, is formed into thin, narrow sheets, which are rolled round a central cord of linen, so as to form a cylinder from half an inch to an inch in diameter, and several inches long. This is enclosed in a covering of silk or linen sewed firmly around it; and, when used, may be cut by a razor into transverse slices a few lines in thickness. By leaving a hole in the center of the cylinder, the combustion will be rendered more vigorous, and a deeper eschar produced.

Cauterization by fire has been used from time immemorial among savages, half-civilized, and intelligent communities, and is said to have been re-introduced into Europe by the early Portuguese navigators from the Far East. Though at one time much employed for the purposes of revulsion, this form of cauterization has fallen into complete desuetude. The details of its application are described in the 18th ed., *U. S. D.* The first sensation experienced is not disagreeable; but the operation becomes gradually more painful, and towards the close is for a short time very severe. The pain could probably be prevented by the use of cocaine.

Muawin Bark.—This is the bark of a Mozambique tree, which in Eastern Africa is used as an ordeal poison. In appearance and structure it closely resembles the erythrophloeum bark obtained from numerous species of *Erythrophloeum* (Fam. *Leguminosae*). An alkaloid, *muawine*, was discovered in it by E. Merck, 1891. The hydro-bromide, a yellowish powder soluble in water and alcohol. The characteristic test is said to be that with vanadinsulphuric acid, which gives with muawine first a pale green, passing into a pale blue. (H. Jacobsohn, *In. Dis.*, Dorpat, 1892; see also *Merck's Jahresbericht*, 1891.) According to Jacobsohn, the hydrobromide when injected sub-cutaneously does not cause any irritation, but produces in frogs symptoms similar to those caused by digitalin, and in warm-blooded animals slowing of the pulse, increase of the heart action, elevation of blood pressure, and contraction of the arterioles. The action of muawine is, therefore, like that of digitalin, but is distinguished by being very temporary.

MUCILAGINES

MUCILAGES

Mucilages, *Fr.*; Schleime, *G.*; Mucilagines, *It.*

Mucilage, in the ordinary acceptation of the term, and in the sense in which it is employed in the U. S. Pharmacopoeia, is an aqueous solution of gum, or of substances closely allied to it. In the British Pharmacopoeia (1885) the term is applied also to the semi-liquid, jelly-like substance resulting from the cooling of a hot solution of starch.

MUCILAGO ACACIAE. U. S., Br.

MUCILAGE OF ACACIA Mucil. Acac.

Mucilage of Gum Arabic; Mucilage of Gum Acacia; Mucilage de Gomme, *Fr. Cod.*; Mucilage arabique, *Fr.*; Mucilago Gummi Arabici, *P. G.*; Gummischleim, *G.*; Mucilagine di gomma arabica. *It.*; Mucilago de goma arabica, *Sp.*

"Acacia, in small fragments, three hundred and fifty grammes [or 12 ounces av., 151 grains]; Distilled Water, a sufficient quantity, to make one thousand grammes [or 35 ounces av., 120 grains]. Place the acacia in a tared bottle or flask having a capacity not exceeding one thousand mils [or 33 fluidounces, 6% fluidrachms], wash the drug with cold water, allow it to drain, and then add enough warm distilled water to make the mixture weigh one thousand grammes [or 35 ounces av., 120 grains]. Securely stopper the container, and agitate it from time to time until the acacia is dissolved. Strain the Mucilage and preserve it in small, well-filled bottles in a refrigerator or in a cool place. Mucilage of Acacia should be frequently made and must not be dispensed if it has become sour or moldy." *U. S.*

"Gum Acacia, 100 grammes; Distilled Water, 150 millilitres. Rapidly rinse the Gum Acacia with a little water; then dissolve it in the Distilled Water in a closed vessel and strain. The Mucilage should be recently prepared. In India and the Eastern Divisions of the Empire, Mucilage of Indian Gum may be employed in making the official preparations for which Mucilage of Gum Acacia is directed to be used (see 'Gummi Indicum')." *Br.*

The gum used for this purpose should be in small fragments or coarse powder, as it is more readily dissolved in this state than when finely pulverized. Straining is necessary to separate the foreign substances which are often mixed with gum arabic. This mucilage is semi-transparent, almost colorless, if prepared from good gum, viscid, tenacious, of a feeble, peculiar odor, and nearly tasteless. By straining a solution of gum through a layer of freshly precipitated alumina it can be almost entirely decolorized, particularly if the operation be repeated several times. By keeping, the mucilage becomes sour, and this happens even though it be enclosed in well-stoppered bottles; but, according to Guerin, the solution of pure gum undergoes no change *in vacuo*. Heat in its preparation is

said to favor the production of acid, and hence cold has been substituted for boiling water in the present formulas. The U. S. P. VIII directed the addition of lime water in making this mucilage; this addition has proved advantageous by neutralizing the acidity generally found in acacia and it promotes stability, but the U. S. P. IX process deleted the lime water. According to R. Bother (*A. J. P.*, xlv, 113), if glycerin be employed in the proportion of one to eight of the mass, and the mixture of water and glycerin be added to the gum in a bottle and solution secured by agitation at intervals over several hours, the resulting mucilage does not spoil; the presence of glycerin is objectionable, however, for many of the uses of mucilage of acacia. E. D. Oesch (*West. Drug.*, 1892, 38) adds about 6 per cent. of alcohol as a preservative. Keller preserves the mucilage by the addition of acetanilid (two grains in the fluid-ounce). (*C. D.*, 1896, 378.) Archer & Co. have found (*A. J. P.*, xlvi, 469) that if "Tolu water" be substituted for water the mucilage will keep for months. The Tolu water is made by rubbing two drachms of the tincture with magnesium carbonate and two pints of water, and filtering. Mucilage is employed chiefly in the making of pills, and in suspending insoluble substances in water. In prescribing it for mixtures, it should be recollected that it is a solution of definite strength, containing, according to the U. S. formula, half an ounce of the gum to each fluidounce of mucilage. The British mucilage is a little stronger. The adhesiveness of the mucilage is stated to be very much increased by the addition of one part of aluminum sulphate to one hundred and twenty-five parts of the mucilage, but this would not be permissible for a mucilage intended for medicinal purposes.

MUCILAGO GUMMI INDICI. Br.

MUCILAGE OF INDIAN GUM

"Indian Gum, 50 grammes; Distilled Water, 150 millilitres. Rapidly rinse the Indian Gum with a little water; then dissolve it in the Distilled Water in a closed vessel and strain. The Mucilage should be recently prepared. In India and the Eastern Divisions of the Empire, Mucilago of Indian Gum may be employed in making the official preparations for which Mucilage of Gum Acacia is directed to be used (see 'Gummi Indicum')." *Br.*

This mucilage was made official in the British Pharmacopoeia (1914); it is not as adhesive as the mucilage of acacia.

MUCILAGO TRAGACANTHAE. U. S., Br.

MUCILAGE OF TRAGACANTH Mucil. Trag.

Mucilage de Gomme Adragante, *Fr. Cod.*, Mucilag adragant, *Fr.*; Traganthschleim, *G.*; Mucilagine di gomma adragante, *It.*

"Tragacanth, six grammes [or 93 grains]; Glycerin, eighteen grammes [or 278 grains]; Water, a sufficient quantity, to make one hundred grammes [or 3 ounces av., 231 grains]. Mix the glycerin with seventy-five mils [or 2 fluidounces, 257 minims] of water in a tared vessel, heat the mixture to boiling, remove the heat, add the tragacanth, and macerate during twenty-four hours, stirring occasionally. Then add enough water to make the mixture weigh one hundred grammes [or 3 ounces av., 231 grains], beat it until of a uniform consistence, and strain it forcibly through muslin." *U. S.*

"Tragacanth, in powder, 1.25 grammes; Alcohol (90 per cent.), 2.50 millilitres; Distilled Water, sufficient to produce 100.00 millilitres. Mix the Tragacanth with the Alcohol; add the Distilled Water as quickly as possible, and shake vigorously." *Br.*

A part only of tragacanth is soluble in water. The remainder swells up and forms a soft tenacious mass, which may be mechanically mixed with water, but does not form a proper solution. Hence trituration is

necessary to complete the incorporation of the ingredients. This mucilage is thick and very viscid, but not permanent, as the water separates from the insoluble portion of the tragacanth on standing. It is chiefly used in making pills and troches. The addition of glycerin renders it more serviceable as an excipient. From its great tenacity, it may be advantageously employed for the suspension of heavy insoluble substances, such as the metallic oxides, in water. When kept long, it is apt to undergo decomposition, and to become offensive, but it will keep well if phenol be added. (A. J. P., 1864.) Lyon (P. J., 1901, 600) recommends the use of chloroform water as a preservative in making this mucilage; this is preferred in all cases if the mucilage is not to be used internally. The alcohol in the British process facilitates the quick production of the mucilage, and in addition acts as a preservative.

Mucuna. *Mucunapruriens* De Cand. *Cowhage*. *Cowage*. *Setae Siliquae Hirsutae*. *Pois veins*, *Pois a gratter*, Fr. *Kratzbohnen*, *Kuhkratze*, G.—This is a leguminous climbing plant which grows in the West Indies and tropical countries of both hemispheres. The fruit is a coriaceous pod, shaped like the Italic letter *f*, about four inches long, and covered with brown bristly hairs, which easily separate, and when handled stick in the fingers, producing an intense itching sensation.

The spicula are said to be very destructive to the *round worm*, acting mechanically by penetrating their bodies. Neither the tincture nor the decoction is effective. Cowhage is efficient, but so disagreeable that it has passed out of vogue. The usual mode of preparing it is to dip the pods into syrup or molasses, and scrape off the hairs with the liquid, which is in a proper state for administration when it has attained the consistence of thick honey. The dose of this preparation is a tablespoonful (15 mils) for an adult, a teaspoonful (3.75 mils) for a child three or four years old, to be given every morning for three days, and then followed by a brisk cathartic.

Muir-Puama.—The wood of a Brazilian tree, believed to be from *Liriosma ovata* Miers (Fam. *Olacaceae*), which, according to Th. Peckolt, contains an alkaloid, *muir-puamine*, and is used by the Brazilian aborigines as an aphrodisiac, also in the treatment of *dysentery*. In *impotence*, ten to twenty minims (0.6-1.3 mils) of the fluidextract may be taken three or four times a day. (See M. R., 1902.)

Mulberry.—There are in the United States three species—the indigenous *Morus rubra* L., with dark purple fruit; *M. alba* L., introduced from Europe, and at one time extensively cultivated as a source of food for the silk worm, having a white fruit; and *M. nigra* L., a tree of middle size, supposed to have been brought originally from Persia into Italy and widely cultivated. The fruit of the last species has a sweet, mucilaginous, acidulous taste, and abounds in a deep red juice having the sp. gr. 1.060. (*Mori.Sucous*, Br., 1885.) For analysis of mulberries see *U. S. D.*, 19th ed., p. 1573. In amount of grape sugar the mulberry is surpassed only by the cherry, 10.79, and the grape, from 10.6 to 19.0. Mulberries are refreshing and laxative, and serve to

prepare a grateful drink well adapted to febrile cases.

Muscari. *Muscari comosum* (L.) Mill. (Fam. Liliaceae.)—In the bulbs of this plant Curci (*Rep. de Pharm.*, March, 1889) has found comosic acid, which he believes to act physiologically like saponin.

Musenna Abyssinica.—A substance known as *taeniol* which is claimed to be derived from the rind of the *Musenna abyssinica*, has been recommended as a vermifuge especially for the treatment of *anchylostoma*. According to Liermberger (*B. K. W.*, 1905, p. 390), it is an efficient and non-toxic anthelmintic. The only unpleasant symptom produced was slight giddiness. It is marketed only in the form of capsules of which 10 to 15 may be taken at intervals of ten minutes. After the sixth or seventh capsule there should be allowed an interval of an hour.

Mushrooms and Toadstools. (*Edible and Poisonous Fungi.*) —Notwithstanding the fact that it has been shown that edible fungi, when compared with other articles of food, do not possess a high food value, the interest in the study of the Fungi, as well as the consumption of edible forms, is constantly increasing. The study of the fungi is one of the most highly specialized, as there have been up to the present time no less than 64,000 species described. From a food standpoint the differentiation of the edible from the poisonous is one of the most difficult that the novice can undertake, as it is almost impossible to lay down any invariable rules.

The fungi are divided into a number of classes, each of which is again subdivided into sub-classes, series, and families. The family of *Basidiosporeae* include the largest and most conspicuous of the fungi and all of the mushrooms and toadstools. It is commonly believed that mushrooms are edible and that toadstools are poisonous; in reality, however, no such distinction should be made. The plants of the *Hymenomycetes* are characterized in general in that they arise from a mass of colorless threads, known as "mycelium" or "spawn," produced in the ground, bark of trees, etc. Their first appearance above ground is marked by the production of small solid balls (called buttons), which gradually enlarge, and at length shoot up into a stem or stipe bearing at its summit the umbrella top or "pileus," which is at first closed around the stalk like a closed umbrella and then expands more or less widely, according to the species. The under side of the pileus is the part which bears the spores, which correspond to the seeds of higher plants. In some cases the under surface consists of a series of gills resembling knife blades, which radiate from the top of the stalk to the circumference, like the spokes of a wheel, as in *Agaricaceae*; in others it consists of a mass of small pores or tubes packed closely together, side by side, as in *Polyporaceae*; in others of teeth, as in *Hydnaceae*; in others only slightly wrinkled or undulated, as *Thelephoraceae*, etc. The *Basidiosporeae* include about 14,000 species which are included in nine orders and subdivided into twenty-five families. A few of the important are the following:

1.—*Agaricaceae* (the mushrooms and toadstools proper) comprises about 4600 species, some of which are poisonous, as the *Amanitas* (Fly and Deadly Agarics) *Lactarius* (with a milky juice), whereas others are edible, as *Agaricus* (*Psalliata*)

campestris L., the common mushroom, *Cantharellus cibarius*, Fr., etc.

2.—*Polyporaceae* (pore-fungi) includes about 2000 species, many of which are parasites on trees and destructive to timber; some are edible, as *Boletus edulis* Bull., whereas others are poisonous, as *B. satana* Lenz.

3.—*Hydnaceae* (teeth-bearing fungi); Most of the species are too small and woody to be eaten. *Hydnum repandum* forms "fairy rings" in woods.

4.—*Thelephoraceae*: Most of the species are small, and the larger species are tough and leathery.

5.—*Clavariaceae* (coral-shaped fungi) includes some large fungi; none are poisonous and some, as *Clavaria flava* Schaeff., are palatable.

Of these, the most important group are the *Agaricaceae*, both from the point of view of the toxicologist and the epicure.

It is not possible in this limited space to even mention the various poisonous and edible fungi that experience has demonstrated as such. The number of species which have been eaten or experimented with, however, is small compared to the number recognized by botanists. Many students of fungi have formulated rules for distinguishing edible from poisonous fungi. "The different popular tests for distinguishing edible from poisonous fungi, such as, for instance, the blackening of a silver coin or spoon when placed in a mass of poisonous fungi while they are being cooked, are all absolutely worthless." The only safe rule is to use no mushroom which the collector is not absolutely sure from previous experience is edible.

The common mushroom (*Agaricus campestris* L.) is practically the only species cultivated in this country, and is the only fresh species sold in the northern markets during the winter months. It is found wild in open grassy fields and pastures in great abundance in August and September. It is not common on the mountains, never found in woods, and never grows on trees or fallen trunks. The color of the stalk and pileus varies from a whitish shade to drab, but the color of the gills, a point which should never be overlooked, is at first pinkish and then a brownish-purple. The stalk is cylindrical and solid, and has, rather more than half way up, a membranous collar called the ring; but there is no membrane or scales found at the base of the stalk, which appears to come directly out of the ground. "In specimens which are not fully expanded there is a thin membrane or veil which extends from the stalk to the margin of the pileus. When the veil is ruptured, exposing the gills behind, a part remains attached to the stalk, forming the ring already referred to. In older specimens the ring shrinks, but generally a mark remains showing where it has been attached."

Two of the most poisonous forms resembling the common mushroom, and which have been eaten in mistake for it, are the deadly agaric and fly agaric.

The fly agaric (*Amanita muscaria* (L.) Pers.), so called because decoctions have been used for killing flies, is in some localities much more abundant than the common

mushroom. It is seldom found in the grassy pastures preferred by the common mushroom, but more generally in poor soil, especially in groves of coniferous trees. "It grows singly and not in groups and differs from the common mushroom in having gills which are always white, never pink or purple and in having a hollow stem, which is bulbous at the base and clothed with irregular fringy scales on all the lower part. The pileus varies in color from a brilliant yellow to orange and a deep red, the yellow and orange being more frequent than the red. The surface is polished, and has scattered over it a larger or smaller number of prominent, angular warty scales which can be easily scraped off. The gills and stalks are white, and there is a large membranous collar which hangs down from the upper part of the stem."

The deadly agaric (*Amanita phalloides* (Pers.), Fr.), so named because it probably has been more frequently the cause of death than any other fungus, prefers a damper and less sandy soil than the fly agaric and is not pre-eminently an inhabitant of grassy pastures. "The pileus is often a shining white, but may be of any shade from a dull yellow to olive, and when wet is more slimy than the common mushroom or the fly agaric. It has no distinct scales and only occasionally a few membranous patches on the pileus. The gills and stalks are white, and the latter has a large ring like the fly agaric and is hollow, or when young, is loosely filled with cottony threads, which soon disappear. The base of the stalk differs from that of the fly agaric in being more bulbous and in having the upper part of the bulb bordered by a sac-like membrane called the volva. The volva is often of considerable size but more frequently is reduced to a membranous rim."

The list of edible and poisonous fungi are relatively long, and while most belong to the *Hymenomycetes*, some are also yielded by the *Gasteromycetes*, as the puff-balls. The giant puff-ball, *Lycoperdon bovista* (*L. giganteum* Batsch), is found in the region of San Francisco Bay, not rarely forty inches in diameter.

We may conveniently consider the poisonous mushrooms in four groups following the divisions of Kobert. (*Ueber Pilzvergiftung*, 1891.)

In the first group is the genus *Lactarius* which owe their toxic properties to the presence of an irritant resin. Some of this genus, as *L. deliciosus*, are stated to be edible, but most of them produce severe or even fatal gastric enteritis.

The second group contains species belonging to the genus *Helvella*, whose juice contains helvellaic acid, isolated by Boehm. It is asserted that these fungi, when thoroughly dried are not poisonous, and that hot water also extracts from them the poisonous acid, so that boiling makes them edible. The chief physiological action of the acid seems to be to destroy the red blood corpuscles, and, probably by such action, to produce vomiting, hemoglobinuria, jaundice, irritation of the kidneys, etc.

The third and most important group are the *Amanitas*. They are the most common source of mushroom poisoning, not only because of their resemblance to many of the edible species, but also because of the virulence of their effects. The most important of this species is the *A. phalloides*, or *skunk mushroom*. According to Ford (*J. P. Ex. T.*, 1910,1, p. 275), they contain two poisonous substances, one being hemolytic, and the

other causing degenerative changes in the various internal organs, especially the liver, kidney, spleen and muscles. The *Amanita-hemolysin*, which is probably identical with the *Phallin* of Kobert, appears to be glucosidal, and because it is destroyed by heat, probably plays little part in human poisoning. The nature of *amanita-toxin* is not yet determined, but poisons of a similar nature appear to be widespread throughout the whole of the genus.

In the fourth group are included those which contain *muscarine*. This alkaloid was first obtained from the *Amanita muscaria*, but is also found in the *A. pantherina*, the *Russula, emetica*, in *Boletus luridus*, *B. Satanus*, and, according to Ford (*J. P. Ex. T.*, 1911, ii, p. 549), occasionally also in the *Clitocybe dealbata*, which has by some been classed as an edible fungus. Decoctions of the *Amanita muscaria* are used to poison flies, whence the common name of the fly agaric. The inhabitants of the Caucasus also use this fungus as an intoxicant. The *A. pantherina* is used in Japan for like purposes.

Muscarine was first obtained in a state of purity by Schmiedeberg and Koppe. (*Das Muscarin*, Leipzig, 1869.) The alkaloid may be produced artificially by gently heating choline platino-chloride with strong nitric acid. Potassium chloride is used to decompose the muscarine platino-chloride and produce muscarine hydrochloride; treatment with moist silver oxide yields the muscarine as a hydrate ($C_5H_{15}O_3NH_2O$). Muscarine resembles pilocarpine in its physiological action, and is antagonistic to atropine. It increases the secretions of the sweat, salivary and lachrymal glands, contracts the pupil, slows the pulse, and causes motor weakness. The reduction in the pulse rate is due to stimulation of the pneumogastric nerve, and after very large doses diastolic arrest occurs. If atropine be given so as to paralyze inhibition the cardiac movements reoccur. The vasomotor nerves are said to be paralyzed. There is a stimulation of the muscles of the intestines, bladder and spleen. Thus the intestines are transformed into hard, white cords, or afterwards, becoming somewhat relaxed, exhibit a tumultuous peristalsis. The abdominal secretions are greatly increased.

The symptoms of mushroom poisoning will vary greatly according to the special fungus which has been ingested. In the case of the deadly agaric (*Amanita phalloides*) which is the most common source of toadstool poisoning, the symptoms usually do not appear for several hours after the fungus has been eaten. They consist of great prostration and collapse, cold sweats, stupor, sometimes preceded by delirium, convulsions, frequently cyanosis and not rarely icterus. There is usually, also distinct fever and either hemoglobinuria or methemoglobinuria, and evidence of irritation of the kidney is shown by the presence of albumen, or partial suppression of the urine. When the poisoning is produced by fly agaric, to these symptoms will be added those of muscarine poisoning, namely, profuse salivation, contracted pupils and slowing of the pulse. In the poisoning by the lactarii the symptoms are those simply of violent inflammation of the alimentary tract, vomiting, purging and collapse. In poisoning by the *Helvellae* the symptoms resemble those produced by the *Amanitas*.

Little can be done to save the patient. Our utmost efforts should be directed to preventing absorption. A promptly acting emetic, such as apomorphine, should be

administered to produce vomiting. Secheyon (*P. J.*, 1910, liiiv, p. 492) highly recommends animal charcoal for the purpose of absorbing the poison, and thus preventing its entrance into the system. At least a table-spoonful, stirred up in water, should be administered, and repeated libitum. It is also advisable to administer atropine hypodermically in one-sixtieth-grain doses (1 mgm.), as it is the physiological antagonistic to muscarine, and may prove a life-saving remedy in poisoning by fly agaric, and by its general stimulant effect will also exercise a feeble influence in combating the collapse even although due to other forms of poisoning. A rapidly acting cathartic should also be administered to cleanse the intestinal tract. Aside from these measures, the treatment is purely symptomatic—the use of opium if necessary to check the diarrhea and vomiting, and various stimulants to maintain the circulation and respiration.

B. W. Richardson, having noticed that the smoke of the *Lycoperdon Proteus* or *puff-ball* was used for stupefying bees, found that the inhalation of the fumes caused various animals to become insensible. He has himself inhaled the fumes clarified by passing them through water, and experienced symptoms of intoxication and drowsiness. (*M. T. G.*, 1853, 610.) Thornton Herapath, however, maintains, as the result of his experiments, that these anesthetic effects are in reality not owing to any narcotic principle present in the fungus, but to the carbon dioxide gas generated during their combustion. (*Philos. Mag.*, July, 1855.)

Mutisia. *Mutisiaviciaefolia* Cav.—This composite, a native of Chile, is stated to be a valuable anti-spasmodic, useful in *hysteria* and *croup*; it is also a cardiac tonic.

Myrica. *N. F. IV.* *Myrica cerifera* L. *Wax Myrtle. Bayberry. Candle Berry. Arbre a suif, F. Wachsbaum, Wachsgagel, G.*—"The dried bark of the root of *Myricacerifera* Linne (Fam. *Myricaceae*), without the presence of more than 5 per cent. of adhering wood." *N. F. IV.*

This is an indigenous myrtaceous shrub growing in great abundance in the sandy soil along the seashore, and even on the shores of our northern lakes. The leaves of the wax myrtle have resinous dots on both sides, and are very fragrant when rubbed. The fruit is covered with a coating of white wax, and sometimes continues on the plant for two years or more. The coating of wax upon the surface is collected, and known in commerce as *myrtle wax*. (See *Vegetable Wax*.)

For a study of the *Myricaceae* of the Eastern United States, see Youngken. (*A. J. P.*, 1915, p. 391.) The bark of the stem and root is supposed to possess valuable remedial properties, and has been employed to a considerable extent. It yields its virtues to water and alcohol. George M. Ham-bright found in it volatile oil, starch, lignin, gum, albumen, extractive, a red coloring substance, tannic and gallic acids, an acrid resin soluble in alcohol and ether, an astringent resin soluble in alcohol and not in ether, and a peculiar acrid principle having acid properties. (*A. J. P.*, 1863, 193.) Myrtle wax consists of the glycerides of stearic, palmitic, and myristic acids and a small quantity of oleic acid. (Lewkowitsch, *Oils, Fats, and Waxes*, p. 542.)

The National Formulary IV describes the bark as: "In quills or quilled pieces or strips, of variable length and up to 20 nun. in breadth, the bark rarely exceeding 2 mm. in thickness; outer surface varying from dark-brown to gray-brown, occasionally slightly silvery, somewhat lustrous, at least in patches, bearing occasional warts or slight transverse ridges, the periderm frequently much wrinkled; inner surface deep rusty-brown, finely short-striated and somewhat roughened; fracture short and weak, light brown in the outer layer, yellowish-brown in the inner layer. Odor characteristic, rather disagreeable; taste astringent, mildly bitter and slightly acrid." *N. F. IV.*

The bark appears to be moderately tonic and astringent, and in large doses emetic, it has been considerably used by the eclectics in *diarrhea*, *jaundice*, *scrofula*, etc. Externally the powdered bark is used as a stimulant to indolent *ulcers*, and the decoction as a gargle and injection in chronic *inflammation of the throat*, *leucorrhea*, etc. Dose of the powder, twenty to thirty grains (1.3-2.0 Gm.), of a decoction (one ounce to one pint), one or two fluidounces (30-60 mils). An alcoholic extract, very inappropriately named *myricin*, is given in the dose of about five grains (0.32 Gm.).

From the bark of *Myrica Nagi* Thunb., the yellow coloring matter of which is known as *myricetin*, A. G. Perkin has separated a glucoside, *myricetrin*, closely resembling *quercitrin*. (See *Proc. Chem. Soc.*, xviii, 11.) For analysis of the rhizome, *Myrica asplenifolia* L., see *A. J. P.*, 1892, 303.

The leaves of the *Myrica Gale* L. (*sweet gale*) or *Dutch myrtle* have been used in France as an emmenagogue and abortifacient, and were formerly official in that country under the name of *Herba Myrti Rabantini*. They contain a poisonous volatile oil.

MYRISTICA. U. S., Br.

MYRISTICA Myrist. [Nutmeg]

"The ripe seeds of *Myristica fragrans* Houttuyn (Fam. *Myristicaceae*), deprived of the arilli and seed-coats. Preserve the kernels in tightly-closed containers, adding a few drops of carbon tetrachloride or chloroform from time to time to prevent attack by insects. Reject broken or wormy kernels." *U. S.* "Nutmeg is the dried kernel of the seed of *Myristica fragrans*, Houtt." *Br.*

Muscade, *Fr. Cod.*; Nux Moschata, Noix muscade, *Fr.*; Semen Myristicae, *P. G.*; Muskatnuss, *G.*; Noce moscata, *It.*; Nuez moscada, *Sp.*

The nutmeg tree is about thirty feet high, with numerous branches, and an aspect somewhat resembling that of the orange tree. The leaves are alternate, petiolate, oblong-oval, pointed, entire, bright green and somewhat glossy on their upper surface, whitish beneath, and of an

aromatic taste. The staminate and pistillate flowers are upon different trees. The former are disposed in axillary, peduncled, solitary clusters; the latter are single, solitary, and axillary; both are minute and of a pale yellowish color. The fruit, which appears on the tree mingled with the flowers, is round or oval, of the size of a small peach, smooth, at first pale green, but yellow when ripe, and marked with a longitudinal furrow. The external covering, which is at first thick and fleshy and abounds in an austere, astringent juice, afterwards becomes dry and coriaceous, and, separating into two valves from the summit, discloses a scarlet reticulated membrane or arillus, commonly called *mace*, closely investing a thin, brown, shining shell, which contains the kernel or *nutmeg*. The nutmeg tree is a native of the Moluccas and other neighboring islands, and abounds especially in that small cluster distinguished by the name of Banda, whence the chief supplies of nutmegs were long derived. But numerous varieties of the plant are now cultivated in Sumatra, Java, Singapore, Penang, Ceylon, and other parts of the East Indies, and have been introduced into the Isles of France and Bourbon, Cayenne, and several of the West India islands. Various species of the genus *Myristica*, other than those which are official, yield commercial seeds or products:

The larger part of the nutmegs of commerce is said still to come from the Dutch Banda Islands. The Penang nutmegs are distinguished by not being limed. The tree is produced from the seed. It does not flower until the eighth or ninth year, after which it bears flowers and fruit together, without intermission, and is said to continue bearing for seventy or eighty years. Little trouble is requisite in its cultivation. A branch of the staminate tree is grafted into all the young pistillate plants when about two years old, so as to insure their early fruitfulness. J. H. Hart presented an interesting report (*Bull. Bot. Dept.*, Trinidad, 1907, p. 202) showing that 16-year-old nutmeg trees growing in Trinidad bear both staminate and pistillate flowers. Indeed, he found both kinds of flowers on the same branch of the tree, and he therefore suggests that an attempt should be made to perpetuate this variety by grafting.

In the Moluccas the tree yields three crops annually. The fruit is gathered by hand, and the outside covering rejected. The arillode, constituting the mace of commerce, is then carefully separated, so as to break it as little as possible. It is flattened, dried in the sun, and afterwards sprinkled with salt water, with the view of contributing to its preservation. The nuts are dried in the sun or by ovens, and exposed to

smoke until the kernel rattles in the shell. They are then broken open, and the kernels, having been removed and steeped for a short time in a mixture of lime and water, in order to preserve them from the attacks of worms, are now cleaned, and packed in casks or chests for exportation. Lumsdaine has found them to keep better if rubbed over with dry lime than when prepared in the moist way. (See *Am. J. Sci.*, Nov., 1851.) Tschirch confirms the value of liming as a preservative against the attacks of insects. (*Ph. Rev.*, 1898, 196.) This is, however, not sufficient protection, as the commercial nutmegs are sometimes "wormy." Nutmegs are brought to this country either directly from the East Indies or indirectly from England and Holland. They are also occasionally imported in small quantities from the West Indies.

The amount of unground nutmegs imported into the United States averages about two million pounds a year.

Properties.—*Myristica* is officially described as "ovoid or ellipsoidal, from 20 to 30 mm. in length and about 20 mm. in thickness; externally light brown to dark brown, re-ticulately furrowed, the broad end with a large, circular upraised scar from which arises a furrow extending to the chalaza; easily cut, the surface having a waxy luster and mottled by reason of the light brown perisperm penetrating into the yellowish-brown endosperm; a longitudinal section through the endosperm above the large scar shows a small irregular cavity with the more or less shrunken remains of the embryo, and usually containing a growth of mold; odor and taste agreeably aromatic. The powder is dark reddish-brown; consisting of irregular, yellowish-brown or brownish-black fragments; fragments of perisperm yellowish-brown with large, circular or elliptical oil reservoirs containing a volatile oil, small, thin-walled parenchyma cells, and occasional spiral tracheae; parenchyma cells of endosperm more or less polygonal and filled with starch grains and aleurone grains; starch grains single or compound, the individual grains being spherical, plano-convex or polygonal, from 0.003 to 0.02 mm. in diameter and colored blue with iodine T.S. (distinction from starch grains in mace, which are colored yellowish-red); mounts in hydrated chloral T.S. show numerous globules of a fixed oil which later may separate in the form of rod-like crystals; mounts in fixed oil show the separation of spheroidal aggregates of crystals which polarize light strongly. The powder made from 'limed' nutmegs show under the microscope, upon the addition of water containing 25 per cent. of sulphuric acid, the immediate separation of crystals of calcium sulphate

in the form of small needles or short rods which do not polarize light. Myristica yield's not more than 5 per cent. of ash." *U. S.*

" Broadly oval or rounded, rarely more than twenty-five millimetres long; greyish-brown externally, marked with reticulated furrows, and minute black points and lines; internally greyish-red with darker brownish-red veins. Transverse section marbled. Strong aromatic odor; taste aromatic, warm and somewhat bitter." *Br.*

The microscopical structure of nutmeg and mace have been well illustrated by Winton and Moeller in the "*Microscopy of Vegetable Foods.*" Spaeth has recently made an interesting contribution to the pharmacognosy of nutmeg and the detection of the prevalent adulterations in *Ph. Zentralh.*, xlix, p. 627. It has been stated that much of the ground nutmeg of commerce has been made from small, stunted and worthless nutmegs, so-called "grinding nutmegs." The powdered drug is sometimes adulterated with corn meal, powdered beans, curcuma and various nut-shells.

Under the names of *long, female, or wild nutmeg, Macassar nutmeg, Papua nutmeg, New Guinea nutmeg, horse nutmeg*, certain seeds have long been known in European commerce; they have finally become an important article of trade, nearly 77,000 kilos of them having been sold in Holland in the year 1894. These seeds have been variously ascribed to *M. fatua* Houtt. (*M. tomentosa* Thumb., *M. macrophylla* Roxb.), and other species of the genus *Myristica*, but by Bassermann and Warburg have in all their varieties been traced to the *M. argentea* Warburg, of New Guinea, from which country they are often taken to Macassar to finally enter commerce as Macassar nutmegs. (*P. J.*, 1898, 97.) The numerous varieties of these false nutmegs are readily reducible to two, which differ chiefly in size, the larger being commonly known as the Papua nuts, the smaller as the Macassar nuts. They are distinguished from the nutmeg by their greater length, their elliptical shape, their comparatively feeble odor and disagreeable taste, and by the absence of the dark brown veins. (Holmes, *P. J.*, lxxxii, p. 459.) Heckel has described two new so-called wild nutmegs from Madagascar. (*Rep. d. Pharm.*, 1909, p. 49.)

Clifford Richardson (*Bulletin U. S. Dept. Agriculture*, No. 13, 1887) gives as the average of three analyses of imported nutmegs: water, 5.56 per cent.; ash, 2.88; volatile oil, 3.23; fixed oil or fat, 34.22; starch, etc.,

39.62; crude fiber, 9.21; albuminoids, 5.28; total, 100.00. The volatile oil is obtained by distillation with water. (See *Oleum Myristicae*.) The virtues of nutmeg are extracted by alcohol and ether.

Nutmegs have been punctured and boiled in order to extract their essential oil, and the orifice afterwards closed so carefully as not to be discoverable unless by breaking the kernel. The fraud may be detected by their lightness. They are also apt to be injured by worms, which, however, attack preferably the parts least impregnated with the volatile oil. The Dutch were formerly said to heat them in a stove in order to deprive them of the power of germinating and thus prevent the propagation of the tree. The largest nutmegs now command the highest prices. They should be rejected when very light in weight, with a feeble taste and odor, worm eaten, musty, or marked with black veins.

The *concrete* or *expressed oil of nutmeg* (*Oleum Myristicae Expressum*, Br., 1885), often called oil of mace, or nutmeg butter, is obtained by bruising nutmegs, exposing them in a bag to steam, and then compressing them strongly between heated plates. A liquid oil flows out, which becomes solid when it cools. Nutmegs are said to yield from 10 to 12 per cent. of this oil, but Flickiger and Hanbury obtained as much as 28 per cent. (See analyses of Richardson, quoted previously.) A process for obtaining it by means of carbon disulphide has been proposed by Lepage, of Gisors, in France, and has received the sanction of the Society of Pharmacy of Paris. It consists' in treating the nutmeg, thoroughly comminuted, with three times its weight of the well-rectified liquid referred to, agitating the mixture frequently for 24 hours, expressing, repeating the process with two parts only of the menstruum, mixing the products of the itwo macerations, filtering in a covered vessel, and then distilling off the disulphide until the residue is entirely deprived of the solvent. (*J. P. C.*, 3e ser., xxxi, 28.) It would seem difficult to prevent the retention of a little of the solvent. The best nutmeg butter is imported from the East Indies in stone jars, or in rectangular blocks 10 inches long by 2% inches wide, wrapped in palm leaves. It is solid, soft, unctuous to the touch, of a yellowish or orange-yellow color, more or less mottled, with the odor and taste of nutmeg. It is composed, according to Schrader, of 52.09 per cent. of a soft oily substance, yellowish or brownish, soluble in cold alcohol and ether; 43.75 of a white, pulverulent, inodorous substance, insoluble in these liquids; and 4.16 of volatile oil. The pulverulent constituent, which received from Playfair the name of *myristin*, has a silky luster, melts at

31° C. (88° F.), and yields on saponification glycerin and *myristic acid*, $C_{14}H_{28}O_2$. *Myristin*, $C_3H_5(OC_{14}H_{27}O)_3$, is a true fat, or *glyceryl myristate*. It is also found in spermaceti, in cocoanuts, and in the fixed oil of linseed and poppy oil. It may be obtained directly from nutmeg by exhausting it by means of benzene, filtering the liquid, and allowing it to crys-tallize by spontaneous evaporation. To purify the product, it may be dissolved in a mixture of two parts of absolute alcohol and three of benzene with the aid of heat, then filtering the liquid while hot, and setting it aside. On cooling, it deposits the pure myristin in crystals. (*J. P. C.*, June, 1859, p. 471.) Analyzed by Koller, the expressed oil was found to contain, in 100 parts, 6 of a volatile oil analogous to the oil of mace, 70 of myristin, 20 of olein, 3 of resin, and 1 of salts, etc. (*A. Pharm.*, clxxiii, 280.) Wallach found in the volatile oil *pinene* and *dipentene* of the class of terpenes and Semmler found myristicol, $C_{10}H_{16}O$, which is liquid, and *myristicin*, a solid ester of the composition $C_{12}H_{14}O_3$. An inferior kind of the oil is prepared in Holland, and sometimes found in commerce. It is in hard, shining, square cakes, lighter-colored than that from the East Indies, and with less odor and taste. It is supposed to be derived from nutmegs previously deprived of most of their volatile oil by distillation. An artificial preparation is sometimes sold for the genuine oil. It is made by mixing various fatty matters, such as suet, palm oil, spermaceti, wax, etc., adding some coloring substance, and giving flavor to the mixture by the volatile oil.

Ucuhula nut is a round or oval seed of *Myristica surinamensis*. It is one-half to two-thirds of an inch in diameter, light brown, but usually covered by a blackish, thin, friable testa. Internally it resembles the nutmeg, but is distinguished by the presence of extraordinarily large and handsome albuminous crystalloids. These seeds are said to contain over 70 per cent. of a solid yellow fat, melting at 36° C. (96.8° F.). (See *A. J. P.*, 1886; also *A. Pharm.*, July, 1888.) The kernel of the fruit of the Brazilian *Myristica officinalis* Mart. (*M. Bicuhyba* Schott), resembles the nutmeg in form and structure, but is covered with a black shell marked with broad furrows. It contains crystals like those above spoken of, but less splendid and regular, and apt to be in three forms. It yields a fat (*bicuhyba fat*, or *bicuhyba balsam*) very much like that of the ordinary nutmeg, but having a rather sour, sharp taste, melting at 47° C. (116.6° F.). It contains a peculiar fatty acid, *bicuhybasteoric acid*. The *otoba fat* is the product of the fruit of *Myristica Otoba*. It is almost colorless, when fresh has a nutmeg-like odor, melts at 38° C. (100.4° F.),

and contains *myristin*, *olein*, and *otobite*. The latter principle crystallizes in shiny, colorless crystals, melting at 133° C. (271.4° F.). The fruit of *Virola sebifera* Aubl. (s. *Myristica sebifera* Lam.), also yields a fatty substance which is known as ocuba wax. The so-called *California nutmeg* is not a nutmeg at all, but the seed of a coniferous tree, *Torreya californica*. It is oblong, with a smooth, brownish, thin testa, and affords a marbled cross-section. Its odor and taste are terebinthinate. Neither are the *Jamaica* or *calabash nutmeg*, from *Monodora Myristica*, the *New Holland* or *plume nutmeg*, from *Atherosperma moschata*, and the *clove nutmeg*, from *Agathophyllum aromaticum*, true nutmegs.

Uses.—Nutmeg owes its medicinal and toxic properties solely to the volatile oil which it contains. Powdered nutmeg is rarely used in medicine alone, although it enters into the composition of a number of galenicals. The expressed oil is occasionally used as a gentle external stimulant and was an ingredient in the *Emplastrum Picis* of the 1885 British Pharmacopoeia. *Mace* possesses properties essentially the same as those of nutmeg.

Dose, five to twenty grains (0.32-1.3 Gm.).

Off. Prep.—Fluidextractum Aromaticum (from Aromatic Powder), *U. S.*; Pulvis Aromaticus, *U. S.*; Tinctura Lavandulae Composita, *U. S.*, *Br.*; Trochisci Sodii Bicarbonatis, *U. S.*; Pulvis Catechu Compositus, *Br.*; Pulvis Cretse Aromaticus, *Br.*; Spiritus Armoraciae Compositus, *Br.*; Acetum Opii, *N. F.*; Cordiale Rubi Fructus, *N. F.*; Pulvis Cretae Compositus, *N. F.*

MYROBALANUM. Br.

MYROBALANS

"Myrobalans are the dried immature fruits of *Terminalia Chebula*, Retz., usually distinguished in commerce as *Chebolic myrobalans*." Br.

Five varieties of these East India fruits are distinguished by authors. The most important are as follows: (1) *Myrobalani Chebula*. This is the only variety which is official. It is produced by the *Terminalia Chebula* Retz (*Buceras Chebula*). This by some is believed to be identical with the *T. Bellerica* noted below. The fruit is roundish or ovate, varying in size

from that of a hazel nut to that of a walnut. It consists of an exterior firm fleshy portion and an interior kernel which is light brown, inodorous and with a bitterish, astringent taste.

(2) *Myrobalani Bellericae*. This is obtained from the *T. Bellerica* Roxb. It closely resembles the previous variety but is of a more grayish brown color and is sometimes supplied with a short thick foot stalk which is lacking in the official form.

(3) *Myrobalani citrinae* vel *flava*. These are from a variety of the same tree which affords the chebula myrobalans, from which they differ only in being somewhat smaller, of a light brown or yellowish color, and of a taste rather more bitter. They were formerly sometimes sold in the shops of Philadelphia, under the name of *white galls*, to which, however, they bear no other resemblance than in taste.

(4) *Myrobalani indices* vel *nigrae*. These are thought to be the unripe fruit of *T. Buceras* (*Bucida Buceras*). They are ovate-oblong, from four to eight lines long and from two to three lines thick, of a blackish color, wrinkled longitudinally, and presenting, when broken, a thick brown mass, without kernel, but with a small cavity in the center. They are sourish and very astringent.

(5) *Myrobalani emblicae*. This variety is wholly different from the preceding, and derived from a plant having no affinity to the Terminaliae, of the fam. *Combretaceae*—namely, the *Phyllanthus Emblica* L. (fam. *Euphorbiaceae*).

Myrobalans are officially described in the Br. Pharm., 1914, as "irregularly ovoid or fusiform, from ten to thirty millimetres or more long and from five to fifteen millimetres wide; strongly shrivelled longitudinally, dark brown or nearly black; in transverse section dark, with a small central cavity; hard. No odor; taste very astringent." *Br.*

When the fruit is entire, it is blackish, spherical depressed, of the size of a cherry, presenting six obtuse ribs with as many deep furrows, and separating into six valves, and has a strongly astringent and acidulous taste. It is often in segments, as found in commerce. These fruits contain about 40 per cent. of tannin which is identical with gallotannic acid. They have occasionally been used for the commercial manufacture of tannin. The resulting product is less pure, however, than that from nut

galls.

Uses.—Myrobalans were in high repute with the Arabians, and were long employed by European practitioners, as primarily laxative and secondarily astringent, in various complaints, particularly *diarrhea* and *dysentery*. Pierre Apery states that when roasted they are still used in Turkey with excellent results in. *intestinal* catarrhs. (R. T., Dec., 1887.) Although the myrobalans are of various origin, they all probably depend for their physiological activity upon the presence of gallotannic acid. Procter states that they contain from 30 to 35 per cent. of gallotannic and ellagitannic acids.

The ointment is used as a local astringent.

The internal dose of myrobalans is one-half to one drachm (2.0-3.9 Gm.), given in the form of a powder.

Off. Prep.—Unguentum Myrobalani, *Br.*; Unguentum Myrobalani cum Opio, *Br.*

MYRRHA. U. S., Br.

MYRRH Myrrh. [Gum Myrrh]

"A gum-resin obtained from one or more species of *Commiphora* (Fam. *Burseraceae*)." *U. S.* "Myrrh is an oleo-gum-resin obtained from the stem of *Commiphora Myrrha*, Holmes, and probably other species." *Br.*

Arabian or Somali Myrrh, Herabol Myrrh; Gummi Resina Myrrha; Myrrhe, *Fr. Cod.*; Myrrha, *P. G.*; Myrrhe, *G.*; Mirra, *It., Sp.*; Murr, *Ar.*; Bowl, *Hindost.*

Though myrrh has been employed from the earliest times, it is still uncertain by what plant it is yielded. The *Amyris Kataf* of Forskhal, seen by that traveller in Arabia, was supposed by him to be the myrrh tree, but without sufficient proof. Afterwards Ehrenberg met on the frontiers of Arabia Felix with a plant from the bark of which he collected a gum-resin precisely similar to the myrrh of commerce. From the specimens of the plant taken by Ehrenberg to Germany, Nees von Esenbeck referred it to the genus *Balsamodendron* of Kunth, and

named it *Balsamodendron Myrrha*. It was not thought by De Candolle sufficiently distinct, but is now generally recognized under the name of *Commiphora*, first given it by Jacquin in 1797, and therefore preceding the name of Kunth by some 27 years. Berg found another species in Ehrenberg's collection, to which was attached a label by the discoverer, stating that he had collected myrrh from it, and proposed to call it *Balsamodendron ehrenbergianum*. (A. J. P., 1873, 314.) Both Oliver and Trimen agree that this plant is not specifically distinct from *B. Opobalsamum*. It is probable that there are gum resins from several species of the *Commiphora* which furnish commercial myrrh. Hildebrand (P. J., 1878, ix, p. 893) collected the *C. Myrrha* on the north Somali coast in 1873, and presents evidence to show that it yields myrrh. Although this view has been disputed, E. M. Holmes (Y. P. B., 1913, p. 453) supports it and this species is recognized by the British Pharmacopoeia. Defflers and Schweinfurth (*Ber. d. Pharm Ges. zu Berlin*, 1893), however, believe that genuine myrrh is yielded by *Commiphora abyssinica* (Berg.) Engl, which is found in Southern Arabia, Eritrea, and Northern Abyssinia. *C. Schimperi* (Berg.) Engl, occurring in the Yemen, Abyssinia, and from Kern to Tigre, is likely also to yield some of the commercial Arabian myrrh. It appears to be established that *C. Myrrha* produces myrrh, but it is probable that it is also yielded by other trees belonging to the genus *Commiphora*, which genus includes more than 60 species, natives of Arabia and Africa.

Commiphora Myrrha (Nees) Engler (Syn. *C. Myrrha* Holmes) is a small tree, with a stunted trunk, covered with a whitish-gray bark, and furnished with rough abortive branches terminating in spines. The leaves are ternate, consisting of obovate, blunt, smooth, obtusely denticulate leaflets, of which the two latter are much smaller than the one at the end. The fruit is oval-lanceolate, pointed, longitudinally furrowed, of a brown color, and surrounded at its base by the persistent calyx. The tree grows in Arabia Felix, in the neighborhood of Gison, in dwarfish thickets, interspersed among the *Acaciae* and *Euphorbiae*. The juice concretes spontaneously upon the bark.

Formerly the best myrrh was brought from the shores of the Red Sea by way of Egypt and the Levant, and hence received the name of *Turkey myrrh*, while the inferior qualities were imported from the East Indies, and were commonly called *India myrrh*. These titles have ceased to be applicable, as myrrh of all qualities is now brought from the East Indies, whither it is carried from Arabia and the northeastern coast of Africa.

Aden in the former region, and Berbera in the latter, would appear, from the statements of James Vaughan, to be the chief entrepots of the trade. (P. J., xii, 226.) It is usually imported in chests containing between one and two hundred-weight. Sometimes the different qualities are brought separate, but oftener more or less mingled. Only the best kind should be selected for medicinal use.

There are several varieties of myrrh recognized in commerce. The official description corresponds to that of that known as the Arabian myrrh or Somalian myrrh.

Another variety of myrrh coming from Arabia known as the *Fahdi myrrh* is described in the *Pharmacographia* as "occurring in irregular masses, seldom exceeding 1½ inches long, and having a somewhat gummy-looking exterior. The larger lumps seem formed by the cohesion of small, rounded, translucent, externally shining drops or tears. The fracture is like that of common myrrh, but less unctuous, and has not the whitish markings. The odor and taste are those of the ordinary drug." This myrrh is said to be collected on the hills about Shugraeea and Sureeae, east of Aden. "*Meetiya*," or *Arabian Myrrh of Dymock*, is said to be sold in India as true myrrh. It has a dull surface, a dark reddish-brown color, a more unctuous and waxy fracture, and has white marks like Somali myrrh, which it resembles in taste, but its odor is rather less fragrant. Yemen Myrrh, which is said by Hanbury to contain a resin which differs from that of Somali myrrh and the Arabian myrrh or Fahdi in that its solution in petroleum spirit does not give a violet color on the addition of bromine. This myrrh is said to enter commerce chiefly from Makulla via Aden and Bombay. It occurs in large pieces 1 to 3 inches long, irregularly rounded and characterized by a dark reddish-brown color with a similarly colored fracture free from white streaks. Odor and taste similar to Somali myrrh, but stronger and more rank.

Mecca balsam, according to G. Schweinfurth, is yielded by *Commiphora Opobalsamum*, from which it is collected in the valleys near Mecca. It is said to be the myrrh of the Bible, the error of translation having been made on account of the similarity of the old Hebrew word "mar" with the modern Arabic word "morr," the name of the true myrrh.

Properties.—Myrrh is "in rounded or irregular tears or masses, brownish-yellow or reddish-brown, and covered with a brownish-yellow

dust; fracture waxy, somewhat splintery, translucent on the edges, sometimes marked with nearly white lines; odor balsamic; taste aromatic; bitter and acrid. The powder is yellowish-brown; 0.001 Gm. of the powder, when added to a drop of fixed oil on a slide and examined under the microscope, shows numerous angular fragments varying in color from pale yellow to yellowish-brown; when mounted in hydrated chloral T.S. the color of the yellowish fragments is intensified; the addition of iodine T.S. to the powder, previously mounted in hydrated chloral T.S., may show the presence of a few starch grains varying in shape from spherical, polygonal, and narrowly ellipsoidal to somewhat pear-shaped, from 0.01 to 0.035 mm. in diameter; when mounted in phloroglucinol T.S. and hydrochloric acid the powder may show a few fragments of lignified tissues consisting of either sclerenchymatous fibers, or of small groups of stone cells, the individual cells of the latter with very thick, porous walls and from 0.015 to 0.05 mm. in length. Not less than 35 per cent. of Myrrh is soluble in alcohol. Myrrh yields not more than 8.5 per cent. of ash." U. S.

" In rounded or irregular tears, or masses of agglutinated tears, varying much in size; reddish-brown or reddish-yellow externally, dry, and more or less covered by a fine powder; brittle, the fractured surface irregular, somewhat translucent, of a rich brown color, oily, and frequently exhibiting whitish marks. Aromatic odor; taste aromatic, bitter and acrid. Not more than 70 per cent. insoluble in alcohol (90 per cent.). The solution obtained by boiling 0.1 gramme of coarsely powdered Myrrh with 2 millilitres of alcohol (90 per cent.), evaporated in a porcelain dish so as to leave a thin film, yields a residue which assumes a violet color in contact with nitric acid diluted with an equal volume of water. Ash not more than 5 per cent." *Br.*

Under the teeth it is at first friable, but soon softens and becomes adhesive. It is inflammable, but does not burn vigorously, and is not fusible by heat. Its sp. gr. is stated as 1.36. The inferior kind is in pieces much darker, more opaque, less odorous, and often abounding with impurities. We have seen pieces of India myrrh enclosing large crystals of sodium chloride, as if the juice had fallen from the tree and concreted upon the ground where this mineral abounds. Pieces of *bdellium*, and other gummy or resinous substances of unknown origin, are often mixed with it. Among these is a product which may be called *false myrrh*. It is in irregular pieces, of a dirty reddish-brown color, a vitreous brownish-yellow fracture, semi-transparent, of a faint odor of myrrh,

and a bitter balsamic taste. Myrrh is best purchased in mass, as in powder it is liable to adulterations not easily detected. It is sometimes admixed with small stones which are added when the myrrh is in a moist state. Much of the commercial article is contaminated with the so-called Somali myrrh which does not meet the Pharmacopoeia requirements. It is also adulterated with Senegal gum and chestnuts.

George F. Merson (*P. J.*, Jan., 1900, 42) proposes as a test of the quality of myrrh that it should yield not more than 5 per cent. of ash, which should be almost entirely soluble in diluted hydrochloric acid, and that when, exhausted with 90 per cent. alcohol and dried at 100° C. (212° F.) one gramme should not afford more than 0.6 Gm. of residue.

Myrrh is partially soluble in water, alcohol, and ether. Triturated with water it forms an opaque yellowish or whitish emulsion, which deposits the larger portion upon standing. Its alcoholic tincture is rendered opaque by the addition of water, but throws down no precipitate. According to Neumann, alcohol and water severally extract the whole of its odor and taste. By distillation a volatile oil rises, having the peculiar flavor of myrrh, and leaving the residue in the retort simply bitter. The gum-resin, is soluble in solutions of the alkalies, and, when triturated with them in a crystalline state, forms a tenacious liquid. Hence potassium carbonate may be used to facilitate its suspension in water. Hirschsohn recommends as a reagent for myrrh, trichloroacetalchloroform, which is obtained by conducting chlorine into seventy-five per cent. alcohol until turbidity ensues and two layers are formed; the lower of these is shaken with an equal volume of water and then with calcined magnesia and filtered. In one part by weight of the trichloroacetal thus obtained, four parts by weight of hydrated chloral are dissolved by heating. The syrupy reagent thus made, which fumes slightly in the air, gives a violet color with the smallest quantity of pure Herabol myrrh. Hirschsohn failed to get a similar reaction with any other resin, not even with Bisabol myrrh. (*Ph. Centralh.*, 1903, 809.) An analysis by Buickoldt gave 2.183 per cent. of volatile oil, 44.760 of resin, 40.818 of gum or arabin, 1.475 of water, and 3.650 of calcium and magnesium carbonate, with some gypsum and ferric oxide. The volatile oil has been called *myrrhol* or *myrrhenol*, and, according to Ruickoldt, has the formula $C_{10}H_{14}O$. Koehler (*A. J. P.*, 1890, p. 346) confirms this formula, and states that this body, while isomeric with thymol and carvol, is distinct from them. He found 7 or 8 per cent. of essential oil, instead of 2.18 as previously given. Gladstone (*J. Chem. S.* [2], 2, 1)

found that the oil had a sp. gr. of 1.0189 at 7.5° C. (45.5° F.), a boiling point of 266° C. (510.8° F.), and was laevorotatory. The resin, which he calls *myrrhin*, $C_{48}H_{32}O_{10}$, is neutral, but becomes acid when kept for a short time in fusion. In the latter state Buickoldt proposes to call it *myrrhic acid*. (*A. Pharm.*, lxi, 1.) Koehler has found in the portion soluble in alcohol an indifferent soft resin, to which he gave the formula $C_{26}H_{32}O_5$, containing three replaceable OH groups, and two dibasic resin acids, of the formulas $C_{26}H_{32}O_{16}$ and $C_{26}H_{32}O_9$. An investigation of the essential oil of Bisabol myrrh from the interior of the Somali country was made by W. Tucholka. (*Schism. Rep.*, Oct., 1897, 36.) He obtained by distillation 7.8 per cent. of an oil of 0.8836 sp. gr., boiling at from 220° to 270° C. 428°-518° P.). From this was separated, by means of the crystalline hydrochloride, a terpene boiling at from 259° to 260.2° C. (498.2°-500.36° F.), which the author calls *bisabolene*, and an oxygenated portion to which he gives the rather strange formula $C_{56}H_{96}O$. According to Bley and Diesel, myrrh containing a little volatile oil always has an acid reaction, which they ascribe to the oxidation of the oil. They also found formic acid in the specimen examined by them. The same investigators propose as a test of myrrh the production of a transparent dirty-yellow liquid with nitric acid, while false myrrh affords a bright-yellow solution in the same fluid, and bdellium is not dissolved, but becomes whitish and opaque. (*A. J. P.*, xviii, 228.) According to Righini, if powdered myrrh, rubbed for fifteen minutes with an equal weight of ammonium chloride, and fifteen times its weight of water gradually added dissolves quickly and entirely, it may be considered pure. Chas. E. Escott (*A. J. P.*, 1887) extracted a sample of myrrh with petroleum benzin, and on spontaneous evaporation of the solvent obtained 18.75 per cent. of oily residue. The gum left after treatment with alcohol had a barely perceptible odor of myrrh and a slightly mucilaginous taste, was neutral to test paper, and, though of a pale color, gave with water a dark-brown solution. The insoluble portion amounted to 15 per cent., or 8.4 per cent. of the weight of the myrrh. The diluted solution acquired a purple color by ferric chloride, changed to reddish-yellow by ammonia. Stronger solutions were precipitated by alcohol, not gelatinized by borax, and the precipitate with lead subacetate was not redissolved. The gum makes a good mucilage, and, when making tincture of myrrh, the residue insoluble in the alcoholic menstruum should be saved for that purpose.

Uses.—Myrrh is a stimulant tonic, with some tendency to the lungs,

and perhaps to the uterus. It is also employed as a tonic in *dyspepsia*, and as an expectorant and emmenagogue in *debilitated states* of the system, in the absence of febrile excitement or acute inflammation. The diseases in which it is usually administered are *chronic catarrh*, *phthisis pulmonalis*, other *pectoral affections* in which the secretion of mucus is abundant but not easily expectorated, *chlorosis*, *amenorrhoea*, and the various affections connected with this state of the uterine function. It is generally given combined with chalybeates or other tonics, and in *amenorrhoea* very frequently with aloes. It is used also as an application to *spongy gums*, the *aphthous sore mouth* of children, and various kinds of *unhealthy ulcers*.

A *plaster of myrrh* is made by rubbing together powdered myrrh, camphor, and balsam of Peru, of each an ounce and a half, then adding the mixture to 32 ounces of lead plaster previously melted, and stirring well until the plaster thickens on cooling. It is then to be formed into rolls. This plaster may be employed in all cases where a gentle and long-continued rubefacient effect is desired.

Myrrh may be given in the form of powder or pill, or suspended in water, as in the famous antihectic mixture of Griffith. (*Mistura Ferri Composita*.) The infusion is also sometimes given, and an aqueous extract has been recommended as milder than myrrh in substance. The tincture is used chiefly 'as a local application.

Dose, ten to thirty grains (0.65-2 Gm.).

Off. Prep.—Decoctum Aloes Compositum, *Br.*; Mistura Ferri Composita, *Br.*; Pilulae Aloes et Myrrhae, *N. F. (Br.)*; Pilulae Rhei Compositae, *U. S. (Br.)*, Tinctura Myrrhae, *U. S., Br.*; Pilulae Aloes, Hydrargyri et Scammonii Compositae (from Tincture of Aloes and Myrrh), *N. F.*; Pilulae Antiperiodicae, *N. F.*; Pilulae Antiperiodicae sine Aloe, *N. F.*; Tinctura Aloes et Myrrhae, *N. F.*; Tinctura Antiperiodica, *N. F.*; Tinctura Antiperiodica sine Aloe, *N. F.*; Tinctura Capsici et Myrrhae, *N. F.*

Myrtus. *Myrtus communis* L. *Myrtle*. (Fam. *Myrtaceae*.)—From the leaves of this plant is distilled a volatile oil which, under the name of myrtol is employed in medicine. This oil contains pinene, cineol and a characteristic alcohol, myrtenol. The mixture usually known as *myrtol* is collected between 160° and 180° C. (320°-356° F.). Myrtol has been recommended as an antiseptic and a powerful stimulant to the pulmonic and genito-urinary mucous membranes, and useful in chronic *bronchitis*, *cystitis*, or *pyelitis*. Dose, from one to two minims (0.06-0.13 mil), given in capsules, from four to

eight times a day. A. de Vevey (*R. T.*, Ixiii, 1896) has used the 10 per cent. solution in sterilized olive oil hypodermically in doses of eighty to one hundred and sixty minima (5-10 mils) once or twice in twenty-four hours.

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Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. I have deleted some of the wonkish essay tests for the "Oleum" group - Michael Moore]

Nabalus. *Prenanthes alba* L. Rattlesnake Root. White Lettuce. Cancer Weed. Gall of the Earth. Lion's Foot. (Fam. *Compositae*.)—In certain portions of Virginia and North Carolina, where this perennial herb grows, great value is attached to it in rattlesnake bite. The milky juice is taken freely internally, and its leaves steeped in water which is locally applied and frequently changed. The plant is also used in dysentery, and N. B. Williams has found tannin in the rhizome. (A. J. P., 1887.)

Nance Bark.—This bark is believed to be obtained from the *Malpighia glabra* L. (Fam. *Malpighiaceae*.) It is much used in Mexico for tanning, and, according to F. Holberg, contains 26.2 per cent of tannin. (A. J. P. xvi. 239.)

Narcissus. *Narcissus Pseudonarcissus* L. Daffodil. *Narcisse des pres*, *Porillon*, Fr. *Gelbe Narcisse*, G. (Fam. *Amaryllidaceae*.)—Both the bulb and the bright yellow flowers of this common garden plant have been used in medicine. The flowers have a feeble peculiar odor, and both have a bitter mucilaginous taste. They are an uncertain emetic. It is probable that the flowers of the wild European plant are more powerful than those of the cultivated. A. W. Gerrard examined the bulbs of daffodil, and obtained a crystalline neutral principle and an amorphous alkaloid, which he calls pseudonarcissine. According to Ruiger, the alkaloid obtained by Gerrard from the bulb of the flowering plant dries the mouth, checks perspiration, dilates the pupil, especially when applied locally, quickens the pulse, and acts on the heart of the frog antagonistically to muscarine and pilocarpine, while the alkaloid taken from the bulb after flowering causes salivation and perspiration, internally taken contracts the pupil, and topically applied dilates it slightly. (J. P., i, 436.) In France, narcissus flowers have been used as an antispasmodic. The dose of the powder, to produce an emetic effect, varies, according to the statements of different physicians, from twenty grains to two drachms (1.3-7.7 Gm.); while the extract is said to cause vomiting in the dose of two or three grains (0.13-0.20 Gm.). The bulb is most powerful in the recent state.

Nard. *Spikenard*.—Several aromatic roots were known to the ancients under the name of nardus, distinguished, according to their origin or place of growth, by the names of *Nardus indica*, *Nardus celtica*, *Nardus montana*, etc. They are supposed to have been derived from different valerianaceous plants. Thus, the *Sardus indica*, is

referred to *Nardostachys, Jatamansi* (Roxb.) DC. (*Valeriana Jatamansi* Roxb.), of Bengal, the *Nardus Celtica* to *V. celtica* L., inhabiting the Alps, Apennines, etc., and the *Nardus montana* to *V. tuberosa*, which grows in the mountains of the south of Europe. The Indian ward, or spikenard, sometimes also called Syrian nard, is still occasionally to be found in commerce. It is a small delicate root, from one to three inches long, beset with a tuft of soft, light brown, slender fibers, of an agreeable odor, and a bitter aromatic taste. It was formerly very highly esteemed as a medicine, but is now almost out of use. Its properties are analogous to those of valerian.

Naregamia, or **Goanese Ipecacuanha**.—The root of *Naregamia alata* Wight and Arn. (Fam. *Meliaceae*), of Western India, has been much employed as an emetic, as an hepatic stimulant in dysentery, and in small doses as an expectorant in bronchitis. Drasche of Vienna, confirms the value of the drug. (06. G. T., 1890.) In it Hooker has found an alkaloid, naregamine, an oxidizable fixed oil, and a wax. (See P. J; vol. xv, 1887.) The dose of a concentrated tincture (1 to 4) is from five to ten minims (0.3-0.6 mil); as an emetic, from fifteen to thirty minims (0.9-1.8 mils).

Nasturtium. *Watercress. Cresson de fontaine, Fr. Brunnenkresse, G. Radicula Nasturtium aquaticum* (L.) Britten et Rendle. (Fam. *Cruci-ferae*.)—In sensible and medicinal properties watercress bears some resemblance to scurvy grass, though milder, and on this account is preferred for the table. It is thought to be useful in scorbutic affections and visceral obstructions. It contains a volatile oil, which, according to A. W. Hofman, contains as its chief constituent a body boiling at 253° C. (487.4° F.), which he considers to be the nitrile of phenyl-propionic acid, C₉H₁₀O₂, and therefore has the formula C₉H₁₀N. The expressed juice is sometimes given in the dose of one or two fluidounces (30-60 mils) ; but the herb is more frequently used in the form of a salad.

Other species of *Radicula* grow in similar situations with the *R. Nasturtium*, and act similarly.

Nerium. *Nerium Oleander* L. *Laurier Rose, Laurose, Fr. Oleander, Rosenlorbeer, G.* (Fam. *Apocynaceae*.)—The common ornamental shrub known as oleander is affirmed to. have been used from time immemorial in portions of Southern Europe for destroying rats, and a number of cases of poisoning by it have been reported. (For collection, see *T. G.*, July, 1888.) The symptoms have been vomiting, abdominal pain with frequent cries, dilatation of the pupil, vertigo, convulsive movements, insensibility, small, very slow pulse, and in fatal cases epileptiform convulsions with coma ending in death. The action on the heart has in some cases in which death has not ensued, been very pronounced, the pulse for five days remaining as low as forty per minute. The infusion made from four ounces of the root is affirmed to have taken life.

Two supposed alkaloids have been discovered in oleander by Leukowsky (*J. P. C.* (3"), 46, 397), one named *pseudocurarine*, the other named *oleandrine*. Both neutralize acids; the former dissolves in water and alcohol, but not in ether, and is neither volatile nor poisonous; the latter is yellow, amorphous, very bitter, very slightly

soluble in water but more freely in alcohol and ether, and poisonous in its action on the system. H. G. Greenish isolated two substances, neriodorin and neriodorein, which are probably not pure proximate principles. (*A. J. P.*, 1881, 350.) B. C. L. Bose (*P. J.*, 1901, 553) obtained a resinous substance, *karabin*, C₂₁H₄₉O₆, which he states is one of the active constituents of this plant. Haemel (*Ph. Ztg.*, 1901, 58) obtained a semi-concrete oil to the amount of 0.025 per cent. from the leaves of *N. Oleander*. Dubigadoux and Durieu affirm that they have obtained stpophanthin from the oleander of Algeria.

Schmiedeberg (*A. E. P. P.*, 1883, Bd. xvi, 145) finds two active substances in the oleander leaf—*neriin* and *oleandrin*. Schmiedeberg shows that the latter, which had been previously described by Leukowsky as an alkaloid, is a glucoside, and on boiling with very dilute acids breaks up into sugar and a yellow resinous substance like digitaliresin. With concentrated acids it also decomposes, yielding an inactive resin. Schmiedeberg also obtained from African leaves a glucoside, *nerianthin*, which he surmises to be an educt from oleandrin. He found oleandrin to be a powerful cardiac poison, but nerianthin not to have the power of arresting the frog's heart, although it exerts some influence upon it, possibly, as Schmiedeberg surmises, through contaminating oleandrin. Pieszczyk obtained from oleander bark a principle which he named *rosaginin*, which was very poisonous, resembling strychnine in its action. (*A. Pharm.*, ccxxviii, 352.) (See also *M. R.*, 1911, and *J.P. C.*, 1912, 108.)

Leulier found in oleander bark a glucoside which seems to be identical with the Isevo-strophanthin of Thorns. (*P.J.*, lxxxvii, p.407.)

Pouloux (*B. G. T.*, May 15, 1888) having confirmed the earlier conclusions of Pelikau (*C. R. A. S.*, 1866, 239) that oleander acts upon the heart like digitalis, used it successfully in a few cases of valvular heart disease. In seventy-five cases under the care of Freiherr (*Acrzt. Rund.*, 1892) it acted promptly as a heart stimulant and tonic. Its diuretic action is said to be very marked, and not rarely it acts as a cathartic. Any irritation of the alimentary canal contra-indicates its use. Under its influence the pulse rapidly becomes regular and slow, and dyspnea and edema disappear. Freiherr asserts that it is safer than digitalis in atheromatous diseases. Freiherr used it in infusion or tincture, representing as the daily dose from three-quarters to one and a half grains (0.048-0.096 Gm.) of the dried oleander bark, one and a half to three grains (0.096-0.2 Gm.) of the fresh bark, one and a quarter to three and a half grains (0.08-0.23 Gm.) of the dried fruit. Pouloux's dose of the extract was three-quarters of a grain (0.048 Gm.). Orfele has used the dried flowers—dose, three grains (0.2 Gm.) in substance, or from ten to twenty minims (0.5-1.0 mil) of a 10 per cent. tincture—with success.

Nierenbergia Hippomanica. *Chus-chu*.—This solanaceous plant is the not infrequent source of poisoning to cattle in Argentine, where it is a native. Laveur and Sanchez (*J. P. G.*, 1907, xxvi) have isolated a poisonous alkaloid to which they give the name *nierenbergine*. Apparently this alkaloid resembles saponin in some of its properties. They were not able to find the glucoside *hippomanin* which had previously been reported.

Nigella. *Nigella sativa* L. *Nutmeg-flower. Small Fennel-flower. Faux Cumin*, Fr. *Schwarz-kummel*, G. (Fam. *Ranunculaceae*.)—A small, annual plant, growing wild in Syria and the south of Europe, and cultivated in various parts of the world. The seeds, *semen nigellae*, are ovate, somewhat compressed, from 2.5 to 3.5 mm. in length and less than 2 mm. in thickness, usually three-cornered, with two sides flat and one convex, black or brown externally, white and oleaginous within, of a strong, agreeable, aromatic odor, like that of nutmegs, and a spicy, pungent taste. (*P. J.*, 1882, 681.) Their chief constituents are a volatile and a fixed oil (1.5 per cent. of the former and 35 per cent. of the latter), and an amorphous glucoside, *melanthin*, which is decomposed by diluted hydrochloric acid into *melanthisgenin* and sugar. The *nigellin* of Reinsch does not seem to have been a pure substance. Rochebrune has found a powerful paralyzing alkaloid, to which he gives the name of *nigelline*. (*Toxicol. Africaine*, vol. i.) Melanthin, according to W. von Schuiz, exhibits the typical physiological action of the most poisonous saponins. In India the seeds are considered as stimulant, diaphoretic, and emmenagogue, and are believed to increase the secretion of milk. They are also used as a condiment, and as a corrigent or adjuvant of purgative and tonic medicines. In the seeds of the *Nigella Damascena* Schneider (*Ph. Centralh.*, 1890, xxxi, p. 173) found an alkaloid which he called damascenine, whose construction was studied by Pommerehne and Keller. (*A. Pharm.*, 1904, ccxiii, p. 295.) It has been made synthetically. They were unable to find any alkaloid in *N. sativa*. (See also *A. Pharm.*, 1908.)

Njimo Wood.—The wood of *Sarcocephalus esculentus* Afzel. (Fam. *Rubiaceae*), known as *Njimo*, was introduced into Germany from the Cameroons with the statement that it had digestive properties similar to those of pepsin. It is a stem wood, often with pieces of root, of a yellow color, musk-like odor, and bitter taste. Schulz (*Ph. Ztg.*, June 12, 1886) finds that it is not a digestive, and that it yields a resinous extract not poisonous to frogs. The alcoholic extract of the rug is yellow by transmitted light, but exhibits a green fluorescence resembling uranium glass. The bark of this same plant called "Dundaki," according to Heckel and Schlagdenhauffen (*Compt. Rend.*, 1885, 69) contains an alkaloid, *Dundakine*.

NUX VOMICA. U. S., Br.

NUX VOMICA Nux Vom. [Strychni semen, P. I.]

"The dried, ripe seeds of *Strychnos Nux-vomica* Linne (Fam. *Loganiaceae*), yielding not less than 2.5 per cent. of the alkaloids of *Nux Vomica*." *U. S.* " *Nux Vomica* consists of the dried ripe seeds of *Strychnos Nux-vomica*, Linn." *Br.*

Semen Nucis Vomicae; Poison Nut, Quaker Buttons, Dog Buttons; Noix vomique, *Fr. Cod.*; Semen Strychni, *P. G.*; Krahenaugen, Brechnuss, *G.*; Noce vomica, *It.*; Nuez vomica, *Sp.*

Strychnos Nux-vomica is a tree of a moderate size, with numerous strong branches, covered with a smooth, dark gray bark. The young branches are long, flexuous, smooth, and dark green, with opposite, roundish-oval, petiolate, entire, smooth, and shining leaves. The flowers are small, white, funnel-shaped and in terminal corymbs. The fruit is a round berry, about as large as an orange, with a smooth, yellow or orange-colored, hard, fragile rind, and many seeds in a juicy pulp. It has frequently been asserted that the pulp is innocuous, but Fluckiger and Hanbury, and also Dunstan and Short (*P. J.*, 3d series, xv, 1) have demonstrated that it contains strychnine. Dunstan and Short have also proved that of the commercial varieties of nux vomica Bombay seed stands first in percentage of contained strychnine, then Cochin, and lastly Madras. (*P. J.*, 1883, xiv, 1053.)

The tree is a native of the East Indies, growing in Bengal, Malabar, on the Coromandel Coast, in Ceylon, in many islands of the Indian Archipelago, in Cochin China, and in Northern Australia. The drug is largely shipped from Madras, where it is estimated that in 1912 nearly 400,000 pounds were marketed. Much of the nux vomica shipped to the United States is exported from Bombay, and in 1910-1911 some 45,000 pounds of nux vomica were exported to the United States from the Bombay district. The chief markets for nux vomica are China, and America, small quantities are shipped to London, and the importations to Hamburg are very irregular. Joblin states that during the fiscal year 1909 there were imported into the United States 1,666,957 pounds of nux vomica; in 1910, 2,738,662 pounds. (*Cons. & Tr. Rep.*, 1911, p. 350.)

The wood and root are very bitter, and are employed in the East Indies for the cure of intermittents. The *radices colubrinae* and *lignum*, colubrinum of the older writers, long known in Europe as narcotic poisons, have been ascribed to this species of *Strychnos.*, under the impression that they were identical with *Strychnos colubrina*, to which Linnaeus refers them. They were ascertained by Pelletier and Caventou's researches to contain a large quantity of strychnine. The bark has been mistaken for cusparia, and hence is sometimes referred to as *false angustura*. Gehe & Co. (*Handelsbericht*, 1914, p. 119) state that a new variety of nux vomica, the origin of which is unknown, is being exported from Burma. The seeds are externally light gray, internally yellow and are devoid of strychnine.

Properties.—*Nux vomica* is officially described as "orbicular, nearly flat, occasionally irregularly bent, from 10 to 30 mm. in diameter and from 4 to 5 mm. in thickness, very hard when dry; externally grayish or greenish-gray, covered with appressed hairs giving it a silky luster, hilum indicated by a circular scar at the center of one of the flattened sides and connected with the micropyle at the edge by a ridge; internally showing a thin, hairy seed-coat and a large grayish-white endosperm at one end of which is embedded a small embryo with two broadly ovate, 5- to 7-nerved cotyledons; inodorous; taste intensely and persistently bitter. The powder is light gray; consisting chiefly of thick-walled endosperm cells containing globules of a fixed oil and a few small aleurone grains, and fragments of strongly lignified, non-glandular hairs, the walls of the latter possessing large, circular, or long, slit-like pores. In the tissues of the adhering pulp occur a few small, nearly spherical starch grains. *Nux Vomica* yields not more than 3.5 per cent. of ash." *U. S.*

"Seeds disc-shaped, nearly flat, but sometimes irregularly bent; rounded or somewhat acute at the margin, from a small prominence on which a raised line passes to the central hilum. Ash-grey or greenish-grey. From two to two and a half centimetres in diameter, and about six millimetres thick. Surface densely covered with short, satiny, radiately arranged and closely appressed hairs. Endosperm large and horny; cotyledon small and leafy. Powdered *Nux Vomica* exhibits fragments of the endosperm, the cell-walls of which are very thick but not lignified, also slender rod-like fragments of the hairs and their thickened, pitted, lignified basal portions. No odor; taste extremely bitter. Yields not less than 1.25 per cent. of strychnine when tested by the following process." *Br.*

The seeds are destitute of odor, but have an acrid, very bitter taste, which is much stronger in the kernel than in the investing membrane. They impart their virtues to water, but more readily to diluted alcohol. For a method of distinguishing powdered *nux vomica* from powdered *ignati'a* and other powders, see *Proc. A, Ph. A.*, 1897, 503.

Herder has proposed a detection of the alkaloids in *nux vomica* by various microchemical means and shows how they may be localized in the seeds and growing plants. (*A. Pharm.*, 1906, p. 129.) Tunmann (*A. Pharm.*, 1910, 644) has studied the distribution of the alkaloids in the germinating seeds of *Strychnos Nux vomica*, and concludes that the

embryo of the seed contained only brucine and that strychnine, which was contained in the endosperm only in the cell plasma of the cell content, appears to act as a protection for the growing plant. Grutterink has also published an illustrated article on the microchemical examination of the several alkaloids of nux vomica. (*Zeit. An. Chem.*, li, p. 187.) Rushy has reported the shipment of nux vomica which consisted of small inferior seeds which had been rolled in some mixture of clay. (*Proc. A. Ph. A*; 1908, Ivi, p. 794.) Powdered nux vomica has been adulterated with ground olive stones and the raspings of vegetable ivory. (See *Rep. d. Pharm.*, 1909, p. 241; *Ann. d. chim. Analyt.*, 1909, p. 261.)

The chemists Pelletier and Caventou discovered in nux vomica two alkaline principles, *strychnine* and *brucine*, united with a peculiar acid which they named *igasuric*. Its other constituents are a yellow coloring matter, a fixed oil, gum, starch, a small quantity of wax, and several earthy phosphates. Charles Bullock, in preparing the alcoholic extract of nux vomica with a moderate continuous heat, so as to dry it sufficiently to be pulverized, separated from 150 pounds of the seeds 5 pints of a liquid oil. This oil has a saponification number of 124, and an iodine number of 64 to 67. The unsaponifiable portion of the oil was identified as a mixture of phytosterin. (*A. Pharm.*, 1912, p. 398.) F. Meyer (*In. Dis.*, St. Petersburg, 1875) investigated the fatty oil from nux vomica, and found it to consist of the glycerides of capric, caprylic, caproic, butyric, and palmitic acids. (*A. J. P.*, 1874, 405.) Shenstone (*J. Chem. S.*, xxxix, 453) has shown that the *igasurine* of Desnoix is a mixture of strychnine and brucine. A glucoside, *loganin*, has also been found in the nux vomica seeds, but it exists more largely in the surrounding pulp. Dunstan and Short, its discoverers (*P. J.* 1883, xiv, 1025), gave to it the formula $C_{25}H_{34}O_{14}$. Boorsma stated that he had discovered a new alkaloid in the leaves of *S. Nux vomica* (*Bull. de l'Inst. Bot. de Buitenzorg*) and he named it *strychnicine*; it is only slightly poisonous. (See also *P. J.*, 1902, 65.)

Hugo H. Schafer (*J. A. P. A.*, 1914, p. 1077) announces a new alkaloid in nux vomica which he has named *struxine*. This alkaloid is stated to have the chemical formula $C_{21}H_{30}C_4N_2$. It is present only in the drug coming from Cochin China, and was found in an amount of 0.1 per cent.

Igasurine was said to be found in the mother waters from which strychnine and brucine have been precipitated by lime. Jorgensen

believed that it was identical with brucine (see *A. J. P.*, June, 1872, p. 257), and W. A. Shenstone confirmed this view. (*A. J. P.*, Dec., 1881.)

Loganin is present in the pulp to the amount of 4 or 5 per cent., and is contained in small quantity also in the seeds. It was obtained by exhausting the pulp with a mixture of chloroform and alcohol (100 :25). The exhaustion was effected in an apparatus for hot repercolation. The percolate, on cooling, deposited crystals, which when recrystallized a number of times from alcohol, and finally from absolute alcohol, were obtained pure. Loganin is easily soluble in water and alcohol, less soluble in ether, chloroform, and benzene. Its aqueous solution is not precipitated by any of the alkaloidal reagents. Its most characteristic reaction is found in its behavior with concentrated sulphuric acid. A very small quantity of loganin, when gently warmed with a few drops of concentrated sulphuric acid, yields a fine red color, which, on standing, develops into a deep purple. By boiling with dilute sulphuric acid, loganin is resolved into glucose (reducing Fehling's solution) and a body for which the name *loganetin* is proposed. This substance, like loganin, gives the characteristic reaction with sulphuric acid, but the purple color does not develop so rapidly. Loganetin is soluble in water and alcohol, less soluble in ether, carbon disulphide and chloroform. (*P. J.*, 1884, p. 1025.)

Strychnine (C₂₁H₂₂O₂N₂) was discovered by Pelletier and Caventou in 1818, in both the nux vomica and the bean of St. Ignatius, and received its name from the generic title of the plants (*Strychnos*) to which these two products belong. According to these chemists, it exists much more abundantly in the bean of St. Ignatius than in the nux vomica, the former yielding 1.2 per cent., the latter only 0.4 per cent., of strychnine, but Dragendorff obtained from nux vomica from 1.9 to 2.1 per cent. of mixed alkaloids, about half of which was strychnine. (*Jahresbericht*, 1874, 103.) For valuable practical information about the yield of the alkaloids, extracts, etc., by E. L. Patch, see *Proc. A. Ph. A.*, 1891, 91; also *P. J.*, 1889, 341; *Proc. Michigan Pharm. Assoc.*, 1889; *Proc. Ohio Pharm. Assoc.*, 1889; *P. J.*, 1890, 493.

Other species of *Strychnos* contain the poisonous alkaloids, and may some time become a commercial source of them. *Bidara laut* of the Indian bazaars, believed to be obtained from *S. ligustrina*, has been analyzed by Russow, who found the wood to contain 2.26 per cent. and the bark 7.38 per cent. of brucine without strychnine. Henry Q.

Greenish found in the wood and bark respectively of *S. colubrina* 0.96 per cent. and 5.54 per cent. of mixed alkaloids; the same analyst obtained from false *Angustura* bark (*S. Nux vomica*), young bark 3.10 per cent., old bark 1.68. (*P. J.*, 3d ser., ix, 1014.) According to Bernelot-Moens, the dry seeds of the *S. tieute* contain 1.469 per cent. of strychnine, with a trace of brucine. (*A. J. P.*, 1866, p. 506.) From the seeds of *Strychnos Rheedii*. W. R. Dunstan obtained a yield of 0.06 per cent. of brucine and no strychnine. (*Imp. Inst. Rep.*, 1901-1902.) The Congo poison known as *Cupua Apus*, according to Vinci (*A. I. P. T.*, xx), is produced from the *Strychnos kipapa*. The bark of the root contains 6 per cent. of strychnine and the wood 0.1 per cent.

Brucine ($C_{23}H_{26}O_4N_2$) was discovered by Pelletier and Caventou, first in the bark called *false Angustura*, in combination with gallic acid, and subsequently, associated with strychnine in the form of igasurates, in the *nux vomica* and the bean of St. Ignatius. It is crystallizable from alcohol, the crystals then containing $4H_2O$. It is without odor, but of a permanent, harsh, very bitter taste; is soluble in 850 parts of cold and in 500 of boiling water; very soluble in alcohol, whether hot or cold; it dissolves in 4 parts of chloroform, 440 parts of ether, 60 parts of benzene, and 120 parts of petroleum benzin. It is permanent in the air, but melts at a temperature a little above that of boiling water, and on cooling congeals into a mass resembling wax. The hydrated crystals melt at $115^{\circ} C.$ ($239^{\circ} F.$), and sublime at $204^{\circ} C.$ ($399.2^{\circ} F.$), while the anhydrous base melts at $178^{\circ} C.$ ($352.4^{\circ} F.$), changing color, and depositing carbon. (*P. J.*, 1868, 375.) It forms crystallizable salts with acids. Concentrated nitric acid produces with brucine or its salts an intense crimson color, which changes to yellow by heat, and upon the addition of stannous chloride becomes violet. A test for brucine, given by Stanislas Cotton, consists in adding to a warm solution of brucine (from 40° to $50^{\circ} C.$ (104° - $122^{\circ} F.$)) in nitric acid, a concentrated solution of sodium thio-sulphate. The mixture first becomes violet, and then passes to green when the alkaline salt is in excess. (*J. P. C.*; Juillet, 1869, 18.) These effects serve to distinguish brucine from strychnine, and, if produced with the latter alkaloid, evince the presence of the former. According to Larocque and Thibierge, auric chloride produces, with solutions of the salts of brucine, precipitates at first milky, then coffee-colored, and finally chocolate-brown. (*Journ. de Chim. Med.*, Oct., 1842.) Chlorine water produces with solution of brucine a rose color, due to the formation of *dichlor-brucine*. This is a reddish-brown, hygroscopic

powder. (A. Pharm., 1886, 934.) A *dinitro-brucine*, $C_{23}H_{24}(NO_2)_2N_2O_4$, has also been obtained by the action of nitrogen trioxide upon the brucine in alcoholic solution. Brucine appears to bear a definite relation to strychnine in chemical constitution, being a *dimethoxy-strychnine*. According to the analyses of Shenstone and Dragendorff, the bark of the nux vomica contains brucine, with a trace of strychnine, while in the leaves Hooper found only brucine. (*P. J.*, 1890, xxi.)

Brucine may be procured from false *Angustura* bark, in a manner essentially the same as that in which strychnine is procured from *nux vomica*, with this difference, that the alcoholic extract obtained from the precipitate produced by lime or magnesia should be treated with oxalic acid, and subsequently with a mixture of rectified alcohol and ether, which takes up the coloring matter, leaving brucine oxalate. This is decomposed by magnesia, and the brucine is separated by alcohol, which by spontaneous evaporation yields it in the state of crystals. Prescott (*Organic Analysis*, 1887, p. 458) gives two methods for the separation of strychnine from brucine; first, by the use of alcohol of 0.97 sp. gr., which easily dissolves brucine, but has very slight solvent power upon strychnine; second, by Dunstan and Short's method with potassium ferrocyanide. This method has been reported upon by Hoist and Beckurts (*Ph. Centralh.*, N. P., 1887, p. 119), who find that if the hydrochloric acid solution containing mixed alkaloids is not too dilute, on the addition of potassium ferrocyanide the whole of the strychnine will be precipitated as ferrocyanide, while the brucine salt will remain in solution.

The separation of brucine from strychnine is most conveniently effected by exposing the mixed alkaloids to the action of diluted nitric acid, which destroys brucine very rapidly while having no appreciable action on strychnine; this method is used in the former official assay process.

Igasuric acid has been regarded as erroneously named, and investigators have stated that it was malic acid and tannic acid, while Q. Sander (*A. Pharm.*, 1897, 133) believes that the acid found in *nux vomica*, heretofore known as *igasuric acid*, is *caffeo-tannic acid*.

Uses.—The medicinal and toxic properties of *nux vomica* are those of its alkaloid. (See *Strychnina*.) The belief held by some physicians that it acts more favorably as a bitter upon the stomach has only this much of justification—namely, that it is more slowly absorbed, and therefore acts

locally somewhat more persistently.

BRUCINE.—On account of the difficulty of separating strychnine from brucine, it has been found by physiologists difficult to determine the exact action upon the human organism of the pure alkaloid. It was formerly taught that brucine closely resembled strychnine in its physiological action, except that it was less poisonous and that it was depressant to the peripheral sensory nerves. Dickson and Harvey (*P. J.*, 1908, lxxxii, p. 367), however, experimenting with a chemically pure brucine, reach the conclusion that its dominant action is a paralysis of the peripheral motor nerves, and that the convulsive action which is the characteristic effect of strychnine is almost entirely absent in the case of brucine. According to the observation of Mays, brucine is an active paralyzant to the sensory nerves and a 5 or 10 per cent. solution applied to the mouth causes local anesthesia. He has used it for the relief of *pruritus*. Bumett also asserts that a 5 per cent. solution is a valuable local anodyne in inflammations of the external ear.

Dose, of nux vomica, one to four grains (0.065-0.26 Gm.).

Off. Prep.—Extractum Nucis Vomicae (from Liquid Extract), *U. S.*, *Br.*; Fluidextractum Nucis Vomicae, *U. S.* (*Br.*); Tinctura Nucis Vomicae (from Extract), *U. S.* (from Liquid Extract), *Br.*; Elixir Phosphori et Nucis Vomicae (from Tinctura), *N. F.*; Pilulae Aloes et Podophylli Compositae (from Extract), *N. F.*; Pilulae Ferri, Quininae, Aloes et Nucis Vomicae (from Extract), *N. F.*; Pilulae Laxativae Post Partum (from Extract), *N. F.*

Nymphaea.—The seed of *Nuphar luteum* Smith (*Nymphaea lutea* Linne), *European Yellow Pond Lily* (Fam. *Nymphaeaceae*), according to W. Gruning, contains *nuphar-tannic acid*, $C_{56}H_{56}O_{37}$, in considerable quantity. (*A. J. P.*, 1883, 96.) Goris and Crete state that the *nupharine* of Gruning has the composition $C_{18}H_{24}O_2N_2$. They obtained it from the fresh rhizome of *N. luteum*. (*J. Chem.* 8., 1910.) The name *Nymphaea* has been incorrectly applied also to the American white pond lily, which belongs to the genus *Castalia*, *Castalia odorata* (Ait.) Woodv. and Wood. (*Nymphaea odorata* (Ait.)), *Sweet-scented Water Lily*. The root of this well-known American plant is very astringent and bitter, and, according to Bigelow, contains much tannin and gallic acid. The root of *Castalia alba* Presl. (*Nymphaea alba* L.), or *European white water lily*, was esteemed anaphrodisiac by the ancients and the tannic acid contained in it has been named *nymphae-tannic acid*, and the formula $C_{56}H_{68}O_{38}$ given it. (*A. J. P.*, 1883, 96.)

Nyssa. *Nyssa aquatica* L. *Tupela Gum.* *Sour Gum.* *Swamp Tupelo.* (Fam.

Cornaceae.)—A large tree growing in deep swamps in the Southern United States. The root, known as Tupelo root, has been recommended for surgical tents. (*A. J. P.*, 1883.)

Ocimum. *Ocimum Basilicum* L. *Basil.* *Sweet Basil.* *Grand Basilic,* Fr. *Basilienkraut,* G. (Fam. *Labiatae*.)—An annual, aromatic plant, a native of India and Persia, and cultivated in Europe and in this country in gardens. It yields by distillation from 0.02 to 0.04 per cent. of a yellowish, volatile oil. The French and German oil have a penetrating odor resembling estragon, the Reunion has a camphor-like odor, a higher specific gravity and is dextrogyrate. Basil has the ordinary properties of the aromatic plants, and is used as a condiment. The seeds are said by Ainslie to be used in India in *gonorrhoea*.

Œnanthe. *O. crocata* L. *Water Hemlock.* *Water Dropwort.* *Dead Tongue.*—A perennial, umbelliferous, aquatic, European plant, exceedingly poisonous both to man and inferior animals. The root, which has a sweetish not unpleasant taste, is sometimes eaten by mistake for other roots, often with fatal results. The symptoms produced are those of irritation of the stomach, besides failure of circulation, and great cerebral disturbance, indicated by giddiness, convulsions, and coma. (See *P. J.*, 1874, 202.) Externally applied, the root produces redness and irritation of the skin, with an eruption. It is said to be sometimes used empirically as a local remedy in piles. Other species of *Œnanthe* are poisonous, and the whole genus should be suspected. We have two or three indigenous species. In cases of poisoning, the stomach should be at once evacuated, and symptoms met as they arise. A peculiar resinoid principle, denominated œnanthin, has been found by Gerding in *Œnanthe fistulosa* L., the common water hemlock of Europe, of which half a grain (0.032 Gm.), given to an adult, produced long-continued irritation of the fauces, and a grain (0.065 Gm.), occasional vomiting. (See *A. J. P.*, xxi, 68.) Poehl (*A. E. P. P.*, 1885, xxxiv, p. 258) claimed to have isolated a toxic principle, to which he gave the name of *œnanthotoxin*, and assigned a formula of $C_{17}H_{22}O_5$. Tutin, however (*P. J.*, Aug. 26, 1911), asserts that this body is not a pure principle but a mixture of neutral resins of unknown nature. He confirms the conclusions that the resin is an active poison. He also examined the tuberous roots of *O. crocata* and found *triacontane*, $C_{30}H_{62}$, and *hentriacontane*, $C_{31}H_{64}$. In the *P. J.*, vol. xvi, 357, is a paper by Henry William Jones upon the recognition of *O. crocata* in cases of suspected cattle poisoning; he found that the starch granules possessed characters which enabled him to distinguish the tubers from all others.

Œnanthe aquatica Lam. (*Œnanthe Phellandrium* Lam., *Phellandrium aquaticum* L.) *Fine-leaved Water Hemlock.* *Water Fennel.* *Fructus Phellandrii.* *Wasserfenchel,* G. *Phellandrie aquatique,* *Fenouil d'Eau,* Fr.—A biennial or perennial, umbelliferous, European water plant, the fresh leaves of which are said to be injurious to cattle, producing a kind of paralysis when eaten. By drying, they lose their deleterious properties. The seeds are from 4 to 5 mm. in length (about 2 mm. broad), ovate-oblong, narrow above, somewhat compressed, marked with ten delicate ribs, and crowned with the remains of the calyx, and with the erect or reverted styles. Their color is yellowish-brown; their odor peculiar, strong, and disagreeable; their taste acrid

and aromatic. Among their constituents is a volatile oil, upon which their aromatic flavor depends. By C. Fronefield it has been rendered probable that they contain a volatile alkaloid, analogous to coniine, if it be not coniine itself, for if the powdered seeds are rubbed with solution of potassium hydroxide, the peculiar mouse-like odor of that alkaloid is exhaled. The powder was submitted to distillation with potassium hydroxide, the alkaline liquid obtained was neutralized with sulphuric acid and evaporated to a syrupy consistence, alcohol was added to precipitate the ammonium sulphate, the liquid was then filtered, treated with potassium hydroxide, and again distilled. On the surface of the distillate a yellow oily fluid floated, which was only slightly soluble in water but readily so in ether and alcohol, evinced an alkaline reaction with turmeric paper, and neutralized the acids. (*A. J. P.*, May, 1860, 211.) The ethereal oil of water fennel which is present to the extent of 1 to 2.5 per cent. is a yellow liquid of strong, pleasant characteristic odor and burning taste. It has a sp. gr. of 0.85-0.89 and is dextrorotatory. It contains about 80 per cent. of the terpene *phellandrene*, $C_{10}H_{16}$. In overdoses the seeds produce vertigo, intoxication, and other narcotic effects. They have been used in chronic pectoral affections, such as *bronchitis*, *pulmonary consumption*, and *asthma*; also in *dyspepsia*, *intermittent fever*, obstinate *ulcers*, etc. The *dose* of the seeds, to commence with, is five or six grains (0.32-0.4 Gm.), so repeated as to amount to a drachm (3.9 Gm.) in twenty-four hours. They should be given in powder. *Dose*, of the alcoholic extract, three grains (0.2 Gm.). (*P. J.*, xii, 591.)

Œnothera. *Œnothera biennis* L. *Tree Primrose. Evening Primrose. Onagre*, Fr. *Nachtkerze*, Gr. (Fam. *Onagraceae*.)—The fleshy root of this plant, before the introduction of the potato, was used as a table vegetable. Many years ago R. E. Griffith commended very highly a strong decoction of the plant frequently applied to eruptive skin diseases. More recently the drug has been commended in whooping cough and spasmodic asthma, and the ointment has been used in prurigo and other cutaneous affections of infants, and as an application to ulcers. *Dose*, of fluidextract, from a half to one fluidrachm (1.8-3.75 mls). The ointment may be made by incorporating four ounces of the fluidextract in a pound of vaseline or lard.

Oil of Akee.—This is a yellow, non-drying, butter-like fat obtained from the *Blighia sapida* Kon. (Fam. *Sapindaceae*), native of Guinea, but cultivated in Jamaica. (*P. J.*, 65, p. 691.)

Oil of Aleurites Triloba.—The *Aleurites triloba* Forst. is a small tree belonging to the *Euphorbiaceae*. It is widely diffused throughout the tropics. The fruit is a nut nearly as large as a walnut, consisting of a thick shell enclosing a kernel containing much protein and rich in oil, of which it is said to yield nearly one-half its weight by expression. The nuts strung together on the fibers of the palm leaf were formerly used in many Pacific islands as a substitute for candles. The oil has been long known in the various countries inhabited by the plant, being called in Jamaica *Spanish walnut oil*, in India *Belgaum walnut oil*, in Ceylon *kekune oil*, and in the Hawaiian Islands *kukui oil*. It is very fluid, of an amber color, without odor, of a nutty, pleasant taste, congealing at 0° C. (32° P.), insoluble in alcohol, readily saponifiable, "and very strongly drying." It is said to be a mild cathartic, acting like castor oil, but more

promptly and without griping effects. (*J. P. C.*, 3e ser., xxiv, 228.) The dose is from one-half to one fluidounce (15-30 mls), the smaller quantity generally answering. The cake left after the expression of the oil, given to a dog in the dose of about half an ounce (15 Gm.), produced no vomiting, but acted strongly as a purgative.

The oil of the *Tung Tree*, *Aleurites cordata* (Thunb.) Mull.-Arg., is used to a large extent in the arts in China, under the name of *Chinese wood oil* or *tung oil*. (This must not be confounded with the Indian oil of wood.) It is prepared in China by a crude process of expression. It occurs in two forms, *white oil*, a moderately thick, yellowish, transparent liquid, and the *black oil*, which is thick, black, and opaque. Wood oil is used in China and Japan either as a direct application to wood or mixed with various substances, as lacquer varnish, or paint. Its most remarkable characteristic is its extraordinary drying property, which is said to exceed that of any known oil. When applied to wood it forms a resinous layer which is affirmed to be impermeable by water and ordinary solvents. Wood oil is also exported to Europe, where it is used in the making of varnishes. This oil is obtained from the seeds of the tung tree, which contains about 53 per cent. of fixed oil. According to R. H. Davies, its sp. gr. at 15.5° C. (60° F.) is 0.94015; it remains liquid at -13.3° C. (8° F.). 100 Gm. of the oil require 0.39 Gm. potassium hydroxide for neutralization, and 21.1 Gm. for complete saponification. (*P. J.*, 1885, 636.) E. M. Holmes believes that the dark colored oil is made by boiling the kernels previous to expression, the cold drawn oil being colorless, inodorous, and nearly tasteless. The latter, according to Cloez (*C. R. A. S.*, 1875, vol. lxxxii, 469), has the sp. gr. 0.9362, congeals at -18° C. (-0.4° F.) to a transparent mass, solidifies rapidly when exposed to light in a closed vessel, and is the most drying oil known. (*C. D.*, May, 1902.) (See also *Proc. A. Ph. A.* 1897, 677; and *Chem. News*, 1912, 14.) Over 60,000 kilo-grammes are said to be sent yearly from Hankow, on the Yang-tse-kiang, to the various Chinese seaports. It has been used in *ulcerations* and *skin diseases*. The seeds of the tung tree are used in China for killing rats, and are also affirmed to have emetic properties.

Oil of Anda.—A fixed oil procured by expression from the seeds of *Johannesia princeps* Veil. (Fam. *Euphorbiaceae*.) The bark of *J. princeps*, growing in the maritime provinces of Brazil, yields on being wounded a milky juice, which is said to be poisonous, and to be used for stupefying fish. The fruit, which is about as large as an apple, ash-colored, with two larger and two smaller ridges, encloses a two-celled nut, containing two seeds, about the size of a chestnut. Like the seeds of other euphorbiaceous plants, these are actively purgative, one seed, according to Martius, being the dose for a man. By expression these seeds yield a pale yellow, transparent oil, with little odor or taste, which is said to be used in Brazil for burning and painting. It has a sp. gr. 0.927, and in properties belongs to the class of semi-drying oils. (*P. J.*, 1905, 910.) Mello Olliveria has found in it an alkaloid, *johannesine*, which Couty affirms to be inert. (*N. R.*, 1881, 260.) Norris, who tried the oil at the Pennsylvania Hospital, found it to operate on the bowels moderately in the dose of fifty drops (2.5 mls), and copiously when more largely given. Manoel de Castro and other Brazilian physicians assert that in doses of from one to two teaspoonfuls (3.75-7.5 mls) it acts in a manner very similar to castor oil, over which it has the great advantage of not being nauseous to the taste.

Oil of Anise Bark.—There has appeared in the European markets a bark, closely resembling Massoi bark, and is supposed to be derived from a species of *Illicium*, probably *I. parviflorum* Michaux, growing in Madagascar, which yields fully three and a half per cent. of a light, yellow oil, the odor of which slightly resembles safrol. It has a spicy taste, but is only slightly sweet. Its specific gravity is 0.969 at 15° C. (59° P.). Optical rotation -0° 46' in a 100-mm. tube. Refractive index at 16° 1.52510. It contains a small quantity of ordinary anethol, but consists principally of the isomeric fluid anethol, the *methyl-chavicol* of Eykman, $\text{CH}_3\text{O.C}_6\text{H}_4.\text{CH}_2.\text{CH}:\text{CH}_2$.

Oil of Ben. Behen Oil.—This is a fixed oil extracted from the seeds of *Moringa arabica* Pers. (Fam. *Moringaceae*), and from *M. pterygosperma* Gaertn. (*M. Oleifera* Lam.). It should not be confounded with oil of benne from *Sesamum indicum* L. (Fam. *Pedaliaceae*). These are trees of the Fam. *Moringaceae*, inhabiting different parts of India, Arabia, Syria, etc., and introduced into the West Indies. The leaves and other parts have an acrid property, which has probably given the name of horseradish tree to *M. pterygosperma*. According to Henry Schachan (*Nouv. Rein.*, 1890), the tincture of the root is very actively diuretic and useful in cardiac *dropsy*. The oil of the seeds has long been known, though used in the arts rather than in medicine. It is prepared in Europe from the seeds brought from Egypt; and it would appear, from the statements of Macfadyen, that the idea generally prevailing that it is also extracted in the West Indies is incorrect. The oil has a sp. gr. of from 0.912 to 0.917; it solidifies at about 0° C. (32° F.); indeed at 7° C. (44.6° F.) it begins to deposit the solid fats. It is inodorous, clear, and nearly colorless, and keeps long without becoming rancid. It resembles olive oil, and is used for similar purposes. Merat and De Lens say that it is purgative; but most of the fixed oils are so in sufficient doses. According to Volcker, the oil contains palmitin, olein, and a peculiar fatty matter yielding an acid by saponification, which he names benic (or behenic) acid. (*J. P. C.*, xvi, 77.) Heintz considered benic acid as simply a mixture of palmitic and myristic acids. (*Pogg. Ann.*, xcii, 601.) It is, however, now recognized as one of the normal fatty acid series, possessing the formula $\text{C}_{22}\text{H}_{44}\text{O}_2$.

Oil of Bergamot. N. F. IV (U. S. 1890). *Oleum Bergamottae. Oleum Bergamii. U. S. 1880.* —"A volatile oil obtained by expression from the rind of the fresh fruit of *Citrus Aurantium Bergamia* (Risso et Poiteau) Wight et Arnott (Fam. *Rutaceae*), and containing not less than 36 per cent. of ester, calculated as linalyl acetate. Preserve It in small, amber-colored, well-stoppered bottles in a cool place, protected from light." N. F.

The bergamot tree has oblong-ovate, dentate, acute, or obtuse leaves, somewhat paler on the under than on the upper surface, and with footstalks more or less winged or margined. The flowers are white, and usually small; the fruit is pyriform or roundish, about three inches in diameter, terminated by the remains of the short style, with concave receptacle of oil in the rind. The pulp of the fruit is sourish, somewhat aromatic, and not disagreeable. The rind is shining, and of a pale-yellow color, and abounds in a very grateful volatile oil. This may be obtained by expression or distillation. In the former case it preserves the agreeable flavor of the rind, but is

somewhat turbid; in the latter it is limpid but less sweet. The mode of procuring it by expression is exactly the same as that used for oil of lemon. (See *Oleum Limonis*.) It is brought from Italy, the south of France, and Portugal.

"Oil of Bergamot is a green or greenish-yellow liquid, neutral or only faintly acid, having a characteristic fragrant odor and an aromatic bitter taste.

"Two volumes of the Oil, when mixed with 1 volume of alcohol, give a clear solution and this does not become turbid on the further addition of alcohol. It is soluble in 2 volumes of 80 per cent. alcohol with not more than a slight cloudiness, and no separation of oil globules. Also soluble in all proportions in glacial acetic acid.

"Specific gravity: 0.875 to 0.880 at 25° C. (77° F.).

"It is dextrorotatory, the angle of rotation varying from + 8° to + 24°, in a 100 mm. tube, at 25° C. (77° F.).

The oil of bergamot, often called *essence of bergamot*, has a sweet, very agreeable odor, a bitter, aromatic, pungent taste, a pale greenish-yellow color, and a slightly acid reaction.

It contains limonene, dipentene, linalool, a solid greasy compound called *bergaptene*, or *bergamot camphor*, and *linalool acetate*, $C_{10}H_{17}.C_2H_3O_2$, which latter makes up about 40 per cent. of the expressed oil, but is decomposed in large part by the process of steam distillation. Bergaptene has been very fully studied by Pomeranz. (*M. Chem.*, 1891, 379.) It melts at 188° C. (370.4° F.), and has the composition $C_{12}H_{10}O_4$, being the lactone or inner anhydride of *bergaptenic acid*, $C_{12}H_{10}O_5$. By fusion with potassium hydroxide, bergaptene yields *phloroglucin*. (See *Schim. Rep.*, April, 1893, and 1895, 24; also *Proc. A. Ph. A.*, 1897, 630.) The oil is distinguished from lemon and orange oils by readily dissolving in solution of potassium hydroxide and forming with it a clear solution. (Zeiler.) Though possessed of the stimulant properties of the volatile oils in general, it is employed chiefly as a perfume.

According to Galewsky (*Ph. Ztg.*, 1915, IX, p. 55) the oil of bergamot is an extraordinarily active insecticide and useful to protect the body against lice and other vermin.

It is often adulterated. (See *C. D.*, 1908, 383; also 1910, 52.)

Oil of Birch Tar, Rectified. *Oleum Betulae Empyreumaticum Rectifactum. N. F. IV. Rectified Oil of Birch Tar. Rectified Empyroligneous Oil of Birch. Oleum Rusci Rectificatum.*—"The pyroligneous oil obtained by the dry distillation of the bark and wood of *Betula alba* Linne (Fam. Betulaceae), rectified by steam distillation." *N. F.*

Under this name the National Formulary IV has introduced this oil of tar from the birch. It is, however, not certain whether the rectification has removed some of the valuable constituents. (See *Betula*)

It is described as follows:

"Rectified Oil of Birch Tar is a limpid, dark brown liquid having a penetrating, empyreumatic odor resembling that of Russian leather.

"It yields clear solution with 3 volumes of dehydrated alcohol, and with ether, chloroform, glacial acetic acid, amyli alcohol, oil of turpentine, benzene, or carbon disulphide. When mixed with 3 volumes of alcohol or purified petroleum benzin, the solution is not more than slightly turbid but a decided turbidity is produced when mixed with the same volume of methyl alcohol.

" Specific gravity: 0.886 to 0.950 at 25° C. (77° F.).

Oil of Callitris.—The pine trees of Australia belong to the genus *Callitris*, of which only one or two species are found outside of Australasia and New Zealand. The wood of these trees is of great value as building timber because of the fact that it is not attacked by white ants. According to Baker and Smith ("Research on the Pine Trees of Australia," 1910) this protection is due to the presence of a phenol-like body, to which they give the name *callitrol*. The constitution of this substance which they have obtained from the wood of *C. glauca* they have not as yet determined. Several of the Australian species yield a resin with the same properties as those of Sandarac, but at present they have not been employed commercially as sources of this resin. The term cypress pine is applied in Australia to a number of these trees.

Oil of Cardamom. *N. F. IV. Oleum Cardamomi.*—"A volatile oil distilled from the seeds of *Elettaria Cardamomum* White et Meton (Fain. *Zingiberaceae*). Preserve it in small, well-stoppered, amber-colored bottles, in a cool place, protected from light." *N. F.*

This oil has been introduced into the National Formulary IV. It is used in the preparation of *compound spirit of cardamom*, which is an ingredient in *compound elixir of cardamom*. It is also used as a flavor in other elixirs. It is to be regretted that cardamom seeds were not used instead of this oil which is largely adulterated. In fact oil of cardamom has been found in the market made from oils which contain no oil of cardamom whatsoever. The high price of cardamom seeds and the small percentage of volatile oil found in them offers an extraordinary inducement to adulterators. Care must therefore be used to employ only the oil which complies strictly with the requirements of the National Formulary IV. It is described as follows:

" Oil of Cardamom is a colorless or very pale yellow liquid having the characteristic, aromatic, penetrating and somewhat camphoraceous odor of cardamom, and a persistent, pungent, and strongly aromatic taste.

" It is very soluble in alcohol and readily soluble in four volumes of 70 per cent. alcohol, forming a clear solution.

" Specific gravity: 0.924 to 0.947 at 25° C. (77° F.).

"It is dextrorotatory, the angle of rotation varying from, +22° to +44°, in a 100 mm. tube, at 25° C." (77° F.) *N. F.* (See *A. J. P.*, 1910, 167.)

Oil of cardamom is not used medicinally but solely for pharmaceutical purposes.

Oil of Chione.—The bark of this West Indian tree, *Chione glabra* (Fam. *Rubiaceae*) yields on distillation 1.5 per cent. of a light yellow volatile oil, consisting chiefly of *oxyacetophenone*, $C_6H_4.OH.CO.CH_3$. A compound obtained synthetically from *o-nitrocinnamic* acid proved to be identical with that isolated from the oil. (See *J. Chem. S.*, vol. Ixxv, 1899.)

Oil of Citronella.—There are a group of closely allied grasses which yield sweet scented volatile oils. Of these volatile oils, which are sometimes spoken of collectively as *Indian Grass Oils*, there are at least five commercial varieties, namely. *Oils of Citronella, Lemon Grass, Palmarosa, Ginger Grass*, and of *Vetiver*. The botany of the sweet-scented grasses from which perfumery oils are obtained, has been somewhat confused. Stapf (see *Schim. Rep.*, April, 1907, p. 20) divides them into three groups, the *Cymbopogon, Andropogon* and *Vetiveria*.

Andropogon nardus L. (Fam. *Gramineae*) yields citronella oil. It grows in Ceylon, the Malaccan Peninsula, India and to some extent in tropical East Africa. There are two principal varieties, the one, *Lana Batu*, grows widely in Ceylon and yields an oil relatively poor in geraniol and is the principal source of the oil of commerce. The second variety, known as *Matia pangiri*, is generally cultivated in the Straits Settlements and in Java. This latter oil has a lower specific gravity, a lighter color and is claimed to be superior in quality.

Oil of citronella is produced in Ceylon, the Straits Settlements, close to Malabar, the Malay Peninsula and Java, the last named being the most highly esteemed. The exports of citronella oil from Ceylon amounted in the year 1909 to 1,512,084 pounds. Oil of citronella is of a yellowish-green color, having a characteristic odor and pungent taste. Its sp. gr. is, according to Gilde-meister and Hoffmann, 0.886-0.900. It mixes with alcohol in all proportions, and the test for purity given by Schimmel and Co. is based upon its behavior towards alcohol of 80 per cent: " One volume of the oil must form an absolutely clear solution with two, or at least two and a half, volumes of 80 per cent. alcohol at a temperature not below 20° C. (68° F.). A cloudy mixture indicates the presence of turpentine, certain fixed oils, and other essential oils which are sometimes used to adulterate it." The most important ingredients in this oil are *geraniol* and *citronellal* which together may make up as much as 93 per cent. of the oil. It is not used in medicine, but is largely used in the arts, for perfuming cheap soaps, especially so-called honey soap. An ointment containing 25 per cent. of the oil of citronella affords an excellent protection against the bites of mosquitoes and other insects.

Oil of lemon grass is official in the British Pharmacopoeia (1914). (See *Oleum*

Graminis Citrati)

The *Palmarosa* oil is produced chiefly in India, and is the product of the *Cymbopogon martini* (*Andropogon schoenanthus* Pluck. and Hanb. not L.). Its most important ingredient is geraniol, of which it may contain as high as 94 per cent. It is largely employed in the perfumery arts, and also as an adulterant to the oil of rose and the oil of geranium.

Ginger grass oil resembles palmarosa oil in its properties but contains a much smaller percentage of geraniol.

From the roots of the *vetiver* or *cus-cus grass*, *Vetiveria zizanioides* Stapf. (*A. muraticus* Retz), which grows in the island of Reunion and in the Philippine Islands, is distilled a volatile oil. The odoriferous principle of this oil is at present unsettled. It has been attributed by Genivesse and Landlois to a peculiar alcohol which they named *vetivenol*, but this has been denied by Bacon. (*Philippine Journal of Science*, 1909, iv, p. 118.)

Various other allied grasses, such as the *Cymbopogon polyneuros* or *Delft Grass*, and the *C. Coloratus*, etc., yield sweet-scented oils which have, however, not become commercially important.

Oil of Coconut. *Cocoanut Oil. Cocoanut Butter. Oleum Cocos, P. G. Oleum Cocois. Beurre de Coco, Fr. Kokosnussol, G.*—This must not be confounded with the fixed oil of the chocolate nut, which is often called *cocoa butter*. (See *Oleum Theobromatis*) The substance here considered is the fixed oil of the coconut, which is the fruit of a species of palm, *Cocos nucifera* L., universally known as the *coconut tree*, or *cocoa-nut tree*. The oil is obtained either by expression or decoction, often by insolation—i. e., exposing the rasped nuts to the heat of the tropical sun. It is of a fine white color, of the consistence of lard at ordinary temperatures, becoming solid, like suet, between 4.4° C. (40° F.) and 10° C. (50° F.), and liquid at about 26.7° C. (80° F.), of a bland taste, and a peculiar, not disagreeable odor. It is readily dissolved by alcohol. It contains large quantities of the glycerides of myristic and lauric acids, with smaller quantities of the glycerides of palmitic and oleic acids. It has also been found to contain several volatile acids, as caproic, caprylic, and capric acids. (Lewkowitsch, *Chemical Analyses of Oils, Fats, and Waxes*, 2d ed., 1898, 538.)

The oil has been used for various purposes in medicine and pharmacy. It has been employed as a substitute for cod liver oil, especially in the form of a proprietary preparation, *coco-olein*. In Germany it has been used in pharmacy, to a considerable extent, as a substitute for lard, to which, according to Pettenkofer, it is preferable on account of its lesser tendency to rancidity, its more ready absorption when rubbed on the surface of the body, and its lesser liability to produce chemical changes in the substances with which it is associated. Thus, the ointment of potassium iodide, when it is made with lard, becomes yellow in a few days, while, if made with coconut oil, it remains unchanged for two months or more. Vegetable substances also keep better in ointments prepared with this oil than with lard. Besides, it takes up one-third more

water, which is a useful quality when it is desirable to apply saline solutions externally. To prepare it for use, nothing more is ordinarily necessary than to melt it at a moderate heat, and strain it through linen. If colored, it may be digested with powdered animal charcoal, and subsequently filtered through paper. (*A. J. P.*, xxix, 331.) When chilled and pressed, a solid residue, which is *coco-stearin*, is obtained. This is extensively used as a substitute and adulterant of the genuine cocoa butter in the confectionery trade. Coconut oil is employed in the manufacture of soap, particularly of the transparent varieties, and the so-called "*marine soaps*" and *filled soaps*; it is also largely used for giving firmness and lathering qualities to the ordinary soap; this property also permits of the addition of a large quantity of water to the soap. Unfortunately, coconut oil soap is very apt to contain free caprylic acid; and the persistent rancid odor, resembling that of infants' vomit, left upon the skin after washing with its soap is an effectual bar to its very extended use. The exportations of coconut oil from Ceylon amount to 15,000 tons annually, from British India to 4000 to 6000 tons, and from the Dutch Indies to 1300 tons per annum. Besides the oil itself, the dried pulp of the coconut is sent to European markets in large amounts under the name of *copra*. The export of copra from Ceylon amounts to 5000 tons annually, from Tahiti to 4000 tons, from Samoa to 3000 tons, and from Singapore to 4000 tons.

The importations of coconut oil into the United States for 1914 amounted to 74,386,213 pounds, valued at \$6,703,942, and for 1915, 63,135,428 pounds, valued at \$3,430,581.

According to Parisi, the endocarp or meat of the coconut is a powerful tenicide. The patient should drink the milk and then eat the flesh of the nut. The coconut is said to be largely used in India as a vermifuge, and the matter appears to have practical importance.

Powdered coconut shells have been largely used in America as an adulterant for spices. Their debris is readily recognized by the microscope. (See *A. J. P.*, 1901.)

E. Millian describes the following test to determine the purity of coconut oil: 4 mls of the clean, water-free fat is introduced into a test tube with 2 mls of ethereal solution of phloroglucin and 'mixed by circular agitation; 2 mls of benzene solution of resorcin is then added and the whole again mixed. The tube is then immersed for a few minutes in ice-water, to bring the temperature to 10° C. (50° F.) ; 4 mls of nitric acid, sp. gr. 1.35, free from nitrous fumes, is then added, and the tube being closed with a rubber cork previously washed with the same acid, the whole is well shaken for five seconds. Pure coconut oil remains perfectly unaltered, negligible traces of impurities may impart a scarcely perceptible rose tint to the mixture; but the presence of any seed oil, such as cotton, sesame, arachis, etc., will at once be indicated by a distinct currant-red color if 5 per cent. of the adulterant be present. The color reactions which occur later, when the temperature of the mixtures rises to 40° C. (104° F.) are disregarded. It is important that the reagents and solvents employed should be absolutely pure, and that the temperature of the reagents and the oil should be between 10° C. (50° F.) and 12° C. (53.6°F.). (*C. R. A. S.*, 1903, cxi, 1702.)

Oil of Colza.—An oil expressed from the seed of *Brassica campestris* L., or *field cabbage*, a cruciferous plant which grows wild throughout the greater part of Europe, and is largely cultivated in France and Germany for the sake of this oil. *Colza oil* is used in Europe as a burning oil, as a lubricating oil, and, after purification by heating with starch, as a table oil. The raw oil has a sp. gr. of 0.915, and the refined oil 0.9136. Chilled to -4° C. (24.8° F.), stearin separates out, and at -6° C. (21.2° F.), it becomes a yellowish buttery mass. The oil contains the glycerides of stearic, *erucic* (or *brassic*) acid, C₂₂H₄₂O₂, and an acid isomeric with, but differing in some respects from, ordinary oleic acid. A similar oil is derived from rape-seed (*Brassica napus*). The total consumption of rape and colza oil in Europe is estimated at from 280,000 to 300,000 tons per annum. For analysis of commercial samples, see *C. D.*, 1894, 140.

Oil of Cypress.—An oil derived from *Cupressus sempervirens* L. (Fam. *Pinaceae*) has been strongly recommended by Bravo in *whooping cough*; it is used by sprinkling the oil upon the clothes, bed, etc., of the patient.

Winterseel (*In. Dis.*, Bonne, 1908) has studied cypress oil physiologically and finds that its action is similar to the other essential oils, but is of relatively low toxicity. When the reflexes are excited by spinal stimulants it acts as a depressant to the spinal cord. He confirms the favorable results of its inhalation in cases of whooping cough.

Oil of Doegling. *Oleum Choenoceti. Doegling Oil. Doegling Thran. Ernie de Rorqual Rostre*, Fr.—The oil derived from the Norwegian whale, *Balaena rostrata*, is said by Gustave Guldberg to possess a lower specific gravity than any other animal oil (0.876 at 15° C. (59° F.)), and also remarkable penetrative properties. It is affirmed that if mixed in equal quantities with chloroform it carries the latter agent through the skin, and enables it to act as a local anesthetic in pruritus, neuralgia, etc. Mixed with wax, it is highly recommended as a basis for ointments by the same authority.

Oil of Egg Yolk.—A fatty oil obtained by expression from the yolks of fresh eggs. It has been used in lotions and as a popular remedy on the continent in the treatment of corneal opacities.

Thorpe's Dictionary gives the following composition and properties of egg oil: Specific gravity, 0.9144; solidification point, 8°-10° C. (46.4°-50° F.); melting point, 22°-25° C. (71.6°-77° F.); acid value 1.2; saponification value 184.4-190.2; iodine value 68.5-81.6; insoluble fatty acids and unsaponifiable matter 95.16 per cent.

Benedikt states that the refractive index of egg oil is 1.4655. and that it gives the elaidin reaction. It is also stated that the oil obtained by expression differs from that extracted by solvents in that the latter contains *cholesterol* and *lecithin*.

Oil of Erigeron. *Oil of Fleabane. Oleum Erigerontis. U. S. VIII. Oil of Canada Fleabane. Essence d'Erigeron*, Fr.—"A volatile oil distilled from the fresh, flowering herb of *Erigeron canadensis* Linne (Fam, *Compositae*)." *U. S. VIII.*

Oil of erigeron is limpid, of a light straw color, a peculiar, aromatic, persistent odor, and a characteristic taste. By exposure it becomes darker and thicker. Its reaction is neutral. Its sp. gr. is about 0.850, increasing with age (0.855 to 0.890, *Sohim. Rep.*). It consists chiefly of dextrogyrate limonene, together with some terpineol. (*A. J. P.*, 1893, 420.) It was officially described as "a pale yellow, limpid liquid, rapidly becoming darker and thicker by age and exposure to the air, having a peculiar, aromatic, persistent odor, and an aromatic, slightly pungent taste. Specific gravity, 0.845 to 0.865 at 25° C. (77° F.). Soluble in an equal volume of alcohol (distinction from oil of fireweed derived from *Erechthites hieracifolia* Rafinesque (fam. *Compositae*) and from *oil of turpentine*). It is dextrogyrate, the angle of rotation being not below +45° in 100 mm. tube, at a temperature of 25° C. (77° F.)." *U. S.* When distilled without water, it comes over colorless, and a little resinous matter is left behind, probably resulting from the oxidation of one or both of the constituent oils. It is slowly reddened by potassium hydroxide, combines with iodine without explosion, is instantly decomposed by sulphuric acid, and is acted on by strong nitric acid, slowly at ordinary temperatures, but with heat explosively. (*Procter, A. J. P.*, xxvi, 502.) The plant yields 0.2 to 0.4 per cent. of oil. When exposed to the air, the oil darkens and rapidly resinifies. For an account of the difference in properties between this oil and that from *Erechthites hieracifolia*, see a paper by Albert M. Todd, *A. J. P.*, 1887, p. 302; also one by Frank Rabak, *Ph. Rev.*, 1905, 81, and also *Ph. Rev.*, 1906, 326.

It was first brought into notice by the so-called eclectic physicians, who use it in *diarrhea*, *dysentery*, and the *hemorrhages*, and apparently it is a valuable remedy in *hemoptysis* when there is no fever or other marked evidence of constitutional irritation. J. W. Moorman speaks of it most highly, in *diarrhea of debility*, in *dysentery* after sufficient evacuation of the stomach and bowels, and especially in *hemorrhage from the bowels during typhoid fever*. (*Am. J. M. S.*, Oct., 1865, p. 393.) It probably acts like the oil of turpentine as a hemostatic, but is much less irritant and stimulating.

Dose, ten minima to half a fluidrachm (0.6-1.8 mls), repeated every hour or two.

Oil of Eulachon.—The fish known by the North Pacific Indians under the name of *Eulachon* or *Oulachon*, and by the English as *Hoolakins* or *Candle fish*, the *Thaleichthys pacificus* of scientists, yields a great abundance of an oil which has been proposed as a substitute for cod liver oil. According to the editor of *N. R.* (1881, 356), this oil first begins to congeal and become opaque at -7° C. (19.4° F.), although authorities state that at ordinary temperatures it grows solid and lard-like. Specific gravity at 15.5° C. (60° F.), 0.907; mixed with one-half its volume of nitric acid, specific gravity 1.37, it develops a beautiful pink color which fades slowly to amber, and after standing fifteen hours it is considerably thickened and its color is changed to a deep amber of a reddish cast. It contains about 20 per cent. of palmitic and stearic acids, and 60 per cent. of oleic acid and 13 per cent. of an unsaponifiable substance, which resembles the similar constituent of sperm oil. (*T. (?)*, Sept. 15, 1884.)

Oil of Euphorbia.—A fixed oil, obtained from the seeds of *Euphorbia Lathyris* L.

(Fam. *Euphorbiaceae*), a biennial plant somewhat naturalized in this country, though believed to have been introduced from Europe. It is often found near gardens and in cultivated fields, and is generally called *mole plant*, under the impression that molea avoid the ground where it grows. (Pursh.) It is the caper plant of England. Like the other species of *Euphorbiaceae*, it contains a milky juice, which is extremely acrid, and the whole plant possesses the properties of a drastic purge; but the oil of the seeds is the only part used in medicine. This may be extracted by expression, or by the agency of alcohol or ether. In the first case, the bruised seeds are pressed in a canvas or linen bag, and the oil which escapes is purified by decanting it from the whitish flocculent matter which it deposits upon standing, and by subsequent filtration. By the other process, the bruised seeds are digested in alcohol, or macerated in ether, and the oil is obtained by filtering and evaporating the solution. According to Soubeirari, however, the oils obtained by these different processes are not identical. That procured by expression is probably the purest.

Oil of euphorbia is colorless, inodorous, and, when recent, nearly insipid; but it speedily becomes rancid, and acquires a dangerous acidity. Soubeiran has ascertained that it has a complex composition, containing, besides the pure oil, four distinct proximate principles. (*J. P. C.*, xxi, 259.) From 40 to 44 parts are obtained by expression from 100 of the seed. It is a powerful purge, but in doses of from five to ten drops is stated by Continental physicians to act kindly upon the bowels. In this country, however, it has been found very uncertain in its effects, and very liable to cause vomiting. (*A. J. P.*, iv, 124.)

Oil of Jasmine.—This oil is obtained from the flowers of the common *white jasmine* (*Jasminum grandiflorum* L.). Alternate layers of the fresh flowers, and of cotton saturated with the oil of ben or other fixed oil, are exposed in a covered vessel to the warmth of the sun, the flowers being renewed until the oil becomes impregnated, when it is separated from the cotton by pressure. This method is necessary, as the flowers do not yield their aroma by distillation. According to Gildemeister and Hoffmann, jasmine oil contains 65 per cent. of *benzyl acetate*, and in addition *linalyl acetate*, benzyl alcohol, and linalool. The oil is used only as a perfume. W. H. Hall records (*M. S. Rep.*, Jan., 1861) the case of a child poisoned by the fruit of a jasmine, probably the common white species. The symptoms were coma, widely dilated pupil, and snoring respiration, with a cold pale surface, and slow and feeble pulse, followed by violent convulsions, with rigidity of the muscles about the head and throat.

Oil of Kuromoji.—Under this name there have entered commerce two fragrant Japanese oils— one, *Kouromotsi*, said to be obtained from the *Lindera sericea* Bl., and one, *Kuro matsi*, yielded by *Lindera umbellata* (Fam. *Lauraceae*). (See *Schimmel's Bericht*, 1904.)

Oil of Linaloe.—This volatile oil which is produced in Mexico, according to Seyffert (*Schim. Rep.*, Oct., 1907), is obtained from the wood of two species of *Bursera*, one of which is known in the Spanish as *Linaloe*, and the other as *Copal limon*. The latter tree is probably the *B. aloexylon* Engl. Better grades of this oil have a pleasant odor resembling a mixture of lemon and jasmine, while the poorer grades have a caraway-

like odor. It is important in perfumery as the source of *linalyl acetate*, and is used as a substitute for oil of bergamot.

Oil of Maize.—Our American maize or Indian corn yields a bright golden-yellow oil, of peculiar pleasant odor and taste. It is moderately thick, and has a sp. gr. at 15° C. (59° F.) of 0.916 to 0.924. It consists of olein and palmitin, and solidifies at -10° C. (14° F.). The oil is contained in the germs of the seed alone. Reckoned on the whole weight of the seeds the oil constitutes about 5 per cent., reckoned on the weight of the germ itself, after separation from the starchy body of the seed, the oil amounts to nearly 50 per cent. It is now being extensively produced in connection with the working of starch and glucose factories. It is used as a lubricant and for soap making, and as a substitute for cotton seed oil. In 1914 the amount of corn oil exported was 18,-281,576 lbs., and in 1915, 17,789,635 lbs.

Oil of Myrcia. *N. F. IV. Oleum Myrcice. Oil of Myrcia. Oil of Bay.*—"A volatile oil distilled from the leaves of *Pimenta acris* Wight (not *Myrcia acris* DC.) (Fam. *Myrtaceae*)." This oil, formerly official in U. S., 1890, is now official in the National Formulary IV.

"A volatile oil distilled from the leaves of *Pimenta acris* (Swartz) Wight (Fam. *Myrtaceae*). Preserve it in small, well-stoppered, amber-colored bottles, in a cool place, protected from light." *N. F.*

The commercial oil of bay is a mixture of both heavy and light oils, as G. M. Beringer found the specific gravity of two samples of undoubted purity to be 0.975 and 0.994. (*A. J. P.*, 1887, 286.) Mittmann (*A. Pharm.*, 1889, 529) reported the following constituents: 1, pinene; 2, possibly *dipentene*; 3, a polyterpene, probably *diterpene* (insoluble in alcohol); these three in small quantity only; 4, eugenol, the chief constituent; and, 5, methyl-eugenol, in smaller quantity. It has since been examined (March, 1895) by Power and Kleber, who state that it contains from 60 to 65 per cent. of phenols, of which two were identified: *eugenol*, C₁₀H₁₂O₂, and chavicol, C₉H₁₀O; two phenol esters, methyl-eugenol, C₁₁H₁₄O₂, and methyl-chavicol, C₁₀H₁₂O; phellandrene and a newly discovered terpene which they named myrcene, C₁₀H₁₆, and *citral*, C₁₀H₁₆O. (*Ph. Rund.*, 1895, 60.) The oil is officially described as "a yellow or brownish-yellow liquid having a pleasant, aromatic odor and a pungent, spicy taste.

"With an equal volume of alcohol, glacial acetic acid, or carbon disulphide, it yields slightly turbid solutions. An alcoholic solution is slightly acid to litmus paper.

" Specific gravity: 0.962 to 0.990 at 25° C. (77° F.).

" It is laevorotatory, the angle of rotation not exceeding -3°, in a 100 mm. tube, at 25° C. (77° F.).

Oil of bay is not used internally, but solely for making *bay rum*. (See *Spiritus Myrciae Compositus*, Part III.) For a paper describing the manufacture of bay rum and oil of bay, see W. O. Fishlock, *C. D.*, 1912, 714.

For an English formula for bay rum, see *P. J.*, 1896, 468.

The oil of bay is an active antiseptic, 1 part in 1000, according to Peck (*J. A. M. A.* 1899, xxxii, p. 6) being sufficient to prevent the growth of bacteria.

Bay rum is used chiefly as a refreshing perfume in cases of *nervous headache*, *faintness* and other *nervous disorders*, either held to the nostrils, or applied on soft linen to the head and forehead. According to Berger (*Th. M.*, 1907, xxi, p. 221) it is a valuable local application in various diseased conditions of the skin, especially in seborrhea of the scalp. It is also grateful to the feeble and convalescent patient, by being sprinkled on the bed covering or otherwise made to impregnate the air of the chamber. The oil of bay is often adulterated, and is frequently sold by smugglers.

Oil of Neat's-foot. *Oleum Bubulum. Oleum Pedum Tauri. Axungia Pedum Tauri. Huile (Oraisse) des Pieds du gros Betail, Fr. Klauenol, Ochsen Klauenfett, G.*—This formerly official oil is obtained by boiling for a long time the feet of the ox, previously deprived of hoofs. The fat and oil which rise to the surface are removed and introduced into a fresh portion of water, heated nearly to the boiling point. The impurities having subsided, the oil is drawn off, and, if required to be very pure, is again introduced into water, which is kept for twenty-four hours sufficiently warm to enable the fat which is mixed with the oil to separate from it. The liquid being then allowed to cool, the fat solidifies and the oil is removed and strained, or filtered through layers of small fragments of charcoal free from powder. The oil is clear and yellowish in color, of sp. gr. 0.916 at 15° C. (59° F.), and, when properly prepared, inodorous and of a bland taste. It thickens or congeals with great difficulty, and is, therefore, very useful for greasing machinery. It is also used for softening leather and in grinding metals. It has been given as a substitute for cod liver oil in scrofulous diseases. It is apt to be laxative, and in certain cases proves useful in this way. It is given in the same dose as cod liver oil. (See *Am. J. M. S., N. S.*, xxiv, 498.) It is at present difficult to obtain pure neat's-foot oil in commerce.

Oil of Orange Flowers. *N. F. IV (U. S. P. 1890). Oleum Aurantii Florum. Oil of Neroli. Oleum Naphae, G.*—"A volatile oil distilled from the fresh flowers of the Bitter Orange, *Citrus aurantium amara* Linne (*Citrus vulgaris* Risso, *Citrus Bigaradia* Risso). (Fam. *Rutaceae*). It should be kept in well-stoppered bottles, in a cool place, protected from light." *U. S.*, 1890. *N. F.*

This oil, official in the U. S. P., 1890, is employed for its odor and taste, and is largely used as an ingredient in cologne water, perfume, etc. The best quality of *oil of neroli*, as it is universally called in commerce, comes from Nice, and is derived from the flowers of the *Citrus Aurantium sinensis* L., or sweet orange, by distillation with water; this is called *neroli petale*. The next quality is obtained in the same way, but by using the blossoms of the *Citrus Bigaradia* Risso, or bitter orange: this is called *neroli bigarade*, while an inferior sort, *essence de petit grain*, is made by distilling the leaves and unripe fruit. This should not be classed with neroli, as it is unworthy of the name. *Oil of petit grain citronnier* is a fragrant oil, distilled from the leaves and twigs of the

lemon tree; it closely resembles the essence de petit grain which is made from the orange leaves and fruit. (*C. D.*, 1897, 53.)

It is officially described as follows:

"Oil of Orange Flowers is a pale yellow, slightly fluorescent, neutral liquid, having a distinctive fragrant odor similar to that of orange blossoms and an aromatic, at first sweet then somewhat bitter, taste.

"It is soluble in an equal volume of alcohol, the solution having a violet fluorescence and a neutral reaction to litmus paper. Also soluble in two volumes of 80 per cent. alcohol, the solution becoming cloudy on the further addition of alcohol of the same percentage.

"Specific gravity: 0.868 to 0.880 at 25° C. (77° F.).

" It is dextrorotatory, the angle of rotation varying from +1° 30' to +5°, in a 100 mm. tube, at 25° C. (77° F.).

Under the name of *nerolin* an artificial product has been placed upon the market in the form of a white crystalline powder, soluble in alcohol and fixed oils and almost insoluble in water. It is used by soap makers as a substitute for oil of neroli, and is said to be ten times as strong. This compound is said to be the *ethyl ether of β-naphthol*. (*Ber. d. Chem. Ges.*, 1893, 2706.) It is also used in the manufacture of eau-de-Cologne with advantage instead of neroli oil. (*Schim. Rep.*, April, 1893.) Oil of neroli of excellent quality is now produced artificially; Schimmel & Co. state that it contains pinene, camphene, dipentene, terpineol, phenyl, acetic acid, benzoic acid, decylic aldehyde, and linalool.

Oil of Palm. *Palm Oil. Huile (Beurre) dei Palme, Fr. Palmol, Palmbutter, G.*—This highly valuable fixed oil is the product of *Eloeis guineensis* Jacq., a palm growing on the western coast of Africa, and cultivated in the West Indies and South America. It is among the handsomest trees of its graceful family which flourish in the tropical regions of Africa. The oil is obtained by expression from the fruit. It is brought to this country chiefly from Liberia and other places on the African coast, although prepared also in the West Indies, Cayenne, and Brazil. It is not improbable that various species of *Palmaceae* contribute to the supply of this article of commerce. At present the chief ports for its shipment are Cape Palmas and Lagos, prima and secunda Lagos being the choicest varieties. The annual export from the African coast is about 50,000 tons, of which the bulk goes to England. The importation into the United States amounted in 1914 to 61,753,482 lbs., valued at \$4,118,077, and in 1915 to 31,482,292 lbs., valued at \$2,024,827.

Palm oil has the consistence of butter, a rich, orange-yellow color, a sweetish taste, and an agreeable odor, compared by some to that of violets, by others to that of the Florentine orris. By age and exposure it becomes rancid and of a pale yellow or nearly white color. It melts with the heat of the hand, and when perfectly fluid passes readily

through blotting paper. Highly rectified. alcohol dissolves it at common temperatures, and in ether it is soluble in all proportions. Its constituents are *tripalmitin* and *triolein*, $C_3H_5(C_{16}H_{31}O_2)_3$ and $C_3H_5(C_{18}H_{33}O_2)_3$. The tripalmitin is converted into *palmitic acid* by superheated steam, with liberation of glycerin. It appears also that a considerable proportion of this acid, together with some glycerin, exists uncombined in the oil, as ascertained by Pelouze and Boudet; so that the changes which are effected in oils, through the agency of alkalis, in the process of saponification, take place, to a certain extent, spontaneously in palm oil. (*J. P. C.*, xxiv, 389.) Hence it is more easily saponified than any other fixed oil. Preparatory to saponification, it may be bleached rapidly, according to J. J. Pohl, by heating it quickly to $240^\circ C.$ ($464^\circ F.$) and keeping it for ten minutes at that temperature. It loses for a time its peculiar odor by the process, acquiring an empyreumatic one; but this after a while ceases to be perceived, and the characteristic odor returns. (See *A. J. P.*, xxvii, 346.) Englehart bleaches it in the following manner: 1000 lbs. of the oil are heated in a boiler to $62.2^\circ C.$ ($144^\circ F.$) and kept at that temperature until the next day, when it is decanted into a clean vessel, and cooled to a point between $36.6^\circ C.$ ($98^\circ F.$) and $40^\circ C.$ ($104^\circ F.$). In another vessel 15 lbs. of potassium dichromate are dissolved in 45 lbs. of boiling water, and, when the solution is partially cooled, 60 lbs. of hydrochloric acid are added. This solution is then mixed with the oil, and briskly agitated. In five minutes the color changes to green, through the reduction of the chromic acid, and, with a continuation of the agitation, the chromium oxide separates, and then nothing more is necessary than washing with water to 'get the oil colorless. (*A. J. P.*, 1868, 333.) Palm oil is said to be frequently imitated by a mixture of lard and euet, colored with turmeric, and scented with Florentine orris. It is much employed in the manufacture of toilet soap, which retains its pleasant odor. Palm oil is emollient, and has sometimes been employed in friction or embrocation, though not superior for this purpose to many other oleaginous substances. It is sometimes used to impart a yellow color to mixtures of fats or manufactured products, such as oleomargarine. In the latter case it is considered as an artificial coloring matter which necessitates the payment of ten cents per lb. additional tax. It is detected in the presence of other fats by a color reaction developed when sulphuric acid is added to a mixture of the suspected oil and an equal volume of acetic anhydride. This is known as Crampton-Simons test for palm oil, but it has been attacked by A. G. Gill (*J. I. & E. C.*, 1917, p. 136) as being fallacious, due not to a specific substance present in palm oil only, but to the presence of carotin, which is present in butter and some other constituents likely to be normally present in oleomargarine, to which this test is usually applied for the purpose of detecting the palm oil as an added coloring matter. The test as carried out is as follows: Preparation of Sample: The sample should be kept in a cool dark place until tested, as exposure to light and air or the presence of water, alcohol, ether or similar reagents, interferes with the tests. Immediately before testing, the sample is filtered as quickly as possible at a temperature not exceeding $70^\circ C.$ ($158^\circ F.$). *First Method:* Dissolve 100 mls of the fat in 300 mls of petroleum ether and shake out with 50 mls of a 0.5 per cent. potassium hydroxide solution. Draw off the aqueous layer, make distinctly acid with hydrochloric acid and shake out with 10 mls of pure carbon tetrachloride. Separate the carbon tetrachloride solution, transfer a portion to a porcelain crucible, add 2 mls of a mixture of one part colorless, crystallized phenol and two parts of carbon tetrachloride, then 5 drops of hydrobromic acid (sp. gr. 1.19)

and mix by gentle agitation. The almost immediate development of a bluish-green color is indicative of palm oil.

Second Method (usually preferred) : Shake out 10 mls of the melted and filtered fat with an equal volume of colorless, chemically pure, acetic anhydride, add 1 drop of sulphuric acid (sp. gr. 1.53) and shake the mixture for a few seconds longer.

If palm oil is present the lower layer, on settling, will be found to be colored blue with a tint of green. The color in this as well as in the preceding test is transient. *Leach*, p. 541-543.

Oil of Patchouli.—The genuine oil is obtained from *Pogostemon Patchouli* Pellet, a plant cultivated in the Straits Settlements and in Penang. The plant has also been cultivated in the West Indies and in Paraguay. A small amount of oil is also obtained from *Microtaena cymosa* Prain, a plant cultivated in the mountainous districts of Assam. The patchouli herb is sometimes dried and sent into commerce. It is not infrequently adulterated with a number of other plants, the latter being present to the extent of 80 per cent. It is believed by Arabs, Chinese, and Japanese to possess prophylactic powers. The oil as found in commerce is of two kinds. The best is that distilled in the East in the neighborhood of the patchouli plantations, from selected fresh leaves; the other kind is distilled in Europe from imported leaves; the latter often arrive in a more or less damaged condition, and are frequently adulterated. *Oil of patchouli* is a thick, brownish-yellow oil with a green tint, and was shown by Gladstone to contain *coerulein*, an intensely blue compound found in oils of absinthium, calamus aromaticus, matricaria, achillea, etc. The oil has the sp. gr. 0.970-0.990 at 15° C. (59° F.), and is laevorotatory. Rodie states that the odor improves by age and hence perfumers prefer the older oils. It deposits a solid, *patchouli alcohol*, C₁₅H₂₅O, which crystallizes in hexagonal prisms, melts at 56° C. (132.8° F.), and boils at 206° C. (402.8° F.), while *cadinene*, C₁₅H₂₄, remains; oil of cedar and oil of cubeb are frequently used to adulterate the oil. They may be detected by fractional distillation. Oil of patchouli is used in perfumery mainly for its valuable property of conferring upon other odors lasting qualities; its characteristic and persistent odor when un-combined is usually not popular among Caucasians.

Oil of Turtle. Turtle Oil.—In South America an oil is prepared from the eggs of turtles, and in the Seychelle Islands and in Jamaica from the fat of the turtle itself. These oils are said to be of equal value with cod liver oil for strumous persons and others in whom the nutritive processes are defective. (See *P. J.*, vol. xv, 573.) C. E. Sage examined *turtle oil* as sold in London drug auctions and found the sp. gr. 0.919 at 25° C. (77° F.). The oil was yellow and semi-solid, having an odor of beef-drippings. (*C. D.*, 1906, 691.) It is stated that 50,000 gallons are sent to Para yearly from the Orinoco, the Amazon, and the Rio Negro, and that 60,000 gallons are consumed by the tribes who prepare the oil. The Seychelles Islands are said to produce 6000 gallons of oil yearly.

Oil of Wood. Wood Oil. Gurjun Balsam.—In the *P. J.* for August, 1854 (p. 65), appeared an account by Charles Lowe of Manchester, of a "new variety of balsam of

copaiba," derived from the East Indies. In a subsequent communication to the same journal (1856, 321) from Daniel Hanbury, it appears that this product, though offered for sale in the London market as *balsam of copaiba*, is known in India under the names of *wood oil* and *gurjun balsam*. Considerable quantities had been imported from Moulmein, in Burma, specimens of a similar drug had been received from Canara and Tenasserim, and it appears to be widely diffused in the Indian markets. This must not be confounded with the *Chinese wood oil*, which is used as a varnish. (See *Oil of Aleurites*.)

This liquid is obtained from *Dipterocarpus turbinatus* Gaertn. f., and several other species of *Dipterocarpus* growing in East India (Fam. *Dipterocarpaceae*), a very large tree which forms forests in Pegu and other parts of Farther India. A large notch is cut in the trunk of the tree, between two and three feet from the ground, and a fire made so as to char the wound. The juice then begins to flow, and is received in suitable vessels. Every three or four weeks the charred surface is cut off and burned anew. A single tree sometimes yields forty gallons in a season. *D. tuberculatus* Roxb. yields a liquid known in Burma as *in oil*, which is sometimes sold as gurjun balsam. (*Proc. A. Ph. A.*, 1913, 223.) It is at first turbid, but may be clarified either by filtration or deposition. After filtration, wood oil is a clear, dark brown liquid, of the sp. gr. 0.964 (Hanbury), and, in consistence, odor, and taste, bears a close resemblance to copaiba. It is soluble in two parts of alcohol of the sp. gr. 0796, with the exception of a very small proportion of darkish flocculent matter, which subsides on standing. According to Lowe, it contains 65 per cent. of volatile oil, 34 of resin, and 1 of acetic acid and water. A characteristic property noticed by Lowe, by which it may be distinguished from copaiba, is that, when heated in a closed vial to 266° F. (230° F., Lowe), it becomes slightly turbid and coagulates, so that the vial may be inverted without changing the position of its contents, and this consistence is retained when the liquid cools. By a gentle heat with agitation the fluidity returns; but the liquid again coagulates if heated to 266° F. According to D. Brandis, this property of coagulation is characteristic of the wood oil from *D. alatus* Roxb. (*P. J.*, xxv), a wood oil which is further to be distinguished by the greenish opalescence of its surface.

Guibourt states that wood oil does not solidify, like copaiba, with one-sixteenth of magnesia, and the two separate on standing. (*J. P. C.*, xxx, 192.) De Vrij of Rotterdam, proposes the reaction of benzene with wood oil and copaiba respectively as a test to distinguish them. With an equal volume of the wood oil, benzene forms a turbid mixture, from which, after a long time, a resinous matter is deposited in flocculi; with copaiba it forms a transparent solution. (*P. J.*, 1857, 374.) The volatile oil from gurjun balsam is a yellow, somewhat thick liquid, of sp. gr. 0.915 to 0.930, and has at times a high optical rotation— viz., -35° to -130°. The oil boils in larger part at 255° to 256° C. (491°-492.8° F.) and consists of a sesquiterpene; C₁₅H₂₄. With hydrochloric acid it yields a deep blue color. The resin left after distilling off the volatile oil is essentially *gurjunic acid*, C₂₂H₃₄O₄. This when purified dissolves readily in ether and strong alcohol, and slowly in benzene. It melts at 220° C. (428° F.) and congeals again at 180° C. (356° F.). Fluckiger has also described a neutral resin from gurjun balsam, which is insoluble in caustic potash, fuses at 126° C. (258.8° F.), and is of the composition C₂₈H₄₆O₂. Fluckiger (*A. Pharm.*, 1876, 420) noticed that wood oil may be

recognized by the violet color it assumes if dissolved in twenty parts of carbon disulphide and mixed with a drop of a cold mixture of equal parts of concentrated sulphuric and nitric acids.

According to O'Shaughnessy, the oil of dipterocarpus is little inferior to copaiba in the diseases for which that medicine is employed. T. B. Henderson has found it very useful in *gonorrhoea*, given in the dose of a teaspoonful two or three times a day, uncombined. (*M. T. G.*, 1865, 571.) It probably has a remedial influence on diseased mucous membranes similar to the different turpentine, which it appears to resemble in composition. The juice may be given in emulsion, in doses of from fifteen to forty minims (0.9-2.5 mls) ; the volatile oil from ten to thirty minims (0.6-1.8 mls).

Oil of Ylang Ylang. *Cananga Oil. Oleum Anonae. Oleum Unonae.*—This is a volatile oil obtained from the flowers of *Cananga odorata* Hook. f. and Thorns (Fam. *Anonaceae*), a large tree inhabiting most parts of Southern Asia; the oil from the Philippine Islands is especially esteemed. According to Schimmel & Co. (*Schim. Rep.*, April, 1897), it contains pinene, linalool, geraniol, esters of acetic and benzoic acids, cadinene, and para-cresol-methyl ester. It is used only as a perfume. (See *N. R.*, April, 1881.) The so-called Macassar hair oil is said to be a solution of it in coconut oil. (See *A. J. P.*, 1881, 123; also *A. J. P.*, 1893, 529.)

Ointment of Cucumber. *Cucumber Ointment.* —An emollient ointment, prepared from the common cucumber (fruit of *Cucumis sativus* L., Fam. *Cucurbitaceae*), has been considerably employed in irritated states of the skin. The following is the mode of preparing it, recommended by Procter. Take of green cucumbers 7 pounds avoirdupois, pure lard 24 ounces, veal suet 15 ounces. Grate the washed cucumbers to a pulp, express, and strain the juice. Cut the suet into small pieces, heat it over a water bath till the fat is melted out from the membrane; then add the lard, and, when melted, strain through muslin into an earthen vessel capable of holding a gallon, and stir until thickening commences, when one-third of the juice is to be added, and the whole beaten with a spatula till the odor has been almost wholly extracted. The portion which separates is to be decanted, and the remaining two-thirds of the juice is to be consecutively incorporated and decanted in the same manner. The jar is then closely covered and placed in a water bath, until the fatty matter entirely separates from the juice. The green co-agulum floating on the surface is now removed, and the jar put in a cool place that the ointment may solidify. The crude ointment is then separated from the aqueous liquid on which it floats, melted and strained, and placed in glass jars, which must be kept closely sealed. A layer of rose water upon its surface will favor its preservation. A portion may be triturated with a little rose water until white and creamy, and put into a separate jar for present use. (*A. J. P.*, xxv, 409.)

Emile Mouchon prepares the ointment by obtaining the juice mixed with a little alcohol, and incorporating this with benzoinated lard and stearyn. He directs 16 parts of the cucumber to be rendered to a pulp, 1 part of alcohol of 36° B. (& 7 per cent. vol.) to be added, and the mixture to be placed on the diaphragm of a percolator. Twenty-four hours afterwards 10 parts of the liquid are obtained of 19° B. Of this liquid 6 parts are to be incorporated with 37.5 parts of benzoinated lard and 12.5 of stearin;

the fatty matters having been previously melted together by means of a water bath, and beaten vigorously on cooling. The liquid is to be added before the completion of the beating, which should then be continued until the whole becomes as light and white as possible. The benzoin and alcohol enable the ointment to keep a long time. (*J. P. C.*, Juillet, 1854, 41.) We prefer to make this ointment by incorporating one part of distilled spirit of cucumbers with seven parts of benzoined ointment. The spirit is made by distilling a mixture of one part of grated cucumbers with three parts of diluted alcohol, retaining the first two parts or distillate which come over. This spirit is permanent, and ointment or cream made from it keeps well, and cucumber cream can be made extemporaneously.

The most frequently used preparation of cucumber at the present time is the cosmetic preparation known as cucumber jelly, which is used as a soothing application in roughness of the skin, etc. It consists of a jelly of tragacanth, quince seed, or some similar mucilaginous drug made up with cucumber juice which imparts to the preparation a characteristic odor.

OLEA.

OILS

These are liquid or solid substances, unctuous to the touch and characterized by inflammability. They are divided into two classes, the fixed and the volatile, because distinguished, as their names imply, most readily by their different behavior on the application of heat.

OLEA FIXA. Fixed Oils.

Fats, Fatty Oils; Huiles Graisses, Huilea fixes, Fr.; Fette, Fette Oele, G.; Olios, It.; Aceites, Sp.

These are sometimes termed *fatty oils*, because they constitute in part the vegetable and animal fats. The distinction between liquid and solid fats is for the most part a physical one only, as they contain the same chemical compounds, although in relatively different proportions. The fatty oils, though existing in greater or less proportion in various parts of plants, are furnished for use exclusively by the fruit, and, as a rule, are most abundant in the dicotyledonous seeds. They are obtained either by submitting the bruised seeds to pressure in hempen bags, or by boiling them in water, and skimming off the oil as it rises to the surface. When pressure is employed, it is customary to prepare the seeds for the press by exposing them to a moderate heat, so as to render the oil more liquid and thus enable it to flow out more readily. Another mode of extracting certain oils is by means of liquids having the power

of dissolving them, and this method is now largely used in practice, carbon disulphide, carbon tetrachloride, and petroleum benzin being used. For the details of the process, see *A. J. P.*, Nov., 1868, 549. Fixed oils may be clarified and decolorized by subsidence, filtration through animal charcoal, clays or earths, or porous solids, precipitation with tannin, lead acetate, plaster of Paris, albumin, gelatin, or other agents; cellulose and asbestos filters are often used, and on the large scale, for separating mechanical impurities, centrifugal machines like those employed for milk. Some oils are given a preliminary treatment with sulphuric acid which is later removed by treatment with alkali. Fixed oils containing stearin or palmitin are likely to deposit these fats in cold weather, leaving the olein in a liquid condition. The olein may be separated by filtration in the cold.

Hydrogenated Fats and Oils.—A. class of solid fats has appeared upon the market which are produced by a process known as hydrogenation, which is carried out in practice by bringing liquid fats into intimate contact with metallic catalyzers (finely divided nickel is usually employed), at elevated temperatures (160°-200° C. or 320°-392° F.). Under these conditions the unsaturated members of the fatty acid series which are usually liquid and are represented by oleic acid, become converted into the solid members of the series, which are saturated as stearic acid. The best known commercial product made in this way is the proprietary fat known as *Crisco*, largely used for culinary purposes.

CLASSIFICATION.

The following scheme of classification of the fixed oils, both liquid and solid (Allen, *Com. Org. Anal.*, 3d ed., vol. ii, Part I, pp. 88-102), gives a general view of their essential characters, points of difference, etc.

I. Olive Oil Group. Vegetable Non-drying Oils.—The oils of this group solidify on treatment with nitrous acid or mercuric nitrate, but do not lose their power of producing a greasy stain on paper, however long they may be exposed to the air. Their density varies from 0.914 to about 0.920, and hence is less than that of Groups III, IV, and V. Their viscosity is notably greater than that of the drying oils.

This group includes almond oil (from *Amygdalus communis*), peach oil (from kernels of *Prunus Persica*), apricot oil (from kernels of *Prunus armeniaca*), oil of ben (from *Moringa oleifera*), earth nut oil (from

Arachis hypogaea), and olive oil (from *Olea europaea*).

II. Rape Oil Group.—The oils of this group are all derived from seeds of the family *Cruciferae*. They are non-drying but less distinctly so than the oils of Group I. They show higher saponification values, higher iodine absorption and less solid elaidins than Group I.

This group includes Colza oil and rape seed oil (from *Brassica campestris*, *B. napus* and other species); oil of black mustard (from seeds of *Brassica nigra*); oil of white mustard (from seeds of *Sinapis alba*).

III. Cotton Seed Oil Group.—The oils of this group occupy a position intermediate between the vegetable non-drying and the true drying oils (Groups I and IV). In density they somewhat exceed the oils of Group I, but are lighter than those of Groups IV and V. They form more or less elaidin on treatment with nitrous acid or mercuric nitrate, but do not become wholly solidified. On the other hand, they undergo more or less drying on exposure to the air, but not so markedly as the oils of Group IV.

This group includes beech nut oil (from *Fagus sylvatica*), cotton seed oil (from *Gossypium* species), hazel nut oil (from *Corylus avellana*, see *Proc. A. Ph. A.*, 1893), sesame or teel oil (from *Sesamum orientale*), and sunflower oil (from *Helianthus annuus*; *H. perennis*), camelina oil (from *Myagrum sativum*), cress seed oil (from *Lepidium sativum*), and maize oil (Corn Oil).

IV. Linseed Oil Group. Vegetable Drying Oils.—These oils are not solidified by treatment with nitrous acid or mercuric nitrate, but become gradually converted into solid masses or varnishes, by exposure to the air. In density the oils of this group vary from about 0.923 to 0.937, and hence are distinctly heavier than the non-drying oils and than most of the oils of Group III. On the other hand, they are lighter than the oils of Group V. The fluidity of the drying oils is also much higher than that of the non-drying oils.

This group includes niger seed oil (from *Guizotia oleifera*), hemp seed oil (from *Cannabis sativa*), linseed oil (from *Linum usitatissimum*; *L. perenne*), poppy seed oil (from *Papaver somniferum*), Scotch fir seed oil (from *Pinus sylvestris*), tobacco seed oil (from *Nicotiana Tabacum*), walnut oil (from *Juglans regia*), weld seed oil (from *Reseda Luteola*),

and soya bean oil (from *Soja hispida*).

V. Castor Oil Group.—The oils of this group are distinguished from those of Groups I, II, III, and IV, by their very high density and viscosity. They are also remarkable for their ready solubility in alcohol, and their marked purgative properties. In their drying characters and behavior with the elaidin test they resemble the oils of the cotton seed oil group. Both castor and croton oil are miscible in all proportions with glacial acetic acid.

This group includes castor oil (from *Ricinus communis*), croton oil (from *Croton Tiglium*), Japanese or Chinese wood oil (from seeds of *Aleurites cordata* or *Elaeococca vernicia*), boiled linseed oil, blown oils (made by oxidation of rape seed, cotton seed, linseed, lard, and other oils).

VI. Palm Oil Group. Solid Vegetable Fats — This group includes solid fats not containing notable quantities of glycerides of lower fatty acids. The densities for the melted fats at 98° and 99° C. (208.4°-210.2° F.) are compared with the density of water at 15.5° C. (60° F.) taken as 1.000, and vary from 0.920 to 0.995.

This group includes palm oil (from fruit of *Elaeis guineensis*), cacao butter (from nuts of *Theobroma Cacao*), nutmeg butter (from nuts of *Myristica fragrans*), and shea butter (from seeds of *Bassia Parkii*).

VII. Coconut Oil Group. Solid Vegetable Fats.—This group includes solid fats containing notable quantities of glycerides of lower fatty acids—that is, of acids distilling with more or less facility in 'a current of steam at 100° C. (212° P.). The group includes cocoa-nut oil (from the nuts of *Corns nudfera*), palm oil (from the kernels of the nuts from *Eiceis guineensis*), laurel oil (from fruit of *Laurus nobilis*), Japan wax (berries of *Khus succe-danea*), myrtle wax (berries of *Myrica cerif-era*). For a description with constants of some of the rarer fixed oils belonging to the vegetable group, see papers by J. A. Wijs, Ph. Ztg., 1903, 563; by Pancoast and Graham, A. J. P., 1904, 70; and by Lewkowitsch, P. J., 1904, 492.

VIII. Lard Oil Group. Animal Oleins.—This group includes those oils fluid at ordinary temperatures which are obtained from terrestrial animals. They resemble the whale or fish oils in their reaction with chlorine, but are not turned red or brown by boiling with caustic soda.

On exposure to air and on treatment with nitrous acid or mercuric nitrate, they behave like the non-drying vegetable oils (Group I). This group includes bone oil, lard oil, tallow oil, and neat's-foot oil. For a paper by P. L. Simmonds on various animal oils, see *Bull. Pharm.*, 1893, 297, 344.

IX. Tallow Oil Group. *Solid Animal Fats.* —This group comprises oils that are solid or semisolid at ordinary temperatures. Their melting points vary somewhat, and; are capable of permanent alteration. The group includes bone fat, butter fat, hog's lard, horse fat, beef tallow and mutton tallow.

X. Whale Oil Group. *Marine Animal Oils.* —This group comprises the various fluid oils obtained from fish and cetaceous mammals. They are distinguished as a class by their offensive fishy odor, by the brown color they assume when subjected to the action of chlorine, and by the reddish color which is produced on boiling them with a solution of caustic alkali. With sulphuric acid they give colorations varying from light red to purple or brown. The fish oils do not dry on exposure to air, and mostly yield but little elaidin on treatment with nitrous acid. The term "train oil" includes whale, seal, shark, cod, and all similar oils. Cod oil (from *Gadus morrhua* and allied species), cod liver oil (from the same), menhaden oil (from *Alosa menhaden*), porpoise oil (from *Delphinus phocaena* and allied species), seal oil (from *Phoca* of various species), shark oil (from *Squatius maximus* and allied species), and whale oil (from *Balaena mistecetus* and allied species) are all members of this group.

XI. Sperm Oil Group. *Liquid Waxes.*—Tho members of this group differ from all the fatty oils of previous classes in not being glycerides, consisting essentially of esters of monatomic alcohols of the ethylic series, in which respect they resemble the true waxes, but are fluid at ordinary temperatures. They are less dense than glycerides, they do not dry or thicken notably on exposure to air, but they yield solid elaidins on treatment with nitrous acid. The group includes sperm oil (from cranial cavities of *Physeter macrocephalus*), doegling or bottle-nose oil, and dolphin oil.

XII. Spermaceti Group. *Waxes Proper.*—Spermaceti and the various waxes differ from the true fixed oils and fats in not forming glycerin when saponified, yielding instead certain of the higher monatomic

alcohols, the identity of which varies with the nature of the wax. These alcohols are insoluble in water, and dissolve to but a limited extent in alcohol, but they are soluble in ether, chloroform, carbon disulphide, benzene, and petroleum benzin, and are apt to be mistaken for added paraffin wax when the substance is saponified and the soap extracted with a solvent.

This group includes beeswax (from honeycomb of various species of bees), Carnauba or Brazil wax (from the leaf-coverings of *Copernicus cerifera*), Chinese wax or Pela wax (produced by a species of *Coccus* which punctures the branches of certain trees), myrtle wax (from berries of *Myrica cerifera*), Ocuba wax (from *Myrica Ocuba*), palm wax (from bark of *Ceroxylon andicola*, of the Cordilleras), and spermaceti (deposit from the oil found in the cranial cavities of the sperm whale, *Physeter macrocephalus*). "Wool fat, which consists largely of *cholesterol* (an alcohol), belongs to this group.

When oils are decomposed by heat they emit vapors of *acrolein allyl aldehyde*, CH_2CHCHO , a highly volatile liquid resulting from the decomposition of glycerin, upon which the fumes of oils mainly depend for their irritating effects on the eyes and nostrils. Exposed to a red heat, in closed vessels, they yield, among other products of the destructive distillation, a large quantity of combustible and illuminating gases, among which ethylene and acetylene are readily recognized. Heated in the open air, they take fire, burning with a bright flame, and producing water and carbon dioxide. When kept in air-tight vessels, they remain unchanged for a great length of time, but exposed to the atmosphere they attract oxygen and undergo change.

Effervescent Oils.—K. Dieterich recommends oils and fats which have been supersaturated with carbon dioxide and introduced by him under the name of "effervescent oils." (See *Proc. A. Ph. A.*, 1900, 494.) Under the influence of carbon dioxide, compounds which are easily split with the fatty acids are produced, which, particularly in the case of cod liver oil, permit the more complete absorption of the oil than is the case with oil not treated with carbon dioxide. The latter, moreover, acts as a preservative of the oils and renders them more palatable, destroying the unpleasant taste of cod liver oil, and to a certain extent also that of added medicaments, very materially. The absorbability of carbon dioxide is, however, not the same in all oils. Cod liver oil is capable of absorbing the largest quantity, castor oil the smallest, while olive oil stands

intermediate. (*Ph. Centralh.*, 1901, 485.)

Some fixed oils, in drying, lose their unctuous character, and are converted into a transparent, yellowish, flexible solid. These are called *drying oils*. Others, especially such as contain mucilaginous impurities, become rancid, acquiring a sharp taste and an unpleasant odor. This change is owing to the development or liberation of free fatty acids, from which the oil may be freed by boiling it for a short time with magnesium hydroxide and water.

Cloes has made investigations in relation to the influence of light in promoting oxidation, and obtained some curious results. The general influence of light is very great, as oils undergo comparatively little change in the dark for a long time; though in relation to some of them the change is at length as great as under the light. Thus, while the oil of poppies had in 30 .days increased about 5 per cent. in weight under white light, and had gained only a 5000th in the dark, yet at the end of 150 days the weight in the former condition was rather lessened than augmented, and in the latter, or in the dark, had increased 6.4 per cent. The effect of the different colored rays is also very different. The change is at first most rapid under the white light, less so under the blue, and much less under the red, yellow, and green, being least of all with the green; but with the advance of time the blue overtakes and even passes the white and at the end of three or four months all are about equal in effect. Heat also accelerates the concretion of the oils, by favoring their oxidation; and the same effect is produced by introducing into the unchanged oil a little which has already been altered by exposure to the air. The oxidation of an oil may be very greatly hastened in this way without the aid of heat.

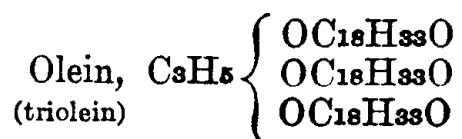
The fixed oils are insoluble in water, but are miscible with that fluid by means of mucilage, forming mixtures which are called emulsions. They are in general very sparingly soluble in alcohol, but readily dissolved by ether, which serves to separate them from other vegetable proximate principles. By the aid of heat they are enabled to dissolve sulphur and phosphorus. The stronger acids decompose them, giving rise, among other products, to oleic, palmitic, and stearic acids. Boiled with diluted nitric acid, some of them give rise to malic and oxalic acids, besides other substances usually resulting from the action of this acid upon vegetable matter. Several acids are dissolved by them without producing any sensible change. They are saponified by various alkalies. The

compounds which these acids form with potassium and sodium hydroxide are the common detergent soaps, although strictly speaking, a soap is the combination of a fatty acid with any metal or base. By the addition of one part of potassium or sodium carbonate, 160 parts of oil may be brought with distilled water into the form of an emulsion. The potassium and sodium soaps and the alkaline sulphides have a similar effect, but not the bicarbonates. The fixed oils also serve as good vehicles for various metallic bases and subsalts, which form soaps to a certain extent soluble in the oil, and thus become less irritant to the tissues. Oils thus impregnated may, like the pure oils, be brought to the state of emulsion with water, for convenient administration, by the addition of a small proportion of potassium carbonate. The fixed oils dissolve many of the alkaloids, the volatile oils, resin, and other proximate principles of plants. The alkaloids are more readily dissolved in them by being first combined with oleic acid, the oleates being more soluble than the alkaloids themselves. According to Buignet, they are, with very few exceptions, indifferent to polarized light; of all those used in medicine, the only exceptions are the liver oils of the ray and dog fish, which have a very feeble lasvo-rotatory power, and castor oil, which is decidedly dextrogyrate.

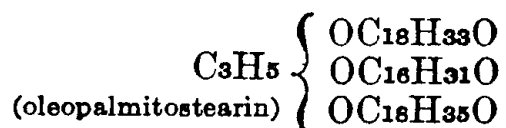
It is very likely that, with the exception of castor oil, whose rotatory power is due to the asymmetric carbon atom of the ricinoleic acid, the rotatory power is not due to the glycerides themselves but to small proportions of optically active substances such as cholesterol. (Lewkowitzsch, *Chem. Analysis of Oils Fats and Waxes*, p. 121.)

The fixed oils, whether animal or vegetable, in their natural state consist in most cases of at least two or three distinct constituents, one liquid at ordinary temperatures, and the other two solid or semisolid. The liquid is a distinct proximate principle, called olein; the more solid principles consist of stearin and palmitin, the former being found most largely in animal and the latter in vegetable oils or fats, and the two in most cases existing together in the same oil. The substance formerly known as *Margarin* is now generally recognized to be a mixture of palmitin and stearin. As the most frequent of these proximate constituents of the fixed oils, and existing in many different oleaginous substances, olein, palmitin, and stearin merit a special notice. Preliminarily to their individual consideration, it will be proper to refer to their nature and composition generally.

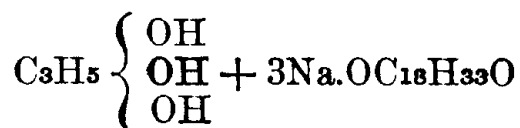
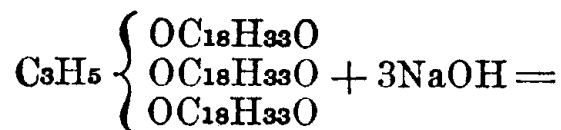
These three substances, *olein*, *palmitin*, and *stearin*, together with *butyryn*, *caprin*, and other minor fat principles, are glycerides; that is, esters or salts of the triatomic alcohol glycerol, $C_3H_5(OH)_3$, and of the several fatty acids, oleic, palmitic, stearic, etc., all of which are monobasic acids. The three mentioned glycerides have the following composition:



There are also mixed glycerides exemplified by the following formula:



When these substances, or oils composed principally of them, are treated with alkali with the aid of heat, decomposition takes place, which may be illustrated as follows:



that is, olein is decomposed by sodium hydroxide into *glyceryl*

hydroxide, or *glycerin*, and *sodium oleate*, or a sodium soap.

The waxes differ from the fats proper in being esters of the higher monatomic alcohols like *cetyl alcohol*, $C_{15}H_{33}.OH$, and *myricyl alcohol*, $C_{30}H_{61}.OH$, instead of being glycerides. The fatty acids present are partly palmitic and stearic, but more largely still higher ones, like *cerotic acid*, $C_{27}H_{54}O_2$.

Other fatty acids represented in fixed oils are: butyric acid, $C_4H_8O_2$; valeric acid, $C_5H_{10}O_2$; caproic acid, $C_6H_{12}O_2$; caprylic acid, $C_8H_{16}O_2$; capric acid, $C_{10}H_{20}O_2$; lauric acid, $C_{12}H_{24}O_2$; myristic acid, $C_{14}H_{28}O_2$; arachidic acid, $C_{20}H_{40}O_2$; erucic acid, $C_{22}H_{42}O_2$; hypogaeic acid, $C_{16}H_{30}O_2$. The first few members of the above list are known as the volatile fatty acids, which serve as the basis for the determination of what is known as the Reichert-Meissl number.

Olein. Elain. Liquid Principle of Oils.—It is extremely difficult to obtain olein pure. Being in most oils associated with the solids stearin and palmitin, it must be separated by pressure and other mechanical means, which separation is not always perfectly effected. As ordinarily procured, therefore, olein contains more or less of palmitin or stearin, or both. In this somewhat impure state it is obtained either by the agency of alcohol or by expression. When one of the oils, olive oil, for example, is dissolved in boiling alcohol, the solution, on cooling, deposits the concrete principles, still retaining the olein, which it yields upon evaporation. The other method consists in compressing one of the solid fats, or one of the liquid oils rendered concrete by cold, between folds of bibulous paper, which absorb the olein, and give it up afterwards by compression under water. Olein is a liquid of oily consistence, congealing at $-6^{\circ} C.$ ($21.2^{\circ} F.$), colorless when pure, with little odor and a sweetish taste, insoluble in water, soluble in boiling alcohol and ether. Its formula, as already stated, is $C_3H_5(OC_{18}H_{33}O)_3$, being an oleate of the triad radical *glyceryl*, C_3H_5 . By reaction with nitric acid, or, more exactly stated, under the influence of nitrous acid fumes, olein is converted into a deep yellow* butyraceous mass. If this be treated with hot alcohol, a deep orange-red oil is dissolved, and a peculiar fatty matter remains, called *elaidin*. This is white, crystalline, fusible at $34^{\circ} C.$ ($93.2^{\circ} F.$), insoluble in water, readily soluble in ether, and appears to be isomeric with olein. It is resolved by saponification with the alkalies into *elaidic*

acid and glycerin.

Palmitin.—Palmitic acid occurs in the more liquid fats, such as palm oil and cocoa-nut oil, as well as in butter and human fat, as glyceride, while in spermaceti and some forms of wax it is combined with monatomic alcohol radicals. Palmitin is the *palmitic acid glyceride*, or *glyceryl tripalmitate*. It is best obtained from palm oil.

Stearin.—This exists abundantly in tallow and other animal fats. It may be obtained by treating the concrete matter of lard, free from olein, by cold ether so long as anything is dissolved. The palmitin is thus taken up, and stearin remains. A better method is to dissolve suet in heated oil of turpentine, allow the solution to cool, submit the solid matter to expression in unsized paper, repeat the treatment several times, and finally dissolve in hot ether, which deposits the stearin on cooling. This is concrete, white, opaque in mass, but of a pearly appearance as crystallized from ether, pulverizable, fusible at 66.5° C. (151.7° F.), soluble in boiling alcohol and ether, but nearly insoluble in those liquids cold, and quite insoluble in water. It consists of glyceryl and stearic acid in combination as a glyceride, $C_3H_5(OC_{18}H_{36}O)_3$, and has been formed synthetically by heating a mixture of these two materials to 280° to 300° C. (536°-572° F.).

Commercially the fixed oils are frequently sold under the names *summer pressed* and *winter pressed*. These were once really seasonal designations, as an oil pressed during the warmer months would contain more dissolved stearin and would consequently congeal or cause a deposit when chilled, while an oil pressed during cold weather would remain transparent at low temperatures, and thus *winter pressed* oils were safer for lubricating purposes and commanded a higher price. Artificial refrigeration now makes it possible to make either grade of oil at any season of the year, although the former seasonal names are still used.

The fixed oils are liable to certain spontaneous changes, which have been investigated by Pelouze and Boudet. It appears from their researches that the oils are accompanied, in the seeds which contain them, with principles which act as a ferment and cause the oils to resolve themselves spontaneously into the several fatty acids which they afford on saponification, and into glycerin. This change takes place in the seeds as soon as the cells containing the oils are broken, so as to

permit the contact of the fermenting principle existing in the grain. The decomposition of fats by the action of enzymes has been made a working method capable of technical application, by Connstein, Hoyer and Wartenburg. The enzyme contained in the castor oil bean has been found best adapted for this. An emulsion of fats, water, 10 per cent. of ground castor oil beans and a small amount of free acid are used, when the decomposition proceeds rapidly. As rancidity in fats renders them altogether useless in pharmacy, and as it is not always readily discoverable by the senses in its earlier stages, it becomes desirable to possess a test by which it may be detected. Such a test is to be found, according to Thos. B. Groves, in potassium iodide, which is rapidly decomposed by the new principles developed, and the orange-brown discoloration produced by the liberation of the iodine indicates the existence of rancidity, and the degree of that discoloration, approximately, the extent of the change. The alteration of color is said by Groves to be plainly perceptible when only one-twentieth of rancid fat is present. The presence of water in a fatty oil favors the production of rancidity.

It is also extremely important to be able to protect fats against this change. The complete exclusion of air, light, and moisture—and, when in relation to air this may not be entirely practicable, the destruction by heat of the ferment-germs contained in the air, by which the decomposition is 'often originated— will go far to effect this object; but it would often be very inconvenient, if not impossible, to carry these measures into complete effect, and hence the discovery of substances which may have the effect of retarding, if not wholly preventing, these fermenting processes, whether by the destruction of the ferment-germs or otherwise, is extremely desirable; this preservative effect has been known and practically used many years, and since the principle upon which they are supposed to act has been discovered the number has been extended. Thus, benzoin rubbed up with fats is well known to preserve them long against rancidity, and *benzoinated lard*, made by extracting ten per cent. of benzoin with melted lard, is one of the official preparations, and the buds of the poplar (*Populus nigra*) are perhaps still more effectual, as, according to Deschamps, lard impregnated with their virtues will keep good indefinitely. In the French Codex the poplar buds are employed in the *Pommade de Bourgeon de Peuplier*, in which 8 parts of the dried buds are used to 40 parts of the ointment, consisting of lard impregnated with the virtues of several narcotic substances, the fresh narcotic plants being boiled with lard until all their water is

evaporated, and the buds afterwards digested in the strained liquid for twenty-four hours. Groves made experiments with many volatile oils and other analogous substances to test their preservative power. (See *A. J. P.*, 1865, 54, 61.) Hirzel says that animal fats may be kept in a good condition for a year by the following plan. Mix 14 pounds of the recently melted fat with 5 drachms of common salt and 15 grains of alum, in fine powder, heat till a scum is formed on the surface, separate the scum, and, when the clear liquid has cooled, wash it many times with water with malaxation, so as to remove all the salt, then evaporate the water at a heat insufficient to injure the fat. (*A. J. P.*, 1868, 334.)

The adulteration of the fixed oils may be effected in several ways—by admixture with the fatty oil of substances distinctly foreign to the fats, and by adding a cheaper or inferior oil to one of greater value. In the former case we may have the addition of paraffin wax, ceresine, mineral oils, neutral tar oils, resin oils, resin, and waxes. Of these, the first three are entirely unsaponifiable, resin oils contain but small quantities of saponifiable substances, waxes are partly saponifiable, and resin almost completely saponifiable. The determination of unsaponifiable matter is therefore of great importance. The common method for this is to saponify the suspected sample with alcoholic potassium hydroxide and then to shake out the unsaponifiable matter with ether or petroleum ether. From this solution, on evaporation, will be obtained the mineral, resin, or tar oils that may have been present. For these there are appropriate tests elsewhere noted. In case a cheaper oil or fat has been added for the purpose of adulterating a more valuable one, we must be guided by the determination of certain constants, such as those mentioned below by Cowley, or by the indication of certain qualitative color tests. The constants referred to are much more to be depended upon in such a case.

R. C. Cowley (*P. J.*, 1897, 331) regards the following as the most important determinations in examining fats and fixed oils. 1. Specific gravity. 2. Melting and solidifying points. 3. Melting and solidifying points of fatty acids. 4. Behavior with solvents. 5. The Hehner value. 6. The Reichert-Meissl value. 7. The saponification value. 8. The iodine value. To these have been added during recent years: 9. The refractive index. 10. The acetyl number. 11. The temperature rise with sulphuric acid (Maumene number).

It is sometimes desirable to deprive the fixed oils of color. The following

process for this purpose is recommended by Brunner. The oil is first brought to the state of emulsion by strongly agitating it with water rendered mu-cilaginous by gum or starch; the emulsion is treated for each part of oil with two parts of wood charcoal, previously well heated and coarsely powdered, the finer particles being sifted out; the pasty mass is then completely dried at a heat not exceeding 100° C. (212° F.), and exhausted by cold ether in a percolator; finally, the ethereal solution, having been allowed to stand, in order that any charcoal present in it may subside, is submitted to distillation, so as to separate the ether, and the oil remains colorless in the retort. (*J. P. C.*, Sept., 1858.) Berlandt recommends the following method: Shake strongly for some minutes 900 parts of the fixed oil with 120 parts of water holding in solution 3 parts of potassium permanganate, allow the mixture to stand for some hours in a warm place, and then filter. The oil becomes colorless. (*J. P. C.*, Oct., 1867.)

The modern method of decolorizing vegetable oils is to filter them through kaolin or Fuller's earth. Preliminary treatment with acids and alkalies is sometimes advisable.

OLEA VOLATILIA. [*Olea Destillata*]

Volatile Oils.

Olea Ætherea, *Ætherolea*; Ethereal Oils, Essential Oils, Distilled Oils; Huiles Volatiles, Huilea Essentielles, Huilea Distillees, Essences, *Fr.*; Fluchtige Oele, Aetherische Oele, *G.*; Essenze, *It.*; Esencias, *Sp.*

These are sometimes called *distilled oils*, from the mode in which they are usually procured; sometimes *essential oils*, from the circumstance that they possess, in a concentrated state, the organoleptic properties of taste and odor of the plants from which they are derived. The word essence is used in some countries to designate the volatile oils themselves, but in America this word has unfortunately been largely applied to the alcoholic solutions of the volatile oils, usually called the *spirits*, and the word *soluble essence* has been used to describe hydro-alcoholic solutions of volatile oils which possess the property of mixing clear with water.

The term *Ætherolea* is used in some countries to distinguish the volatile oils in general from those which are produced by destructive distillation, like oil of amber, oil of cade, oil of tar, etc., which are given the collective

name *pyrolea* (pyroligneous oils).

They exist in all odoriferous vegetable tissues, sometimes pervading the plant, sometimes confined to a single part; in some instances contained in distinct cells, and partially retained after desiccation, in others formed upon the surface, as in many flowers, and exhaled as soon as formed. Occasionally two or more are found in different parts of the same plant. Thus, the orange tree produces one oil in its leaves, another in its flowers, and a third in the rind of its fruit. In a few instances, when existing in distinct cells, they may be obtained 'by pressure, as from the rind of the lemon and orange; but they are generally procured by steam distillation. (See page 738.) Some volatile oils, as those of bitter almond and mustard, are formed in the presence of moisture out of substances of a different nature pre-existing in the plant, and may be subsequently distilled.

The volatile oils are usually colorless when freshly distilled, or at most yellowish, but some are brown, red, green, or blue. There is reason, however, to believe that in all instances the color depends on foreign matter dissolved in the oils. Septimus Piesse succeeded, by the fractional distillation of certain volatile oils, in separating a blue liquid, which, by repeated rectification, he has obtained quite pure. In this state it has the sp. gr. 0.910, and a fixed boiling point of 302.3° C. (576° F.), and yields a dense blue vapor having peculiar optical properties. He named this principle *azulene*, and believed that upon it depends the blueness of volatile oils wherever existing. The yellowness of the oils he ascribed to the resin resulting from their oxidation, the green and brown colors to a mixture of azulene and resin in various proportions. The formula of azulene he gave as C₁₆H₂₆O. (*Chem. News*, Nov. 21, 1863, p. 245.) Gladstone named this blue coloring constituent *caerulein*, and stated that it contains nitrogen and is colored green by acids and alkalies. The volatile oils differ from the fixed oils in not yielding glycerol when treated with alkalies.

The volatile oils have a strong odor, resembling that of the plants from which they were procured, though generally less agreeable. Their taste is hot and pungent, and, when they are diluted, is often gratefully aromatic. The greater number are lighter than water, though some are heavier; their sp. gr. varies from 0.847 to 1.17. They vaporize at ordinary temperatures, diffusing their peculiar odor, and are completely volatilized by heat. When distilled alone, they nearly always undergo

partial decomposition. Heated in the open air, they take fire and burn with a bright flame attended with much smoke. Almost all of them are optically active, and advantage may sometimes be taken of this property to detect adulterations of one of these oils with another. The refractive index is another physical constant that is being studied in connection with volatile oils, but the accumulation of data is not yet sufficiently large to give the factor much value as yet. Exposed at ordinary temperatures, some of them absorb oxygen, assume a deeper color, become thicker and less odorous, and are ultimately converted into resin. This change takes place most rapidly under the influence of light. Before the alteration is complete, the remaining portion of oil may be recovered by distillation.

The volatile oils are sometimes hydrocarbons, although with these are frequently associated alcohol- or ketone-like bodies called camphors, and products of oxidation known under the general name of resins, and undoubtedly formed from the hydrocarbons. Phenols, aldehydes, esters, ethers, and sulphides are also represented. The hydrocarbons are generally known as terpenes, from oil of turpentine, which is taken as a type. *Olea aetherea sine terpeno* is the name proposed by Schweissinger for concentrated volatile oils made so by the removal of the non-fragrant hydrocarbon, and representing from two to thirty volumes of the ordinary essential oils. Thus, one volume of the concentrated oil represents two volumes of the oils of anise, cassia, fennel, gingergrass, mentha crispa, mentha piperita, cloves, sassafras, and star anise; two and one-half volumes of the oils of bergamot, caraway, and lavender; four volumes of cumin and rosemary; five volumes of thyme; six volumes of coriander; eight volumes of calamus; ten volumes of absinthe; twenty volumes of juniper; thirty volumes of angelica, lemon and orange. It is asserted that these concentrated oils are more permanent, more soluble in alcohol and in water, have a finer odor, and are of constant composition, thus enabling the specific gravity and boiling point to be used as tests of purity. They should be kept in the dark. (*Ph. Centralh.*, 1888, No. 25.) Under the name of "*terpeneless volatile oils*," similar products can now be found in the market; they are undoubtedly superior to the ordinary volatile oils both in odor and strength.

Wallach, to whom much of our knowledge on volatile oils is due, divides the hydrocarbons into classes, as follows:

1.—*True terpenes*, of the formula $C_{10}H_{16}$, of which there are two main groups: (a) the *terpane* group, uniting with two molecules of haloid acid or four atoms of bromine; this group includes limonene, dipentene, sylvestrene, terpinolene, terpinene, thujene, and phellandrene, and its members boil between 175° and 185° C. (347° and 365° F.); (b) the camphane group, uniting with one molecule of haloid acid or two atoms of bromine; this group includes pinene, bornylene, camphene, and fenchene, and its members boil between 151° and 161° C. (303.8° and 321.8° F.).

2.—*Hemiterpenes*, of the formula C_5H_8 , such as isoprene.

3.—*Polyterpenes*, such as cedrene, cubebene, etc., of the formula $C_{15}H_{24}$ (sesquiterpenes); colophene, of the formula $C_{20}H_{32}$; and caoutchouc, of the formula $(C_{10}H_{16})_x$.

Hydrocarbons other than those of the ter-pene class or derivable from them, occur very sparingly in the natural oils. Thus there is of the paraffin series of saturated hydrocarbons, *heptane*, C_7H_{16} , occurring in the oil from the *Pinus sabiniana*, or California *digger pine*, and solid hydrocarbons of the same series in oil of rose, and probably in oils of wintergreen and sweet birch. Of the benzene series there is a single representative in *cymene*, $C_{10}H_{14}$, found in the oils of the *Thymus* and *Monarda* species.

In addition to these naturally occurring hydrocarbons, there is a class of artificially prepared hydrocarbons known as *hydroterpenes*, such as dihydrodipentene from dipentene, men-thene and carvomenthene from menthol and carvone.

The terpenes in general are practically insoluble in water, but soluble in alcohol, ether, chloroform, benzene, petroleum benzin, and the fixed and volatile oils.

Many of the essential oils, however, owe their essential character and their value to other constituents than hydrocarbons. We shall briefly notice the most important of these, either describing them or referring to other places in the text where they are already described, and shall then give a classification of the commonly known essential oils based

upon the character of the most important compounds present in them.

I. Alcohols.

Geraniol, Linalool, Citronellol, Terpineol, Menthol, Borneol, Nerol, Sabinol, Santalol.

II. Aldehydes.

Citral, Citronellal, Salicyl Aldehyde, Cumic Aldehyde, Benzaldehyde, Cinnamic Aldehyde, Anisic Aldehyde, Piperonal, Santalal.

III. Ketones.

Methyl-amyl-ketone, Ionone, Methyl-nonyl-ketone, Methyl-heptenone, Carvone, Pulegone, Menthone, Camphor, Fenchone, Thujone, Ione.

IV. Esters.

Methyl Salicylate, Methyl Anthranilate, Benzyl Acetate, Linalyl Acetate, Geranyl Acetate, Bornyl Acetate, Menthyl Acetate, Bornyl Valerate, Geranyl Tiglate.

V. Phenols and Phenol Ethers.

Chavicol, Methyl-chavicol, Anethol, Thymol, Carvacrol, Eugenol, Methyl-eugenol, Iso-eugenol, Chavibetol, Safrol, Iso-safrol, Thymohydro-quinone dimethyl ether, Asarol, Apiol, Diosphenol.

VI. Neutral Bodies, Oxides, etc.

Cineol (Eucalyptol).

VII. Sulphides and Sulphur Compounds.

Diallyl Disulphide, Allyl Isothiocyanate, Dimethyl Sulphide, Butyl Isothiocyanate, Vinyl Sulphide, Acrylyl Isothiocyanate, Phenyl Ethyl Isothiocyanate.

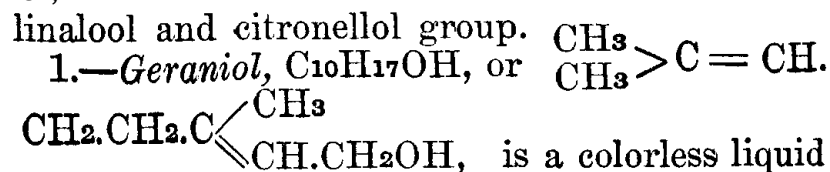
The classification of the volatile oils in any rational and practical manner is a difficult task.

Any system that is devised is either exceedingly complex and cumbersome or, if conciseness is attempted, there are too many inconsistencies and discrepancies. For instance, one of the favored methods of classification is to divide them into four groups, i.e., the terpenes, oxygenated oils, nitrogenated oils, and sulphurated oils. If this be critically studied it is seen that oil of lemon, which is usually given as a typical example of the terpene class, owes its real identity and value to citral, an aldehyde present in only a very small proportion (less than 5 per cent.), and that oil of bitter almond, which is given as the example of the nitrogenated class, owes its classification in this respect only to the incidental presence of hydrocyanic acid, which is frequently removed from the oil, especially when it is used for flavoring purposes. This leaves the sulphurated class, which contains only one important member and the oxygenated class, which is the repository of over 90 per cent. of oils of diversified character.

It is therefore more suitable to follow the foregoing outline adding such explanatory matter and examples as will serve to make it intelligible and valuable for either study or reference purposes.

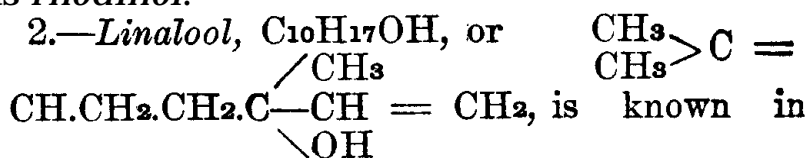
NOTE.—Although the alcohols only were mentioned in the first group given above it will be found convenient to refer to the more important esters of these alcohols as they are taken up for discussion.

I. Alcohols and Their Esters.—This is an interesting group of open chain, unsaturated alcohols, which, with their esters and aldehydes, play a very important part in the composition of many essential oils. It is the geraniol,

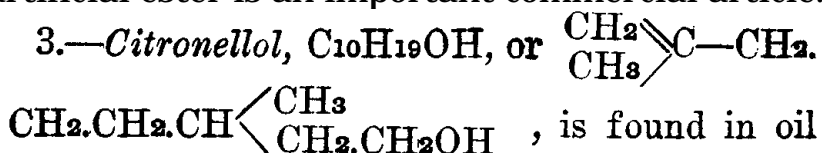


of a pleasant rose geranium odor, boiling at 229° to 230° C. (444.2°-446° F.), under ordinary pressure, and at 129° C. (264.2° F.) under a pressure of 16 mm. Its specific gravity is about 0.881 and its refractive index 1.478. It is optically inactive. By careful oxidation with chromic trioxide it yields its aldehyde, citral, and by heating it in an autoclave with water to 200° C. (392° F.), it is partly converted into its isomer, linalool. It is a monatomic, primary, open chain alcohol, and is the principal constituent of true geranium (pelargonium) oil, as well as of

the so-called "*Turkish geranium oil*," or *oil of palmarosa*. It is a constituent of rose oil, of citronella oil and in very small proportions of a number of other oils. Of the esters of geraniol the most important is the *geranyl acetate*. This is a fragrant oil of specific gravity 0.917, boiling at from 128° to 129° C. (262.4°-264.2° F.), under a pressure of 16 mm. It occurs naturally in several essential oils, and can be made artificially by the action of acetic anhydride upon geraniol. Commercial geraniol is also known as *rhodinol*.

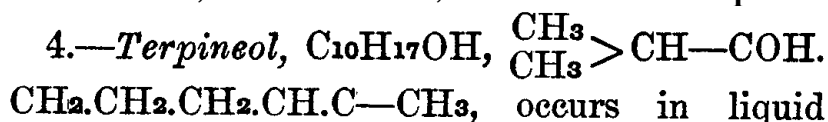


both of the optically active forms as well as in the inactive. It is a liquid having a pleasant odor, and boils under normal pressure at about 198° C. (388.4° F.), and at from 86° to 87° C. (186.8°-188.6° F.) at 14 mm. pressure. Its specific gravity ranges from 0.868 to 0.877, and its refractive index is 1.463. It is a monatomic, tertiary, open chain alcohol, and is an essential constituent of oil of linaloe, and is found in the free state or as an acetic ester in oils of bergamot, coriander, lavender, neroli, etc. The most important of its esters is *linalyl acetate*, which occurs in many essential oils, as in oil of bergamot. It is an odoriferous liquid of the specific gravity 0.912, and boiling at from 105° to 108° C. (221°-226.4° F.) at 11 mm. pressure. It is so prepared artificially, and the artificial ester is an important commercial article.

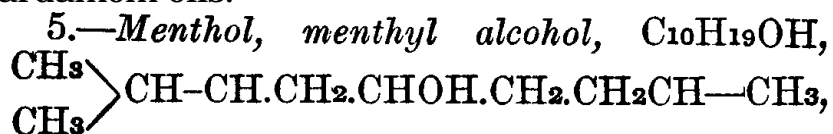


of rose and in Spanish geranium oil. It is an odoriferous oil, boiling at from 117° to 118° C. (242.6°-244.4° F.), under a pressure of 17 mm.; specific gravity, 0.8565 at 17.5° C. (63.5° F.); refractive index, 1.457. It is an open chain alcohol closely related to geraniol and is found in oil of rose, oil of geranium, etc. When obtained from oil of rose it is laevogyrate, while when obtained by reducing the aldehyde it is dextrogyrate; in most geranium oils both varieties exist.

A second group comprises the mono-cyclic alcohols, terpineol, which is unsaturated, and menthol, a saturated compound.



and solid modifications, inactive, as well as in the two optically active, varieties. Besides occurring naturally it is made artificially by the dehydration of terpin hydrate, and is largely used in the perfume industry because of its lilac odor. It has a sp. gr. of 0.940 at 15° C. (59.2° F.). Its most important ester is the acetate, which occurs in eajuput and cardamom oils.



is now official. Two of its esters are recognized as occurring with it in peppermint oil, menthyl acetate and menthyl iso-valerate. Of these the former is the more important. It is an oil having a penetrating odor, boiling at 224° C. (435.2° F.).

To a third group of compounds known as dicyclic, belongs:

6.—*Borneol*, C₁₀H₁₇OH, or CH.CH₂.CH₂.CH₂ CH₃.C.CH₃.CH₂.CHOH.C—CH₃.—This compound occurs naturally in both optically active modifications. It also occurs optically inactive. It forms crystalline masses, which, when quite pure, melt at 203° C. (397.4° F.). Borneol can be prepared artificially by reducing its ketone (camphor) with metallic sodium. In this case, however, there results a mixture of borneol and iso-borneol. Borneol forms a number of esters, of which *bornyl acetate* is the most important. This compound melts at 29° C. (84.2° F.), and has a specific gravity of 0.991 at 15° C. (59° F.). It is the characteristic constituent of the pine needle oils.

Nerol is an alcohol discovered in oil of neroli. It is a stereo-isomer of geraniol. Santalol, so called, is found as an alcoholic constituent of oil of sandalwood. It has been given the formula C₁₅H₂₅OH, but is probably a mixture of several isomeric or closely related alcohols. Sabinol, C₁₀H₁₅OH, is a constituent of oil of savin.

Fenchyl alcohol, thujyl alcohol, and pulegol, all having the same empiric formula as geraniol, C₁₀H₁₇OH, do not occur naturally, but are produced from the respective ketones.

II. Aldehydes.—Of the alcohols just enumerated, only the first group are primary alcohols, and will yield aldehydes. Thus, from geraniol,

there is obtained by oxidation, citral, the corresponding aldehyde, and from its isomer, linalool, the same.

1.—*Citral*, $C_9H_{15}COH$, or $(CH_3)_2C.CH.CH_2.CH_2.C(CH_2)CH.CO$ —Although at one time called *geranial*, this compound is now universally known as citral, which indicates its importance in the oils of the *citrus* family. It is obtained most abundantly from lemon grass oil by the aid of the bisulphite process. It is an oily liquid, boiling at from 228° to 230° C. (442.4° - 446° F.), under ordinary pressure, and at 110° C. (230° F.), under 12 mm. Its specific gravity is about 0.89 and its refractive index 1.49. It is optically inactive. Under the influence of alkalis, citral condenses with acetone with the elimination of water to form pseudo-ionone, $C_{13}H_{20}O$, which is converted into its isomer ionone by means of acids. Reduction with sodium produces the alcohol geraniol.

2.—*Citronellal*, $C_9H_{17}OH$, or $C(CH_3)_2CH.CH_2CH_2CH(CH_3)CH_2COH$, the aldehyde of citronellol, occurs in several essential oils, as in citronella oil. It is an oily liquid of characteristic odor; specific gravity 0.8768, refractive index 1.4481. It is dextrogyrate.

Of the class of aromatic aldehydes, there are found in essential oils, salicyl aldehyde, cumic aldehyde, benzaldehyde, and cinnamic aldehyde.

3.—*Salicyl Aldehyde*, $C_6H_4(OH)COH$.—This body is an oily liquid of aromatic odor, boiling at 196° C. (384.8° F.), and having a specific gravity of 1.172. It occurs in the oils of the several varieties of Spiraea. It can also be formed by the oxidation of its alcohol saligenin, or by the action of chloroform and potassium hydroxide on phenol.

4.—*Cumic Aldehyde*, $C_6H_4(C_3H_7)COH$.— This is p-isopropylbenzaldehyde, and is found in several essential oils, as in cumin oil. It is an aromatic oil, having a specific gravity of 0.973, and boiling at 235° C. (455° F.).

5.—*Benzaldehyde*, $C_6H_5.CO$.—This is now official.

6.—*Cinnamic Aldehyde*, $C_6H_5.CH:CH.CO$. —This was official in the U. S. P. VIII.

Anisic Aldehyde, $C_6H_4(OCH_3)COH$ (oxy-methyl-benzaldehyde), is a synthetic product used in artificial hawthorn perfume.

Piperonal or *Heliotropin*, $C_6H_3O_2CH_2COH$, is a synthetic product used in heliotrope perfume.

Santalal, $C_{14}H_{23}COH$, is found in sandalwood oil.

III. Ketones.—This class of chemical compounds is largely represented in essential oils. Of aliphatic saturated ketones there is only one fairly important representative.

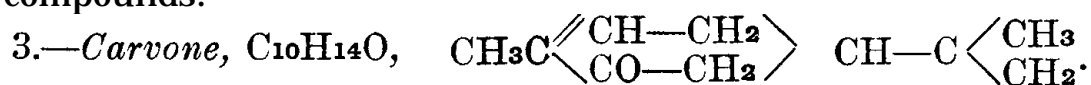
1.—*Methyl-nonyl-ketone*, $CH_3.CO.C_9H_{19}$, which is found in oil of rue, is a liquid of strong odor, boiling at $225^\circ C.$ ($437^\circ F.$), and specific gravity 0.8295 at $17^\circ C.$ ($62.6^\circ F.$). It solidifies when cooled, and melts at $13^\circ C.$ ($55.4^\circ F.$).

Of aliphatic unsaturated ketones there is also one occurring naturally.

2.—*Methyl-heptenone*, $CH_3.CO.C_6H_{11}$, is found in lemon grass oil and other oils, and results from the oxidation of citral or the distillation of cineolic anhydride. It has a specific gravity of 0.853 at $20^\circ C.$ ($68^\circ F.$) and boils at $174^\circ C.$ ($345.2^\circ F.$).

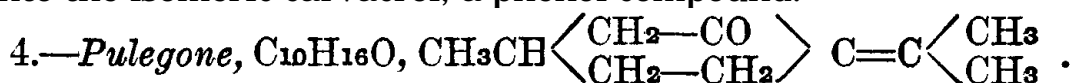
A *methyl-amyl-ketone*, $C_5H_{11}COCH_3$, boiling at $151^\circ C.$ ($303.8^\circ F.$) and having a specific gravity of 0.837 at $50^\circ C.$ ($122^\circ F.$), is found as a minor constituent in oil of cloves.

The most commonly occurring ketones, however, belong to the cyclic compounds:



This compound, found in oils of caraway fennel and dill, is a colorless oil boiling at $225^\circ C.$ ($437^\circ F.$) and having a sp. gr. of 0.960 at $18^\circ C.$ ($64.4^\circ F.$). It is optically active, occurring in both forms. Its most interesting addition compound is that with hydrogen sulphide; this is obtained in crystals, decomposing with alcoholic potassium hydroxide and liberating pure carvone. When heated with glacial phosphoric acid, it is changed

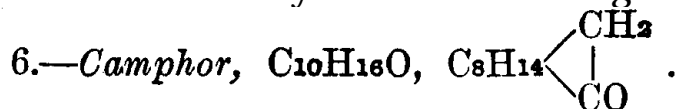
into the isomeric carvacrol, a phenol compound.



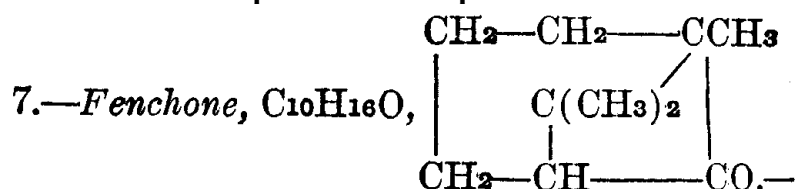
This characteristic ketone of pennyroyal oil is a liquid boiling at 221° C. (429.8° F.), and having a specific gravity of 0.9323 at 20° C. (68° F.). An isomeric body, iso-pulegone, has been obtained artificially.

5.—*Menthone*, $C_{10}H_{18}O$, $CHCH \left\langle \begin{array}{l} CH_2-CH_2 \\ CH_2-CO \end{array} \right\rangle CHCH(CH_3)_2$.—This occurs along with the corresponding secondary alcohol menthol, in oil of peppermint. It is an oily liquid boiling at 206° C. (402.8° F.), with a specific gravity of 0.897 at 15° C. (59° F.). By the action of oxidizing agents it can be converted into thymol, $C_{10}H_{14}O$.

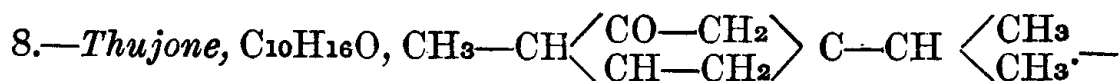
To the class of dicyclic ketones belong the following isomeric bodies:



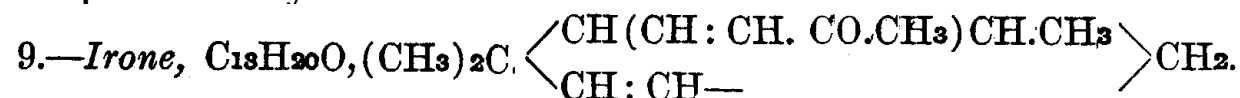
— This most important compound of the ketone class is official.



This ketone occurs as dextro-fenchone in oil of fennel, and as laevo-fenchone in oil of thuja. When purified, it forms an oil of camphoraceous odor, boiling at 193° C. (379.4° F.), and having a specific gravity of 0.9465 at 19° C. (66.2° F.).



This ketone is found in oils of thuja, tansy, wormwood and sage, and is identical with the bodies formerly known as tanacetone and salvone. It is an optically active liquid, boiling at from 200° to 203° C. (392°-397.4° F.) and having a specific gravity of 0.9126 at 20° C. (68° F.). A more complex ketone yet to be noted is:



The characteristic constituent of orris oil, to which also the violet odor is due, is irone. It is an oil almost insoluble in water, but readily soluble in

alcohol, boiling at 144° C. (291.2° F.) at 16 mm., and having a specific gravity of 0.939 at 20° C. (68° F.). In the attempt to effect the synthesis of irone, Tie-mann and Kriiger obtained an isomeric body, *ionone*, from citral, which is now used as the artificial violet odor.

IV. Acids and Their Esters.—While esters of several of the fatty acids, both saturated and unsaturated, are found in the essential oils, the compounds are not so distinctive or characteristic, that they require mention here. Some of the esters have been already described under the appropriate alcohols, see geraniol, linalool, etc. Of esters of aromatic acids there are several of importance, however, comprising the most valuable constituents of the oil in which they occur.

1.—*Methyl Salicylate* is the chief constituent of the oils of wintergreen and sweet birch.

2.—*Methyl Anthranilate* (o-amidobenzoate), $C_6H_4(NH_2)COOCH_3$ —This is the odoriferous constituent of neroli oil. It is an oil solidifying at low temperatures in crystals melting at 24.5° C. (76.1° F.), and boiling at 127° C. (260.6° F.) at 11 mm. Its specific gravity is 1.163 at 26° C. (78.8° F.). It is strongly fluorescent and has a powerful neroli odor.

V. Phenols and Phenol Ethers.—This is an important class, largely represented in the volatile oils. Of monatomic phenols there are:

1.—*Chavicol* (para allyl-phenol), $C_6H_4(OH)C_3H_5$.—This occurs in the *oil of Chavica Betle*, and is a colorless liquid having a strong odor and a specific gravity of 1.035 at 20° C. (68° F.), boiling at 237° C. (458.6° F.). Still more abundantly formed in nature is its methyl ether, which is:

2.—*Methyl-chavicol*, $C_6H_4(OCH_3)C_3H_5$. — This occurs in the oils of anise, star anise, sweet-basil, bay, etc. It is a colorless liquid of an anise-like odor, boiling at from 215° to 216° C. (419°-420.8° F.), and having a specific gravity of 0.979 at 12° C. (53.6° F.).

3.—*Anethol*, $C_6H_4(OCH_3)C_3H_5$, is the methyl ether of p-propenyl-phenol, and is therefore isomeric with methyl-chavicol. It can be formed from the latter by heating it with alcoholic potassium hydroxide. It is the most abundant constituent of the oils of anise, star anise and fennel. It forms white scales having a specific gravity of 0.986 at 25° C. (77° F.),

melting at 21° C. (69.8° F.), and boiling at 232° C. (449.6° F.).

4.—*Thymol* (methyl-propyl-phenol), $C_6H_3.CH_3.(OH)C_3H_7$ 1:3:4.—This is one of the best known of the phenols occurring in volatile oils. As it is official its description will be found under Thymol.

5.—*Carvacrol* (methyl-propyl-phenol), $C_6H_6.CH_3(OH)C_3H_7$ 1:2:4—This important phenol, occurring in oils of marjoram and savory, is isomeric with thymol. It is a thick oil, solidifying at 0° C. (32° F.) and boiling at 236° C. (456.8° F.). It can be prepared artificially by heating carvone, an isomeric ketone, with phosphoric acid or by heating camphor with iodine.

Of diatomic phenols and their ethers, there are the following:

6.—*Eugenol*, $C_6H_3.OH.OCH_3.C_3H_5$ 4:3:1, is the methyl ether of allyl-dioxybenzene. It occurs in the oils of cloves, allspice, bay, Ceylon cinnamon and cinnamon leaves.

7.—*Methyl-eugenol*, $C_6H_3.(OCH_3)_2.C_3H_5$, is found together with eugenol in oil of bay. It has a specific gravity of 1.041 at 11° C. (51.8° F.) and boils at 248° C. (478.4° F.).

8.—*Iso-eugenol* is the methyl ether of propenyl-dioxybenzene, and is produced from eugenol when the latter is heated with alcoholic potassium hydroxide. It is used in the manufacture of artificial vanillin.

9.—*Chavibetol*, $C_9H_8(OCH_3)OH$, is another isomer of eugenol, and occurs with chavicol in oil of betel leaves.

10.—*Safrol*, $C_6H_3 \begin{matrix} O \\ \diagup \\ O \end{matrix} > CH_2.C_3H_5$, is the methylene ether of allyl-dioxybenzene. It is found quite largely in the oils of sassafras, camphor, etc. It was official in the U. S. P. VIII.

II.—*Iso-safrol* is the methylene ether of propenyl-dioxybenzene, and is produced from safrol by heating the latter with alcoholic potassium hydroxide. It is used in the manufacture of *piperonal* (artificial heliotropin).

12.—*Thymohydroquinone dimethyl-ether*, $C_6H_2.(OCH_3)_2.CH_3.C_3H_7$, constitutes the bulk of the oil of arnica root. It is a liquid distilling at from 248° to 250° C. (478.4° - 482° F.).

Of triatomic phenols and their ethers, the representative is:

13.—*Asarol*, $C_6H_2(C_3H_5)(OCH_3)_3$.—This is the trimethyl ether of propenyl-trioxybenzene. It forms the solid constituent of the oil of *Asarum europium*, and occurs in prisms melting at 61° C. (141.8° F.), and boiling at from 295° to 296° C. (563° - 564.8° F.). It has also been made synthetically.

Of tetratomic phenols and their ethers, there is also a representative, as follows:

14—*Apiol*, $C_{12}H_{14}O_4, C_9H_6(OCH_3)_2O_2.CH_2$, is the dimethyl-methylene ether of allyl-tetroxybenzene. It occurs in two isomers—the apiol from oil of parsley and dill apiol from some varieties of oil of dill. Of these, the former is a crystalline solid melting at 30° C. (86° F.) and boiling at 294° C. (561.2° F.) and the latter is an oily liquid boiling at 288° C. (550.4° F.).

VI. Neutral Bodies, Oxides, etc.—One important compound of frequent occurrence in volatile oils has not been classified under any of the preceding groups, for the reason that it is relatively inert in a chemical way and is considered as an oxide of neither distinct acid or basic character.

1.—*Cineol (Eucalyptol)*, $C_{10}H_{18}O$.—This is found in nature in large amounts in eucalyptus oil (hence the name "eucalyptol" sometimes given to it), in cajuput oil (hence the name of "cajuputol"), in lavender, wormseed, and other oils.

VII. Sulphides and Sulphur Compounds.

1.—*Di-allyl-disulphide*, $C_6H_{10}S_2$, is a constituent of oil of garlic and occurs in many oils belonging to the *Cruciferae*. It is a liquid of very unpleasant odor, boiling at 140° C. (284° P.)

2.—*Allyl-isothiocyanate*, $C_3H_5.NCS$, is the principal constituent of the

volatile oil of mustard. It is, however, a decomposition product of the glucoside potassium myronate, which breaks up under the influence of the ferment myrosin. The allyl thiocyanate can also be obtained artificially by distilling allyl iodide or bromide with alcoholic potassium thiocyanate. This artificial product is largely sold in place of the natural oil. It is a liquid having a very unpleasant odor, boiling at 151° C. (303.8° F.), and having a specific gravity of 1.017 at 10° C. (50° F.).

Vinyl sulphide, (C₂H₃)₂S, is found in a variety of garlic.

Butyl isothiocyanate, CH(CH₃)C₂H₅NCS, is found in oil of horseradish, *acrynyl isothiocyanate*, C₇H₇ONCS, is found in white mustard and *phenylethyl isothiocyanate*, C₄H₄(C₆H₅)NCS, is found in oil of mignonette.

CLASSIFICATION.

Classification of the more commonly occurring volatile oils.—In considering the question of classifying the volatile oils, two methods of arrangement naturally suggest themselves, viz.: a classification according to the botanical natural orders to which they belong, and a chemical classification based on the most important chemical constituents of the oils themselves. While the first of these is the more readily made, it suffers from the disadvantage of being cumbrous and less readily understood except by the botanist. On the other hand, the second plan shows at a glance the sources of the valuable odoriferous and medicinally and technically important constituents for which the volatile oils are largely used. That it has not been generally adopted is no doubt due to the fact that many of the oils contain several different constituents of value, and it is therefore difficult to make an assignment of some of them to individual chemical groups. Nevertheless, it is believed that the chemical classification adopted here will be found to have practical value for reference.

Group I.—*Oils containing mainly Terpenes and Sesquiterpenes.*

Cedarwood; cedrene and cedrol (an oxygenated constituent).

Copaiba Balsam; caryophyllene.

Cubeb; cadinene and cubeb camphor (an oxygenated constituent).

Dog Fennel; phellandrene.

Fleabane; d-limonene.
Galbanum; pinene and cadinene.
Ginger; sesquiterpene and phellandrene.
Hemp; cannibene and other terpenes.
Hops; humulene and tetrahydro-cymene.
Myristica; terpenes and myristicol (an oxygenated constituent).
Orange; limonene with small amount of citral and citronellal (both oxygenated constituents).
Turpentine; pinene and sylvestrene.

Group II.—*Oils containing mainly Alcohols and their esters.*

- a. Aliphatic saturated alcohols:
Heracleum; octyl alcohol and octyl ester.
- b. Aliphatic unsaturated alcohols:
Bergamot; linalool and linalyl acetate.
Coriander; linalool and d-pinene.
Geranium; geraniol and geranyl esters.
Lavender; linalyl acetate and geraniol.
Lime; linalyl acetate and limonene.
Linaloes; linalool and geraniol.
Petit Grain; linalool and linalyl acetate.
Rose; geraniol and citronellol with esters.
- c. Monocyclic and dicyclic alcohols.
Angostura; galipol, galipene, and cadinene.
Fir Cones; bornyl acetate and terpenes.
Golden Rod; borneol and bornyl esters.
Juniper Berries; juniper camphor and cadinene.
Ledum; ledum camphor.
Lovage; terpineol.
Mace; myristicol.
Patchouli; patchouli camphor and cadinene.
Peppermint; menthol and menthone.
Pine Needles; bornyl acetate and terpenes.
Rosemary; borneol and bornyl acetate.
Sandalwood; santalol and esters.
Savin; sabinol and sabinyl acetate.
Valerian; borneol and bornyl esters.
- d. Aromatic Alcohols and Esters:
Jasmine; benzyl acetate and benzyl alcohol.

Group III.—*Oils containing Aldehydes as characteristic constituents.*

- a. Aliphatic unsaturated aldehydes:
 - Citron peel; citral and limonene.
 - Citronella; citronellal and geraniol.
 - Lemon; Citral and citronellal (this oil might also properly be classed in Group I, as the terpenes constitute over 90 per cent. of the oils).
 - Lemon grass; citral, citronellal, and methyl-heptenone.
 - Verbena; citral.
- b. Aromatic aldehydes:
 - Bitter Almond; benzaldehyde.
 - Cassia; cinnamic aldehyde.
 - Cinnamon; cinnamic aldehyde and eugenol.
 - Cumin; cumic aldehyde.
 - Meadow Sweet; salicyl aldehyde.

Group IV.—*Oils containing Ketones as characteristic constituents.*

- a. Aliphatic saturated aldehydes:
 - Rue; methyl-nonyl-ketone.
- b. Aliphatic unsaturated aldehydes:
 - Lemon grass; methyl-heptenone.
- c. Monocyclic and dicyclic ketones:
 - Artemisia; thujone.
 - Camphor; camphor.
 - Caraway; carvone and limonene.
 - Dill; carvone and limonene.
 - Orris; irone.
 - Pennyroyal; pulegone.
 - Peppermint; menthone and menthol.
 - Sage; thujone with borneol and cineol.
 - Spearmint; carvone.
 - Tansy; thujone with borneol.
 - Thuja; thujone and fenchone.
 - Wormwood; thujone and thujyl alcohol.

Group V.—*Oils containing Esters.*

- a. Aliphatic Acids:
 - Angelica; methyl-ethyl-acetic esters.
 - Calamus; heptylic and palmitic acid and esters.
 - Cardamom; acetic esters and cineol.
 - German Chamomile; caproic acid esters.

- Roman Chamomile; butyric, angelic and tiglic esters.
- b. Aromatic acid esters:
Neroli; o-amido-benzoic-methyl ester.
Sweet Birch; methyl salicylate.
Gaultheria; methyl salicylate.
- c. Undetermined acids:
Celery; sedanolide and lactone.
Elecampane; alantic acid and lactone.

Group VI.—*Oils containing Phenols and Phenol Ethers.*

- a. Monatomic phenols and their ethers:
Ajowan; thymol and cymene.
Anise; anethol and methyl-chavicol.
Betel; chavicol and methoxy-chavicol.
Fennel; anethol and fenchone.
Marjoram; carvacrol and linalool.
Savory; carvacrol, pinene, and cymene.
Star Anise; anethol, methyl-chavicol and safrol.
Sweet Basil; Methyl-chavicol and d-linalool.
- b. Diatomic phenols and their ethers:
Arnica Root; thymohydroquinone dimethyl-ether.
Bay; eugenol, methyl-eugenol and methyl-chavicol.
Camphor; safrol, eugenol and camphor.
Cascarilla Bark; eugenol and terpenes.
Cinnamon Leaf; eugenol and cinnamic aldehyde.
Cloves; eugenol and sesquiterpene.
Pimenta; eugenol and sesquiterpene.
Sassafras; safrol and camphor.
- c. Triatomic phenols and their ethers:
Asarum; asarol and methyl-eugenol.
Matico; asarol.
- d. Tetratomic phenols and their ethers:
Parsley; apiol.

Group VII.—*Oils containing Neutral Bodies.*

- Cajuput; cineol, terpineol and terpenyl acetate.
Eucalyptus; cineol, pinene, and aldehydes.
Laurel Leaves; cineol and pinene.
Myrtle; cineol, d-pinene and dipentene.
Wormseed; cineol and dipentene.

Group VIII.—Oils containing Sulphur.

Asafoetida; sulphides and pinene.

Garlic; diallyl-disulphide and allylpropyl sulphide.

Mustard; allyl-thiocyanate, allyl cyanide and carbon disulphide.

Onion; allyl-propyl sulphide.

Properties.—Volatile oils are slightly soluble in water. Agitated with this fluid they render it milky, but the major portion separates upon standing, leaving the water impregnated with their odor and taste. This impregnation is more complete when water is distilled with the oils, or from the plants containing them. Trituration with insoluble powders, as talc, magnesium carbonate, kieselguhr, etc., renders them much more soluble, probably in consequence of their minute division. The intervention of sugar also greatly increases their solubility, and affords a convenient method of preparing them for internal use. The hydrocarbon oils are scarcely soluble in diluted alcohol, and, according to De Saussure, the solubility of volatile oils generally in this liquid is proportionate to the oxygen which they contain. The volatile oils dissolve sulphur and phosphorus with the aid of heat, and deposit them on cooling. By long boiling with sulphur they form brown, unctuous, fetid substances, formerly called *balsams of sulphur*. They absorb chlorine, which converts them into resinous oxidation products and then combines with these. Iodine produces a similar effect. They are decomposed by the strong mineral acids, and unite with some organic acids. When treated with a caustic alkali, some of them are saponified or otherwise decomposed. Several of the metallic oxides, and various salts which easily part with oxygen, convert them into resinous oxidation products. The volatile oils dissolve many of the proximate principles of plant and animal tissues, such as the fixed oils and fats, resins, camphor, and many of the alkaloids when in the free state. Exposed to air and light, many of them absorb oxygen and become what are termed ozonized oils which possess oxidizing properties.

Adulterations.—The volatile oils are often sophisticated. Among the greater adulterations are fixed oils, resinous substances, chloroform, hydrocarbon oils, and alcohol, but the most dangerous are those made by mixing the pure oil with the cheaper volatile oils and terpenes and fractions from other oils like limonene. The presence of the fixed oils may be known by the permanent greasy stain "which they leave on paper, while that occasioned by a pure volatile oil disappears entirely

when exposed to heat. They may also in general be detected by their comparative insolubility in alcohol. Both the fixed oils and resins are left behind when the adulterated oil is distilled with wafer. If alcohol be present, the oil will become milky when agitated with water in a graduated tube, and after the separation of the liquids the water will occupy more space and the oil less than before. The following method of detecting alcohol was proposed by Beral. Put twelve drops of the suspected oil in a perfectly dry watch-glass, and add a piece of potassium about as large as the head of a pin. If the potassium remains for twelve or fifteen minutes in the midst of the liquid, there is either no alcohol present, or less than 4 per cent. If it disappears in five minutes, the oil contains more than 4 per cent. of alcohol; if in less than a minute, 25 per cent. or more. Borsarelli employs calcium chloride for the same purpose. This he introduces in small pieces, well dried and perfectly free from powder, into a small cylindrical tube, closed at one end, and about two-thirds filled with the oil to be examined, and heats the tube to 100° C. (212° F.), occasionally shaking it. If there is considerable proportion of alcohol, the chloride will be entirely dissolved, forming a solution which sinks to the bottom of the tube; if only a very small quantity, the pieces will lose their form, and collect at the bottom in a white adhering mass; if none at all, they will remain unchanged. (*J. P. C.*, xxvi, 429.) J. J. Bernoulli -proposes as a test dry potassium acetate, which remains unaffected in a pure oil, but will be dissolved if alcohol be present, and form a distinct liquid. (See *A. J. P.*, xxv, 82.) Distillation, catching the first portion, and testing for alcohol by the iodoform reaction, will detect very small additions of alcohol. The most dangerous adulterant of volatile oils is a liquid sold under some " fancy name," found in the markets of London and other large cities, and recommended for "reducing" essential oils; one specimen examined by John Barclay (*P. J.*, 1896, 463) had a delicate odor, and could be mixed with oils of lemon and bergamot without being detected by odor or taste. It was believed to be a *laevo-pinene*. There are good reasons for believing that similar liquids are used to an enormous extent.

Sometimes volatile oils of little value are mixed with the more costly. The taste and odor afford in this case the best means of detecting the fraud. The specific gravity of the oils may also serve as a test of purity. When two oils, of which one is lighter and the other heavier than water, are mixed, they may be separated by long agitation with this fluid, and will take a place corresponding to their respective specific gravities, but it sometimes happens that an unadulterated oil may thus be separated

into two portions. The difference of apparent effect produced by iodine with the several oils has been proposed as a test, and bromine was employed for the same purpose by John M. Maisch, who used both these tests preferably in the state of ethereal solution, which, as it is liable to spontaneous change by keeping, should be prepared when wanted for use. According to Liebig, when iodine is made to act on a volatile oil, a portion of it combines with the hydrogen of the oil, forming hydriodic acid, while another portion takes the place of the lost hydrogen. Oil of turpentine may be detected by remaining in part undissolved when the suspected oil is treated with three or four times its volume of alcohol of the sp. gr. 0.84; or, according to Mero, by causing the suspected oil, when agitated with an equal measure of poppy oil, to remain transparent, instead of becoming milky, as it would do if pure. The latter test will not apply to the oil of rosemary. (*J. P. C.*, 3e ser., vii, 303.) G. S. Heppe suggests a very delicate test of oil of turpentine and most other non-oxygenated oils, when used to adulterate one of the oils containing oxygen. A piece of copper nitroprusside, of the size of a pin's head, is put into a little of the suspected oil in a test-tube, and heated until the liquid begins, to boil. The boiling must be continued only a few seconds. If the oil be pure and oxygenated, the copper nitroprusside will become black, brown, or gray; if oil of turpentine or other non-oxygenated oil be present, the deposit will be green or bluish-green, and the supernatant liquid colorless or yellowish.

The different relations of the volatile oils to polarized light may, to a certain extent, be made available for the detection of adulterations; especially where the action of the adulterating oil is in an opposite direction to that of the oil adulterated. Thus, the oils of juniper, lavender, and rosemary, rotate the plane of polarization to the left, while American oil of turpentine rotates it to the right; and if this should be added to one of the other oils it might in some degree neutralize their action, and thus offer one means for its detection. Unfortunately, the French oil of turpentine, from the juice of the *Pinus maritima*, acts strongly in the opposite direction. But the very strength of its left-rotatory power might lead to its detection by the abnormal increase of this power which it would impart to the oils in question. Synthetic or artificial volatile oils are now largely manufactured. They vary greatly at times in their resemblance to the natural products. They will be considered under their respective titles elsewhere, a number having received official recognition.

Volatile oils may be preserved without change in small, well-stoppered amber-colored bottles, entirely filled with the oil, and secluded from the light.

They may also be preserved by mixing with them about 5 per cent. of a bland fixed oil which will remain undissolved when the volatile oil is added to alcohol and for which allowance must be made, of course, in the volume of the oil used in formulas, etc. (LaWall, *Proc. A. Ph. A.*, 1910, 1121.)

Manufacture.—Most of the volatile oils may be prepared by the general formula of the U. S. P. 1870: "Put the substance from which the Oil is to be extracted into a retort or other vessel suited for distillation, and add enough water to cover it, then distil by a regulated heat into a large refrigeratory. Separate the Distilled Oil from the water which comes over with it."

A large proportion of the volatile oils of European commerce is produced in Grasse, a town of France, twenty-five miles west of Nice. For an elaborate article on this industry and methods of preparation, see *A. Pharm.*, xxii, 473, abstracted in the *P. J.*, vol. xv, 468. Schimmel & Co., Miltitz, Germany, are large producers of volatile oils.

Under the general observations on the *Aquae*, or *Waters*, will be found remarks upon the use of steam in preparing the Distilled Waters, which are to a considerable extent applicable also to the volatile oils.

The substances from which the volatile oils are extracted may be employed in either the recent or the dried state. Certain flowers, however, such as orange flowers and roses, must be used fresh, or preserved with salt or by means of glycerin, as they afford little or no oil after desiccation. Most of the aromatic herbs, also, as peppermint, spearmint, pennyroyal, and marjoram, are usually distilled while fresh, although it is thought by some that when moderately dried they yield a larger and more grateful product. Dried substances, before being submitted to distillation, require to be macerated in water until they are thoroughly penetrated by this fluid, and to facilitate the action of the water it is necessary that, when of a hard or tough consistence, they should be properly comminuted by slicing, shaving, rasping, bruising or other similar mechanical operation.

The water which is introduced into the still with the substance answers the double purpose of preventing the decomposition of the vegetable matter by regulating the temperature, and of facilitating the volatilization of the oil, which, although in most instances readily rising with the vapor of boiling water, requires, when distilled alone, a considerably higher temperature, and is at the same time liable to be partially decomposed. Some oils, however, will not ascend readily with steam at 100° C. (212° F.), and in the distillation of these it is customary to use water saturated with common salt, which does not boil under 110° C. (230° F.). Recourse may also be had to a bath of strong solution of calcium chloride, or to an oil bath. Other oils, again, may be volatilized with water at a temperature below the boiling point, and, as heat exercises an injurious influence over the oils, it is desirable that the distillation should be effected at as low a temperature as possible. To prevent injury from heat, it has been recommended to suspend the substance containing the oil in a wire basket, or to place it upon a perforated shelf, in the upper part of the still, so that it may be penetrated by the steam, without being in direct contact with the water. Another mode of effecting the same object is to distill it *in vacuo*. Duncan stated that the most elegant volatile oils he had even seen were prepared in this manner by Barry, the inventor of the process. The employment of steam heat also prevents injury, and the best volatile oils are now prepared by manufacturers in this way. Steam can be very conveniently applied to this purpose by causing it to pass through a coil of tube, of an inch or three-quarters of an inch bore, placed in the bottom of a common still. The end at which the steam is admitted enters the still at the upper part, and the other end, at which the steam and condensed water escape, passes out laterally below, being furnished with a stop-cock, by which the pressure of the steam may be regulated and the water drawn off when necessary. In some instances it is desirable to conduct the steam immediately into the still near the bottom, by which the contents are kept in a state of brisk ebullition. This method is used in the preparation of the oil of bitter almond. The same method is applicable to the preparation of distilled waters.

The quantity of water added is not a matter of indifference. An excess above what is necessary acts injuriously by holding the oil in solution when the mixed vapors are condensed, and if the proportion be very large, it is possible that no oil whatever may be obtained separate. On the contrary, if the quantity be too small, the whole of the oil will not be distilled, and there will be danger of the substance in the still adhering

to the sides of the vessel and thus become burnt. Enough water should always be added to cover the solid material and prevent the latter accident. Dried plants require more water than the fresh and succulent. The whole amount of material in the still, should not exceed three-fourths of its capacity, as otherwise there would be danger of the liquid boiling over. The form of the still has an influence over the quantity of water distilled, which depends more upon the extent of surface than upon the amount of liquid submitted to evaporation. By employing a high and rather narrow vessel one may obviate the disadvantage of an excessive quantity of water. Sometimes the proportion of oil in the substance employed is so small that it is wholly dissolved in the water distilled, even though the proportion of the liquid in the still is not greater than is absolutely essential. In this case it is necessary to redistill the same water several times from fresh portions of the plant, until the quantity of oil exceeds the solvent power of the water. This process is called *cohobation*.

The more volatile of the oils pass with facility along with the steam into the neck of the common still, but some which are less volatile are apt to condense in the head and thus return into the still. For the distillation of the latter, a copper still should be employed having a very high head. As, after the distillation of any one oil, it is necessary that the apparatus should be thoroughly cleansed before being used for the preparation of another, it is better that the condensing tubes should be straight, rather than spiral as in the ordinary still. It should be recollected, moreover, that certain oils, such as those of anise and fennel, are rendered solid by a comparatively slight reduction of temperature, and that in the distillation of these the water employed for refrigeration should not be below 5.5° C. (42° F.).

The mixed vapors are condensed into a milky liquid, which is collected in a receiver, and, after standing for some time, separates into the oil and a clear solution of it, the former floating on the surface, or sinking to the bottom, according as it is lighter or heavier than water. The distillation should be continued so long as the liquid coming over has a milky appearance.

The last step in the process is to separate the oil from the water. For this purpose the *Florentine receiver* may be used. For illustrations of this, and other forms of receivers, for collecting and separating immiscible liquids, see Remington's *Practice of Pharmacy*, 6th edition, p. 250. This

is a conical glass vessel, broad at the bottom and narrow towards the top, and very near its base furnished with a tubulure or opening, to which is adapted, by means of a pierced cork, a bent tube so shaped as to rise perpendicularly to seven-eighths of the height of the receiver, then to pass off from it at right angles, and near the end to bend downward. The condensed liquid being admitted through the opening at the top of the receiver, the oil separates, and, rising to the top, occupies the upper narrow part of the vessel, while the water remains at the bottom, and enters the tube affixed to the receiver. When the surface of the liquid attains in the receiver a higher level than the top of the tube, the water will necessarily begin to flow out through the latter, and may be received in bottles. The oil thus accumulates as long as the process continues, but it is evident that the plan is applicable only to the oils lighter than water. For the heavier oils, cylindrical vessels may be employed, to be renewed as fast as they are filled; but, as all the water cannot be removed by these plans, it is necessary to resort to some other method of effecting a complete separation. An instrument called a *separator* is usually employed for this purpose. It consists of a glass funnel, or a globular vessel, furnished with a stopper, and prolonged at the bottom into a very narrow tube. The lower opening being closed, the mixed liquids are introduced and allowed to stand until they separate. The orifice at the bottom is then opened, and, the stopper at the top being a little loosened, so as to admit the air, the heavier liquid slowly flows out, and may be separated to the last drop from the lighter, which floats above it. If the oil is heavier than the water, it passes out of the separator; if lighter, it remains within. According to George Leuchs, all oils obtained by distillation with water, even when perfectly clear, contain some water.

The water saturated with oil should be preserved for use in future distillations, as it can dissolve no more of the oil. One or more volatile acids are frequently found in the distilled water, as acetic, butyric, or valerianic, and Wunder has detected all three of these acids in the water distilled from chamomile flowers. (*J. Pr. Chem.*, lxiv, 499.) For an illustration of a cheap apparatus for distilling volatile oils by steam under slight pressure, see *Proc. A. Ph. A.*, 1894, 680.

According to Overbeck, all the volatile oils may be decolorized by distilling them from an equal weight of poppy seed oil and a saturated solution of common salt. (*A. Pharm.*, lxxxiv, 149.)

When first procured, some volatile oils have a disagreeable somewhat empyreumatic odor, from which they may be freed by allowing them to stand for some days in vessels loosely covered with paper. They should then be filtered and introduced into small opaque bottles, which should be well stoppered so as to exclude the air. When altered by exposure to air, they may sometimes be restored to their original appearance and quality by agitation with a little recently heated animal charcoal, and the same method may be employed for freeing them from adhering water.

They may be administered upon a lump of sugar; or triturated with at least ten times their weight of sugar, forming *oleosaccharates*, which are then dissolved in water; or made into emulsions with water, sugar, and gum arabic. In making emulsions with volatile oils, it has been recommended first to dissolve them in one of the fixed oils, the oil of almond for example, and then to emulsify the oleaginous solution with syrup and gum arabic. For 100 parts of water, 15 of the almond oil in which the volatile oil is to be dissolved, 10 of powdered gum arabic, and 25 of syrup may be taken. The volatile oils are often kept dissolved in alcohol under the name of essences.

Enfleurage.—This term is applied by the French to the impregnation of fixed oil and fatty matters with the odors of certain sweet scented plants, such as jasmine, tuberose, and mignonette, the oils of which are so delicate and fugitive that they cannot well be separated by distillation. The process consists in exposing the fatty matter, placed in layers, in suitable frames, to the exhalations from the flowers, which are absorbed, and give their characteristic odor to the fat. Another plan is to expose alternate layers of the flowers, and of cotton impregnated with bland fixed oil, to the sun, and afterwards to express the oil from the cotton. (*A. J. P.*, xxix, 551.) The French sometimes give to the spirituous solutions made by extracting the odors from fats and oils with alcohol the name of Essences.

The following suggestions on preparing emulsions of the volatile oils may be useful. Oil of turpentine and other volatile oils, to be emulsified in quantity, are most successfully treated by rubbing them with one-half their weight of powdered gum arabic, and, when intimately mixed, adding at once, with rapid trituration, water in the proportion of one and a half times the weight of the gum used. Such an emulsion is more permanent when a little fixed oil is used.

Uses.—While substances differing so widely in their source and in their chemical composition must manifestly exercise dissimilar effects upon the body, but there are certain properties common to so many of the volatile oils that a word concerning the therapeutic effects of this group of principles may be in place. Practically all of the official volatile oils are more or less irritant; some of them only feebly so and some very actively so. By virtue of this action when taken into the intestinal tract they excite peristalsis and are therefore used for the expulsion of flatus in colic as well as to enhance the effect of cathartic drugs. It is probably also to this local irritant effect that their uses as expectorants, diaphoretics, and diuretics is to be attributed. A large number of them are powerful germicides and nearly all of them more or less antiseptic. The antibacterial property of the volatile oils has been investigated especially by Martindale (*Perfume and Essential Oil Record*, 1910, i, p. 266) by Gilmore (*P. J.*, 1910, p. 844) and by Peck (*J. A. M. A.*, 1899, xxxii, p. 6). According to Martindale the oil of origanum is twenty-five times as actively germicidal as phenol and the oil of cloves about 9 times; while Peck finds that the oil of cloves prevents the multiplication of bacteria when present in about 1 part to 1100. The following volatile oils are powerfully germicidal: origanum, thyme, cinnamon, cassia, cloves, bay, and sassafras. Of considerable disinfectant power but weaker than the preceding are: peppermint, eucalyptus, cajuput, bitter almond, sandal wood, spearmint and lavender. The following are feeble in their anti-bacterial properties: anise, bergamot, juniper, cade, and turpentine. Concerning most of the other oils figures are lacking. While the cost of the volatile oils precludes their use for many disinfectant purposes yet for others they are very valuable agents, especially are they employed for their antibacterial properties in the mouth and nose.

Some of the essential oils possess marked local anesthetic powers, among which may be mentioned especially cloves, peppermint, thyme, and cajuput. For this influence they are used in toothache and pruritus.

OLEATA.

OLEATES

Oleates, Fr.; *Oleate*, G.

The oleates are a class of preparations which were introduced to the

medical profession by John Marshall, F.E.S., in 1872. They are usually solutions of certain bases in oleic acid, and are made by triturating the solid substance with the oleic acid until it is dissolved. Whenever it is possible, the application of heat should be avoided, and it has been observed that the freshly precipitated oxides of the metals dissolve more readily than those which are old. The title oleate is probably the best that could be devised, although it must be understood that, as found in the Pharmacopoeias, they are not pure chemical compounds, but merely compounds of the oxides or the alkaloids, as the case may be, with oleic acid dissolved in a great excess of the latter.

Oleates may be made either by direct combination of the ingredients or by double decomposition. When made by the latter method, a good quality of oleic acid should be treated with the proper quantity of solution of sodium hydroxide, to saponify it, any excess of the alkali being neutralized with a little tartaric acid. This soap solution is preferably used diluted.

J. M. Good, in making the oleates of the alkaloids, proposes the use of sufficient oleic acid to dissolve the alkaloid and then diluting the solution with a bland fixed oil, such as almond oil. (*Proc. Missouri Pharm. Association*, 1891, p. 65.)

The *medicinal properties* of the oleates are, of course, dependent upon the base, so that these preparations may be considered the equivalents of the corresponding ointments, over which, however, they have certain advantages. They are much cleaner and more elegant in appearance. They seem to be more irritating than the ointments, and, unless diluted with an equal bulk of cottonseed, olive, or other bland oil, are, when applied with friction, likely to provoke a cutaneous eruption or even pustulation. Marshall recommends that they be applied with a brush, or gently spread over the part with the finger.

OLEORESINA ASPIDII. U. S. (Br.)

OLEORESIN OF ASPIDIUM Oleores. Aspid. [Oleoresin of Male Fern]

:Liquid Extract of Male Fern contains in 100 grammes not less than 20 grammes of filicin." Br.

Extractum Filicis Liquidum, *Br.*; Oleoresina Filicis, Pharm. 1870; Liquid Extract of Male Fern, Oil of Fern; Oleum Filicis-Maris; Extrait de Fougere Male, *Fr. Cod.*; Extractum Filicis, *P. G.*; Farnextrakt, Wurmfarneextrakt, Wurmfarneol, *G.*; Estratto de feice maschio etero. *It.*; Extraeto etereo de helecho macho, *Sp.*

"Aspidium, recently reduced to No. 40 powder, five hundred grammes [or 17 ounces av., 279 grains]; Ether, a sufficient quantity. Place the aspidium in a cylindrical glass percolator, provided with a stop-cock, and arranged with a cover and a receptacle suitable for volatile liquids. Pack the powder firmly, and percolate slowly with ether, added in successive portions, until the drug is exhausted. Recover the greater part of the ether from the percolate by distillation on a water bath, and, having transferred the residue to a dish, allow the remaining ether to evaporate spontaneously in a warm place. Keep the Oleoresin in a well-stoppered bottle. Note: Oleoresin of Aspidium, on standing, usually deposits a granular, crystalline substance. This should be thoroughly mixed with the liquid portion before use." U. 8.

"Male Fern, in No. 20 powder, 1000 grammes; Ether, a sufficient quantity. Exhaust the Male Fern, by percolation with the Ether; from the clear percolate recover the ether by distillation and finally evaporate on a water-bath until an oily extract remains. Specific gravity not less than 1.000. *Refractive index* at 40° C. (104° F.) not less than 1.490. Contains in 100 grammes not less than 20 grammes of filicin as determined by the following process:—Dissolve 5 grammes of the Liquid Extract in 40 milli-litres of *ether*, transfer to a separator, add 100 grammes of *solution of barium hydroxide* and shake vigorously and continuously for five minutes. Allow the liquids to separate and filter off 86 grammes of the aqueous liquid. Acidify this with *hydrochloric acid* and extract with three successive portions of 30, 20, and 15 millilitres of *ether*. Filter the mixed ethereal solutions, wash the filter paper with *ether*, evaporate, dry the residue at 100° C. (212° F.) and weigh. It weighs not less than 0.8 gramme, equivalent to not less than 20 grammes of filicin in 100 grammes of the Liquid Extract. This Liquid Extract contains not less than 20 per cent. of filicin." *Br.*

This is the only preparation of male fern which should be used; in its making aspidium which is green in color and recently collected should be employed. It is a thick, dark green liquid, usually containing a granular deposit of crystalline *filicic anhydride*, often erroneously called *filicin* or *filicic acid*, which is regarded as the active ingredient and should not be separated. For a method of determining the

percentage of filicic acid by Dacomo and Scoc-cianti, see *Ph. Centralh.*, 1896, 208. Wm. G. Greenawalt found both the liquid and the sediment effective tenicides, the sediment somewhat the more active. It has the odor of fern, and a nauseous, bitterish, somewhat acrid taste. According to Hayes, when an absolutely dry root and an anhydrous ether (containing but little alcohol) of a specific gravity below 0.728 are used, the oleoresin remains clear. Kramer states that a very active extract of male fern may be prepared by exhausting with ether the fresh juicy rhizomes collected in May or October freed from scales and cut into small pieces. The ethereal tincture should be kept in a cool place until wanted, when the necessary quantity should be converted into extract. One dose, two to four drachms, of such an extract is said to have always produced satisfactory results. (*Ph. Cb.*, xxv, 578.) Oleoresin of male fern is sometimes found in the market containing noticeable proportions of copper, and in many cases it is colored green artificially.

For therapeutic properties of this oleoresin, see *Aspidium*.

Dose, from one-half to one fluidrachm (1.8-3.75 mils), administered in emulsion.

OLEORESINA CAPSICI. U. S.

OLEORESIN OF CAPSICUM Oleores. Capsic.

Oleoresine (Extrait ethere) de Capsique, Fr.; Spanisch-pfeffer-Oelharz, Aetherisches Spaniachpfeffer-extrakt, G.

"Capsicum, in No. 40 powder, *five hundred grammes* [or 17 ounces av., 279 grains]; Ether, *a sufficient quantity*. Place the capsicum in a cylindrical glass percolator, provided with a stop-cock, and arranged with a cover and a receptacle suitable for volatile liquids. Pack the powder firmly, and percolate slowly with ether, added in successive portions, until the percolate measures *eight hundred mils* [or 27 fluidounces, 24 minims]. Recover the greater part of the ether from the percolate by distillation on a water bath, and, having transferred the residue to a dish, allow the remaining ether to evaporate spontaneously in a warm place. Then pour off the liquid portion, transfer the remainder to a glass funnel provided with a pledget of cotton, and, when the separated fatty matter (which is to be rejected) has been completely drained, mix the liquid portions together. Keep the Oleoresin

in a well-stoppered bottle." *U. S.*

One of the active principles of capsicum, called *capsaicin*, $C_9H_{14}O_2$, is very soluble in ether, and is wholly extracted in the process. Its precise nature has not been determined. Another principle, even still more pungent than *capsaicin*, is *capsacutin* which is also extracted by the official solvent in making this oleoresin. (See *Capsicum*.) After the concentration of the acetone solution, a solid fatty matter separates on standing, but a portion of fixed oil probably still remains. The preparation is a very thick liquid, capable, however, of being dropped, of a dark reddish-brown color, and, though opaque in mass, yet transparent in thin layers. It has not very decidedly the odor of capsicum, but to the taste is intensely pungent. W. C. Alpers found a capsicum which yielded 16 per cent. of oleoresin; the statement has been frequently made that 5 per cent. is the usual yield. (*M. R.*, 1896, 593.) It may be usefully employed to give locally stimulant properties to substances administered internally in a pilular form, in cases of *gastric insensibility* and excessive *flatulence*. One drop given three times a day has produced cystic irritation and strangury. It may be used also as a powerful rubefacient, in strengths of from one to two per cent., diluted with olive oil or soap liniment.

Dose, from one-fourth to one grain (0.015-0.065 Gm.).

Off. Prep.—Emplastrum Capsici, *U. S.*

OLEORESINA CUBEBAE. U.S.

OLEORESIN OF CUBEBA Oleores. Cubeb.

Extractum Cubebae *Æthereum*; Oleoresine de Cubebe, *Fr.*; Extractum Cubeborum, *P. G.*; Aetherisches Kubebenextrakt, Kubebenextrakt, *G.*

"Cubeb, in No. 30 powder, five hundred grammes [or 17 ounces av., 279 grains]; Alcohol, *a sufficient quantity*. Place the Cubeb in a cylindrical glass percolator, pack the powder firmly, and percolate slowly with alcohol, added in successive portions, until the drug is exhausted. Recover the greater part of the alcohol from the percolate by distillation on a water-bath, and, having transferred the residue to a dish, allow the remaining alcohol to evaporate in a warm place, stirring frequently. Keep the Oleoresin in a well-stoppered bottle.

"NOTE: Oleoresin of Cubeb, after standing for some time, deposits a waxy and crystalline precipitate, which should be rejected, the liquid portion only being used." U. S.

A change was made in the menstruum for this oleoresin in the U. S. P. (8th Rev.) alcohol now being used instead of ether or acetone. The use of alcohol was suggested by E. R. Squibb. This oleoresin consists mainly of the volatile oil and resin, with a portion of the cubebin and waxy matter of the cubeb. The consistence differs according to the character of the cubeb employed, its degree of fluidity being proportionate to the amount of volatile oil contained in the medicine. The color is usually blackish brown, with more or less of a greenish hue, according to the quantity of chlorophyll present, which varies with the character of the cubeb and with that of the menstruum, pure ether extracting more of the green coloring matter, while alcohol extracts the brown; unripe fruit or berries yield more chlorophyll than do the ripe fruit. Cubeb yields from one-eighth to one-fifth of its weight of the oleoresin. The preparation deposits waxy matter and crystals of cubebin on standing, which should be separated and discarded; its efficacy is not impaired on this account. It was first introduced into use by Procter. (*A. J. P.*, xviii, 168.)

From carefully conducted experiments by P. V. Heydenreich, it would appear that, of the various constituents of cubeb contained in the official oleoresin, the cubebin has no perceptible effect in the dose of the medicine ordinarily given, that the volatile oil is simply stimulant and carminative, and, finally, that the soft resin has all the diuretic properties of the cubeb. Of the last-mentioned ingredient, twenty grains (1.3 Gm.) given every two hours until five doses were taken considerably increased the secretion of urine, producing at the same time a slight burning sensation in the passage, which ceased with the diuretic action. Pushed beyond this amount, it occasioned severe irritation of the urinary passages, with some fever.

This oleoresin, as it occurs in the market, often has a thin consistence. In one specimen three-eighths of its weight were lost in a short time by the spontaneous evaporation of the ether improperly left in the product.

Dose, from five to ten minims (0.3-0.6 mil), given suspended in water, or mixed with powdered sugar.

Off. Prep.—Trochisci Cubebe, U. S.

OLEORESINA PETROSELINI. U. S.

**OLEORESIN OF PARSLEY FRUIT Oleores. Petrosel.
[Liquid Apiol]**

Apiol, Oil of Parsley Seed.

"Parsley Fruit, in No. 60 powder, five hundred grammes [or 17 ounces av., 279 grains]; Ether, a *sufficient quantity*. Place the parsley fruit in a cylindrical glass percolator provided with a stop-cock and arranged with a cover and a receptacle suitable for volatile liquids. Pack the powder firmly and percolate slowly with ether, added in successive portions until the drug is exhausted. Recover the greater portion of the ether by distillation on a water bath, and, having transferred the residue to a dish, remove the remaining ether by spontaneous evaporation in a warm place, stirring frequently. Allow the Oleoresin to stand without agitation for four or five days, decant the clear liquid portion from any solid residue, and preserve" it in well-stoppered bottles." *U. S.*

This oleoresin is commonly called "liquid apiol." The official process should be strictly followed as cases are on record where commercial gasoline or benzin has been used as the menstruum and the percolate evaporated spontaneously, whereupon a yield of as much as 50 per cent. of a non-volatile, oily liquid was obtained which consisted chiefly of the non-volatile portions from the gasoline. Such a procedure cannot be too severely condemned.

According to L. Wolff (*A. J. P.*, 1877, 2), commercial *apiol* is merely the oleoresin; he proposes a very simple process for true apiol. Powdered parsley seed is exhausted with petroleum benzin, and the liquid is spontaneously evaporated; the residue is a mixture of fixed oil, wax, and apiol; the apiol alone being soluble in alcohol can easily be separated by repeated washings with strong alcohol; the washings evaporated over a water bath at a gentle heat leave as a residue "true apiol." L. Ough (*C. D.*, 1894, 17) obtains apiol by percolating freshly powdered parsley seeds with alcohol, recovering the alcohol from the percolate by distillation, and separating the oily residue from the deposited waxy solid.

Ciamician and Silber (*Ph. Post*, 1888, 391) have investigated apiol, and state that the pure substance occurs in white crystals having the composition $C_{12}H_{14}O_4$, melting at $30^{\circ} C.$ ($86^{\circ} F.$), and boiling at $294^{\circ} C.$ ($561^{\circ} F.$). *Isapiol*, *apiolic acid*, *apiolaldenide*, and *apion* are decomposition products. They state that isapiol has physiological properties resembling those of pure apiol.

H. C. Whitney (*N. R.*, January, 1880) proposed to change the name of commercial apiol, and call it *oil of parsley seed*. He believed that the volatile oil of parsley seed is the active and emmenagogue principle, and obtained it by distilling the freshly powdered seed with salt water. The yield is 4.27 per cent. of an oil which corresponded closely with Joret and Homolle's apiol. Von Gerichten (*Ber. d. Chem. Ges.*, 16, 17) obtained besides the peculiar terpene, parsley camphor, which he thinks is alone entitled to the name of apiol. He gives its melting point as $30^{\circ} C.$ ($86^{\circ} F.$), boiling point $300^{\circ} C.$ ($572^{\circ} F.$), and sp. gr. 1.015.

Parsley camphor has been given the formula $CH_2:CH.CH_2.C_2H(OCH_3)_2:O_2:CH_2.CH.$ -It may be prepared by extracting the oleoresin of parsley seed with ether and subsequent purification. It crystallizes in long needles of a slight parsley odor—insoluble in water, but readily soluble in alcohol. With strong sulphuric acid it gives a blood-red color.

Uses.—The oleoresin of parsley contains a number of bodies of considerable physiological power. The most important of these are crystalline apiol, white apioline, and myristicin. According to the experiments of Lutz (*Bull. Sci. Pharm.*, 1910, xvii, p. 1) the actions of these substances are similar in kind. They produce marked slowing of the pulse with fall of the blood pressure, tremors,, and weakness of the extremities, followed by paralysis with epileptiform convulsions and gasping respirations. After death there was found marked congestion in the lungs and in the pelvic organs. Rimini and Dilitala (*Archiv. di. Farmacologia e. Terap.*, 1908, xiv) have shown that apiol produces in the " cat fatty degeneration of the liver of the same type as is caused by myristicin. They also noted that it had a direct weakening action on the voluntary muscles.

Oleoresin of parsley and other principles derived from this plant have been used in various uterine disorders, especially in *dysmenorrhea*. Our

knowledge of its physiological action, however, furnishes no ground for attributing to it valuable properties in this or any other disease. The congestion in the pelvic organs found after death from this drug, may easily be attributed to the asphyxial nature of the poisoning. There is no evidence that in quantities approaching those used in medicine it has any influence of any kind upon the uterus. Glatard (*Journ. de Mod. et Chir. Prat.*, 1910, p. 674) reports a case of apiol poisoning in a pregnant woman who took six grammes in a period of forty-eight hours. There was vertigo, nausea and vomiting, urticaria, liver swollen and painful, mild icterus, urine scanty and high colored, but free from albumen; pregnancy was not interrupted. Sardou (*A. G. M.*, 1906) recommends apiolin as an antispasmodic in *intestinal colic*.

Dose, five to fifteen minims (0.3-0.9 mil).

OLEORESINA PIPERIS. U. S.

OLEORESIN OF PEPPER Oleores. Piper.

Extractum Piperis Fluidum, *U. S.* 1850; Fluid Extract of Black Pepper; Oleoresine de Peivre noir, *Fr.*; Aethenachea Pfefferextrakt, *G.*

"Pepper, in No. 40 powder, five Hundred grammes [or 17 ounces av., 279 grains]; Ether, a sufficient quantity. Place the pepper in a cylindrical glass percolator, provided with a stop-cock, and arranged with a cover and a receptacle for volatile liquids. Pack the powder firmly, and percolate slowly with ether, added in successive portions, until the drug is exhausted. Recover the greater part of the ether from the percolate by distillation on a water bath, and, having transferred the residue to a dish, set this aside in a warm place until the remaining ether has evaporated, and the deposition of piperine has ceased. Lastly, separate the Oleoresin from the piperine by straining through purified cotton. Keep the Oleoresin in a well-stoppered bottle." *U. S.*

A substance has long been in use under the name of *oil of black pepper*, consisting mainly of the volatile oil, fixed oil, and resin of the pepper, and belonging, therefore, to the oleoresins. As usually found, it is almost black and of a thick consistence, and is a residue of the process for preparing piperine. The official oleoresin made with ether has the same general character, but is more fluid and of more uniform strength, and should, therefore, be preferred. It contains almost all the volatile oil and

acid resin of black pepper, with little of the piperine, and, as the last-mentioned principle, when quite pure, is of doubtful efficacy, the oleoresin may be considered as representing the virtues of the fruit. The color is greener than that of the common oil of black pepper, and not so dark, owing to the fact that the solvent dissolves the green more readily than the brown coloring matter. A pound of black pepper yields about six drachms of the oleoresin.

Dose, from one-fourth to one minim (0.015-0.06 mil), in emulsion or pill.

OLEORESINA ZINGIBERIS. U. S.

OLEORESIN OF GINGER Oleores. Zingib.

Extractum Zingiberis Æthereum; Oleoresine (Piperoide) deGingembre, *Fr*; Zingiberin, Aetherisches Ingwerextrakt, *G*.

"Ginger, in No. 60 powder, five hundred grammes [or 17 ounces av., 279 grains]; Ether, *a sufficient quantity*. Place the ginger in a cylindrical glass percolator, provided with a stop-cock, and arranged with a cover and a receptacle suitable for volatile liquids. Pack the powder firmly, and percolate slowly with ether, added in successive portions, until the drug is exhausted. Recover the greater part of the ether from the percolate by distillation on a water bath, and, having transferred the residue to a dish, allow the remaining ether to evaporate spontaneously in a warm place. Keep the Oleoresin in a well-stoppered bottle." *U. S.*

: In the U. S. formula of 1870 for this preparation alcohol was used in connection with ether, on the score of economy: it was added in order to displace the ether and thus save an unnecessary expenditure of the more costly fluid. A little of the alcohol mixed with the ether at their surface of contact. In the present process both ether and alcohol have been replaced by the solvent, ether. The whole of the virtues of the root are extracted in this preparation, as the residuary ginger is nearly or quite tasteless. The oleoresin constitutes about 5 per cent. of the dried root. It is the *piperoid of ginger* of Beral. (Soubeiran's *Traite de Pharm.*, i, 371.) It is a clear, dark-brown liquid, of a thick consistence (though capable of being dropped), with the flavor of ginger, and very pungent.

The oleoresin of ginger is a useful stimulant in *alcoholic gastritis*,

chronic serous diar-rheas and other atonic conditions of the alimentary canal.

Dose, one-half to one minim (0.03-0.06 mil), well diluted.

OLEORESINÆ

OLEORESINS

Oleo-resines, Extraits ethers, *Fr.*; Oelharze, Aetherische Extrakte, *G.*

The oleoresins, as a class of preparations, were introduced into the U. S. Pharmacopoeia at the revision of 1860, having been previously classed with the Fluidextracts. Their peculiarity is that they consist of principles which, when extracted by means of ether, alcohol, or acetone, retain a liquid or semi-liquid state upon the evaporation of the menstruum, and at the same time have the property of self-preservation, differing from the fluidextracts in not having a definite relation of strength to the drug. They consist chiefly, as their name implies, of oil, either fixed or volatile, holding resin and sometimes other active matter in solution. Their preparation is very simple, consisting in the exhaustion of the drug with acetone, alcohol or ether by means of percolation, and the subsequent evaporation of the menstruum. In consequence of the great volatility of the solvent, it may in great measure be recovered by distillation, thus very materially diminishing the costliness of the process. It is proper not to continue the heat necessary for the recovery of the solvent by distillation until the whole of the solvent is driven over, lest, towards the close, a portion of the volatile matters also should pass, and the strength of the oleoresin be impaired. Hence in every instance the last portions of the menstruum are allowed to separate by spontaneous evaporation. Petroleum benzin has been proposed as a substitute for other solvents in these preparations, but should not be permitted to supersede them until officially sanctioned. It is difficult, if not impossible, to remove the last traces of this solvent without loss of volatile oil. Acetone replaced ether in most of the formulas of the U. S. P. VIII on account of economy, but as ether is again the cheaper solvent because of the use of denatured alcohol in its manufacture, it is again officially directed in the U. S. P. IX. Oleoresin of cubeb is made with alcohol,

OLEUM ABIETIS. Br.

OIL OF SIBERIAN FIR [Oil of Pine]

"Oil of Siberian Fir is the oil distilled from the fresh leaves of *Abies sibirica*, Ledeh." *Br.*

"Colorless or nearly so. Aromatic odor; taste pungent. Specific gravity 0.900 to 0.920; optical rotation -32° to $-4-2^{\circ}$; refractive index at 25° C. (77° F.) about 1.474. Contains from 30 to 40 per cent. of esters, calculated as bornyl acetate, $C_{10}H_{17}C_2H_3O_2$ " *Br.*

This is practically the same in its properties and uses as pine needle oil. (See *Oleum Pini Pumilionis*.)

OLEUM AJOWAN. Br.

AJOWAN OIL [Ptychotis Oil]

"Ajowan Oil is the oil distilled from the fruit of *Carum Copticum*, Benth. and Hook. f." *Br.*

Under the name of *ayowan*, *ajwain*, *ajwan*, and other vernacular appellations, the fruit, of the *Carum Ajowan* Bentley (*C. Copticum* Benth. and Hook. f.) are largely used in India as an aromatic. They resemble in size the fruits of the ordinary parsley and are of a grayish-brown color and have a tubercular surface with five prominent ridges to each mericarp. The odor and taste resemble that of thyme. These fruits yield from 4 to 6 per cent. of an agreeably aromatic volatile oil. Ajowan oil is "colorless, with an odor and taste resembling thyme. Specific gravity 0.910 to 0.930. Optical rotation $+10$ to $+2^{\circ}$. When 10 millilitres with 100 milli-litres of solution of sodium hydroxide in a flask with a narrow graduated neck are heated on a water-bath, well shaken, and allowed to stand, the uncombined oil, cooled to 15.5° C. (60° F.), measures not more than 6 millilitres (presence of not less than 40 per cent. of thymol)." *Br.*

This oil, besides containing thymol, contains a terpene and also the cyclic hydrocarbon cymene.

The oil of ajowan is one of the most important commercial sources of

thymol. Its medicinal virtues are due entirely to this ingredient.

Dose, one-half to five minims (0.03-0.3 mil).

OLEUM AMYGDALÆ AMARÆ. U. S.

OIL OF BITTER ALMOND

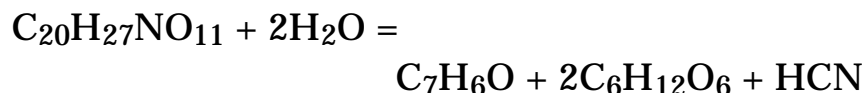
Ol. Amygd. Amar. [Bitter Almond Oil]

"A volatile oil obtained by maceration and distillation from the ripe kernels of *Prunus Amygdalus amara* DeCandolle (Fam. *Rosaceae*), and from other kernels containing amygdalin. It yields not less than 85 per cent. of benzaldehyde [C_7H_6O] and not less than 2 per cent. nor more than 4 per cent. of hydrocyanic acid [HCN]. The botanical source from which it is derived must be stated on the label. Preserve it in small, well-stoppered, completely filled, amber-colored bottles protected from light and air. Oil showing crystals of benzoic acid must not be dispensed.

"NOTE: This Oil is intended for medicinal use; it must not be used for flavoring foods." *U. S.*

Oleum Amygdalarum (Amararum) Æthereum; Oleum Amygdalae Volatile; Volatile Oil of Almond, Huile volatile d'Amande amere, *Fr. Cod.*; Essence d'Amandea ameres, *Fr.*; Bittermandelol, *G.*; Esencia de almendras amargas, *Sp.*

When bitter almonds are expressed, they yield a bland fixed oil, and the residuary cake, reduced to powder by grinding, and submitted to distillation with water, yields oil of bitter almond. This does not pre-exist in the almond, but is produced by the action of water upon the amygdalin contained in it, through the intervention of an enzyme called emulsin (see *Amygdala Amara*), according to the reaction:



It is obtained also by the distillation of the leaves of the cherry-laurel, by the bark of the wild cherry, and of various products of the genera *Amygdalus*, *Cerasus*, *Prunus*, etc. Whipple obtained, upon an average, from the ground bitter almond cake, 1.35 per cent. of the oil. (*P. J.*, x, 297.) Pettenkofer has ascertained that the yield is greater if the cake be macerated in water for forty-eight hours before being submitted to

distillation. (*J. P. C.*, May, 1862, p. 432.) It is sometimes produced from peach kernels. SchimmePs Report for April, 1914, refers to the fact that the sole source of the oil at that time was apricot kernels.

Oil of bitter almond has a yellowish color, a bitter, acrid, burning taste, and the odor of the kernels in a high degree. It is heavier than water, soluble in alcohol and ether, according to Fluckiger soluble in 300 parts of hot or cold water, and deposits, upon standing, a white crystalline substance consisting chiefly of ben-zoic acid. It is officially described as " a clear, colorless or yellow, strongly refractive liquid, having the characteristic odor and taste of ben-zaidehyde. It is slightly soluble in water and soluble in all proportions in alcohol or ether. It dissolves, forming a clear solution, in 2 volumes of 70 per cent. alcohol. Specific gravity: 1.038 to 1.060 at 25° C. (77° P.). Refractive index: 1.5428 to 1.5439 at 20° C. (68° F.) (see Part III, Test No. 22). It is optically inactive or dextrorotatory, not exceeding +0° 10' in a 100 mm. tube at 25° C. (77° F.). When first prepared, the Oil is neutral to litmus paper, but afterwards develops an acid reaction due to the formation of benzoic acid. It does not respond to the Test for heavy metals in volatile oils. Hold the looped end of a piece of clean copper wire in a non-luminous flame until it glows without coloring the flame green, cool the wire, dip the loop into Oil of Bitter Almond, ignite the latter and hold it so that the liquid burns outside of the non-luminous flame. On slowly bringing the flame from the burning Oil of Bitter Almond on the loop in contact with the lower outer edge of the non-luminous flame, no green tinge is discernible (chlorinated products). Add 10 drops of the Oil to a little alcohol, then add a small amount of zinc dust and 2 mils of acetic acid and boil the mixture for a short time; no odor of phenylisocyanide develops after rendering it strongly alkaline with potassium hydroxide T.S., adding a few drops of chloroform and heating (nitrobenzene)." *U. S.*

Besides the peculiar volatile oil, it contains also hydrocyanic acid, with usually a small proportion of benzoic acid produced by oxidation of the aldehyde. It may be obtained pure by agitating it strongly with calcium hydroxide and a solution of ferrous chloride, submitting the mixture to distillation, and drying the oil which comes over by digestion with calcium chloride. George Whipple states that if crude oil be redistilled into a solution of silver nitrate, and again distilled from a fresh solution of the same salt, it is obtained entirely free from hydrocyanic acid, which reacts with the silver and remains behind as silver cyanide. (See

A. J. P., xxvi, 348.) Thus purified, it is colorless, but still retains its peculiar odor, with a burning, aromatic taste, and is destitute of those poisonous properties of the crude oil which are dependent on hydrocyanic acid. The odor of the oil of bitter almond has been erroneously ascribed to that acid, which, on examination, will be found to have a different and more feeble odor. Like most other volatile oils, this may produce deleterious effects if taken very largely. Hippuric acid is found in the urine of animals to which the oil has been given freely. The sp. gr. of the crude oil varies from 1.052 to 1.082, and is said to be greater when the oil is distilled from salt water than when distilled by the ordinary mode. That of the purified oil is 1.060, and its boiling point 180° C. (356° V.). It is *benzoic aldehyde*, $C_6H_5.CO_2H$, which may also be produced by the action of oxidizing agents upon benzyl alcohol, $C_6H_5.CH_2OH$, and yields itself, when oxidized, benzoic acid, $C_6H_5.CO_2H$. The benzoic acid which the oil of bitter almond deposits on standing does not pre-exist in it, but results from the absorption of oxygen, as just stated.

If sulphuric acid produce with the oil a bright-red instead of a brownish-red color, the oil has probably been distilled with salt water, in which case it is prone, according to Ferris, to deposit a blood-red substance, occasionally complained of by druggists.

Uses.—The unpurified volatile oil of bitter almond, which is the product directed by the Pharmacopoeia, acts physiologically like hydrocyanic acid. Death is said to have occurred in a man ten minutes after taking two fluidrachms (7.5 mls) of the oil. It might be substituted with advantage for medicinal hydrocyanic acid, if it always contained a uniform percentage of the acid, as the acid contained in the oil is much less liable to decomposition, remaining for several years unaltered, provided the oil be preserved in well-stoppered bottles. According to Schrader, 100 parts of the oil contain sufficient acid for the production of 22.5 parts of Prussian blue, but the proportion is not constant, varying, according to Groves, from 8 to 12.5 per cent.. the U. S. official standard is, however, not less than 2 per cent. and not more than 4 per cent. It has been employed externally, dissolved in water in the proportion of one minim (0.06 mil) to a fluidounce (30 mls), in *prurigo senilis* and other cases of troublesome *itching*. To facilitate the solution in water, the oil may be previously dissolved in spirit. Oil of bitter almond is sometimes used to conceal the taste of cod liver oil and of

castor oil.

Dose, one-fourth to one minim (0.015-0.06 mil.).

Off. Prep.—Aqua Amygdalas Amarae, *U. S.*; Spiritus Amygdalae Amarae, *U. S.*; Elixir Amygdalae Compositum, *N. F.*; Elixir Anisi (from Spirit), *N.F.*

OLEUM AMYGDALÆ EXPRESSUM. U. S. (Br.)

EXPRESSED OIL OF ALMOND Ol. Amygd. Exp. [Oil of Sweet Almond]

"A fixed oil obtained from the kernels of varieties of *Prunus Amygdalus* Stokes (Fam. *Rosaceae*). Preserve it in well-closed containers, in a cool place." *U. S.* "Almond Oil is the oil expressed from the Bitter or Sweet Almond." *Br.*

Oleum Amygdalae *Br.*; Almond Oil; Oleum Amygdalae Dulcis, *U. S.* 1860; Oil of Sweet Almond; Huile d'Amande douce, *Fr. Cod.*; Huile d'Amandes, *Fr.*; Oleum Amygdalarum, *P. G.*; Mandel ol, *G.*; Olio di mandorle dolci. *It.*; Aceite de almendraa dulces, *Sp.*

This oil is obtained equally pure from sweet and from bitter almonds. In its preparation, the almonds, having been deprived of a reddish-brown powder adhering to their surface, by being rubbed together in a piece of coarse linen, are ground in a mill resembling a coffee-mill, or bruised in a stone mortar, and then pressed in canvas sacks between plates of iron slightly heated. The oil, which is at first turbid, is clarified by rest and filtration. Sometimes the almonds are steeped in very hot water, deprived of their cuticle, and dried in a stove, previous to expression. The oil is thus obtained free from color, but in no other respect better, while it is more likely to become rancid on keeping. Bitter almonds treated in this way impart an odor of hydrocyanic acid to the oil. Boullay obtained 54 per cent. of oil from sweet almonds. Munch gives 55.4 per cent. as the yield of the former, and 52 per cent. as that of the latter. (*J. P. C.*; 4e ser., iii, 400.) These figures are not realized, however, in the ordinary expression methods. Schaedler (*Technologie der Fette und Oele*, 2te Auf., 532) gives 45 per cent. as the average obtained from the sweet almonds, and 38 per cent. from bitter almonds. Though sometimes expressed in this country from imported almonds, the oil is generally brought from Europe.

Properties.—It is "a clear, pale straw-colored or colorless, oily liquid, almost odorless, and having a bland taste. It is slightly soluble in alcohol, miscible with ether, chloroform, benzene, or petroleum benzin. Specific gravity: 0.910 to 0.915 at 25° C. (77° F.). The oil remains clear at -10° C. (14° F.), and does not congeal until cooled to nearly -20° C. (-4° F.) (*olive or lard oil*). Shake vigorously 2 mils of the Oil with a mixture of 1 mil of fuming nitric acid and 1 mil of water; a whitish mixture is formed, which, after standing for several hours at about 10° C. (50° F.), separates into a solid white or nearly white mass and a slightly colored liquid (*oil of peach or apricot kernels*, yielding a red color, and *sesame or cottonseed oil*, yielding a brown color). Heat 10 mils of the Oil with 15 mils of an aqueous solution of sodium hydroxide (1 in 6) and 30 mils of alcohol on a water bath in a flask having a small funnel inserted in the neck, occasionally agitating the mixture until it becomes clear, then transfer the solution to a shallow dish and evaporate the alcohol on a water bath. The residue, when mixed with 100 mils of distilled water, produces a clear solution (*paraffin oil*). Add an excess of hydrochloric acid to this solution; a layer of oleic acid rises to the surface, which, when separated, washed with warm water and clarified by heating on a water bath, remains clear if cooled to 15° C. (59° F.) (*various foreign oils*). One volume of the oleic acid obtained in the last test, when mixed with 1 volume of alcohol, yields a clear solution, which at 15° C. (59° F.) does not deposit any fatty acids, nor become turbid upon the further addition of 1 volume of alcohol (distinction from *olive, arachis, cottonseed, sesame, or other fixed oils*). Saponification value: not less than 191 nor more than 200. Iodine value: not less than 93 nor more than 100." *U. S.*

From the statement of Braconnoit, it appears to contain 76 per cent. of olein and 24 per cent. of a mixture of palmitin and stearin.

According to H. Hager, the oils expressed from the large sweet and the smaller bitter almonds differ considerably, as shown by the elaidin test,—the former oil congealing rapidly, and almost completely, the latter about twelve hours later, and the smaller the bitter almond has been the more imperfectly the oil congeals. Only about one-third of the bulk congeals when the oil is from the small Oporto almonds.

Oil of almond may be used for the same purposes as is olive oil, and, when suspended in water by means of mucilage or the yolk of egg and

loaf sugar, forms a pleasant emulsion, useful in pulmonary affections attended with *cough*.

Dose, one fluidrachm to one fluidounce (3.75-30 mils).

OLEUM ANETHI. Br.

OIL OF DILL

"Oil of Dill is the oil distilled from Dill Fruit." *Br.*

Huile volatile d'Aneth, Essence d'Aneth, *Fr.*; Dill, Dillol, *G.*

Oil of dill is of a pale yellow color, with the odor of the fruit, and a hot, sweetish, acrid taste. Its sp. gr. varies between 0.895 and 0.915. The fruit yields about 3.5 per cent. of it. The oil is a mixture of a paraffin hydrocarbon, and 40 to 60 per cent. of *d*-carvone, $C_{10}H_{14}O$, with *d*-limonene, $C_{10}H_{16}$. (See *Oleum Cari*.) Phellandrene is present in the English and Spanish oils, but not to any appreciable extent in the German oil. "Colorless or pale yellow, darkening on keeping. Odor that of Dill Fruit; taste at first sweet and aromatic, but subsequently pungent. Specific gravity 0.900 to 0.915; *optical rotation* $+70^{\circ}$ to $+80^{\circ}$; *refractive index* at $25^{\circ} C.$ ($77^{\circ} F.$) 1.483 to 1.488. Soluble in 3 parts of alcohol (90 per cent.)." *Br.* R. Nietski obtained from dill, the fruit of *Anethum graveolens*, a volatile oil, which commenced to boil at $155^{\circ} C.$ ($311^{\circ} F.$), the boiling point rising gradually to $260^{\circ} C.$ ($500^{\circ} F.$). About 10 per cent. of the oil consists of a hydrocarbon, $C_{10}H_{16}$, having the boiling point from 155° to $160^{\circ} C.$ (311° - $320^{\circ} F.$), 60 per cent. boiling at from 170° to $175^{\circ} C.$ (338° - $347^{\circ} F.$), of the same composition, and 30 per cent. with the boiling point from 225° to $230^{\circ} C.$ (437° - $446^{\circ} F.$), composition $C_{10}H_{14}O$, and identical with carvol. The odor of the first portion of hydrocarbon is similar to that of turpentine; that of the second portion resembles oil of mace, but when mixed with a little carvol the characteristic dill odor is at once produced. (A. J. P., 1874.) The oil is sometimes used for the preparation of dill water.

Dose, from. one to three minims (0.065-0.2 mil).

OLEUM ANISI. U. S., Br.

OIL OF ANISE Ol. Anisi [Anise Oil]

"A volatile oil distilled from the ripe fruit of *Pimpinella Anisum* Linne (Fam. *Umbelliferae*) or from the ripe fruit of *Illicium verum* Hooker filius (Fam. *Magnoliaceae*). The botanical source from which it is derived must be stated on the label. If solid material has separated, carefully warm the Oil until liquefied, and thoroughly mix it before dispensing. Preserve it in well-stoppered, amber-colored bottles, protected from light." *U. S.* "Oil of Anise is the oil distilled from Anise Fruit; or from the fruit of the star-anise, *Illicium verum*, Hook. f." *Br.*

Huile volatile d'Anis vert (Badaine), *Fr. Cod.*; Essence d'Anis, *Fr.*; Oleum Anisi, *P. G.*; Anethol, Anisol, *G.*; Essenza di anise, *It.*; Esencia de anis, *Sp.*

The product of oil from anise is variously stated at from 1.56 to 3.12 per cent. The oil employed in this country is imported. It is colorless or yellowish, with the peculiar odor and taste of the seed. At 10° C. (50° F.) it crystallizes in flat tables, and it does not melt under 16.6° C. (62° F.). Its sp. gr. increases with age, and is variously given at from 0.9768 to 0.9903. It is soluble in all proportions in alcohol of 0.806; but alcohol of 0.840 dissolves at 25° C. (77° F.) only 42 per cent. Ether dissolves oil of anise in all proportions.

It consists of a small quantity of terpene, C₁₀H₁₆, but mainly of *anethol*, parapropenyl-anisol, C₆H₄C₃H₅OCH₃ (about 85 per cent.), which is present, however, in two isomeric modifications, one solid at ordinary temperatures and heavier than water (*solid anethol*), the other liquid and more volatile (*estragol* or *methyl chavicol*). *Anethol*, both in the liquid and in the solid form, is present, and is the chief constituent of the oils of anise, star anise, and fennel.

Star anise oil contains besides anethol, pinene and phellandrene and some samples have been reported as containing safrol which is present to an appreciable extent in the so-called Japanese star anise oil which is from the leaves instead of the fruit. This latter oil contains eugenol as well as much less anethol than the oil from the fruit.

In consequence of its high price, it is frequently adulterated with

spermaceti, wax, or camphor. The first two may be detected by their insolubility in cold alcohol, the last by its odor. In one instance as much as 35 per cent. of spermaceti was found. Schimmel & Co. have found fennel stearoptene in commercial oil of anise. (*Ph. Rev.*, 1897, 94.) Procter met with a parcel, of which not less than five-sixths was alcohol. (*A. J. P.*, xxvii, 513.) Its comparative mildness adapts it to infantile cases. Most of the oil of anise of commerce is the *oil of star aniseed* (*Oleum Badiani*, or *Oleum Illicii*). Oil of anise has also been distilled from the sweet cicely, *Osmorrhiza longistylis*, of the United States and Canada. (*Ph. Rund.*, July, 1887.) For description and analysis of Russian oil of anise, see *P. J.*, 1896, 164, also 243. Anisic acid is said to be antiseptic, resembling salicylic acid in its action.

Anethol which was official in the U. S. P. VIII is now recognized by the N. F. The description and tests are as follows: "The methyl ether of para-propenyl phenol [$C_6H_4.C_3H_5.OCH_3 = 148.1$]. It is the main constituent in the oils of anise, star anise, and fennel, and is usually obtained from these by fractioning, chilling and crystallizing. Preserve it in well-stoppered, amber-colored bottles protected from light and air. Anethol is a colorless or faintly yellow, highly refractive liquid at a temperature of 23° C. (73.4° F.) or above, having a sweet taste and the aromatic odor of anise. At from 20° to 21° C. (68°-69.8° F.) it solidifies to a white, glistening, crystalline mass which remelts from 22° to 23° C. (71.6°-73.4° F.). Anethol is almost insoluble in water, readily soluble in ether or chloroform, and forms a clear solution with two volumes of alcohol. Specific gravity: 0.984 to 0.986 at 25° C. (77° F.). Boiling point: 232° to 234° C. (449.6°-453.2° F.). Refractive index: 1.5 at 20° C. (68° F.). It is optically inactive or shows a deviation of not more than 0.08° in a 100 mm. tube at 25° C. (77° F.), due to slight traces of the oil from which the Anethol has been prepared (if prepared from oil of anise, this deviation will be laevorotatory, if from oil of fennel, dextrorotatory). Shake 10 mls of Anethol with 50 mls of a saturated aqueous solution of sodium bisulphite in a graduated cylinder and allow the mixture to stand for six hours. No appreciable diminution in the volume of Anethol will be observed nor does a crystalline deposit separate (*aldehydes*)." *N. F.*

Uses.—As a flavoring agent the oil of anise rivals any of the aromatic oils in the extent of its applicability. It is especially enjoyed by young children. Therapeutically it is useful to stimulate peristalsis in *colic* and, according to Kobert, also as an *expectorant*. It has also been

recommended as a means of destroying body vermin.

Dose, from three to five minims (0.2-0.3 mil).

Off. Prep.—Aqua Anisi, *U. S.*; Elixir Aromaticum (from Spirit), *U. S.*; Spiritus Anisi, *U. S., Br.*; Spiritus Aurantii Compositus, *U. S.*

OLEUM ANTHEMIDIS. Br.

OIL OF CHAMOMILE

" Oil of Chamomile is the oil distilled from Chamomile Flowers." *Br.*

Oleum Chamomillae Romanae; Essence de Camomille romaine, *Fr.*; Rondschkamillenol, *G.*

This oil was introduced into the British Pharmacopoeia 1885 with the direction that it should be distilled in Britain. No such restriction is found in the Pharmacopoeia of 1898 or 1914. It is seldom prepared in this country. Baume obtained thirteen drachms of the oil from eighty-two pounds of the flowers; according to Brande, the average product of 100 pounds is two pounds twelve ounces. It has the peculiar odor of chamomile, with a pungent somewhat aromatic taste.

It is " blue when freshly distilled, but gradually becoming greenish or brownish-yellow under the influence of air and light. Odor that of Chamomile Flowers; taste aromatic, characteristic. Specific gravity 0.905 to 0.915. Optical rotation -1° to $+3^{\circ}$; refractive index at 25° C. (77° F.) about 1.445. Soluble in less than 1 part of alcohol (90 per cent.)." *Br.*

The oil was thoroughly investigated in Fittig's laboratory during the years 1878-1879. It was found to consist of a mixture of angelic, butyric, methacrylic, and tiglinic esters of isobutyl, iso-amyl, hexyl, and probably a higher alcohol. *Angelic acid* and *tiglinic acid* are isomeric, and have the formula $C_5H_8O_2$. The relative proportions of these two acids varied in different oils. An ester of a lower homologue of angelic acid having the formula $C_4H_6O_2$ was also obtained. Naudin obtained a small amount of a solid paraffin, $C_{18}H_{36}$, melting at 63° C. to 64° C. (145.4° - 147.2° F.), to which the name of "*anthenen*" was given. (Gildemeister and Hoffmann, *Aetherische Oele*, p. 881.) An isomer of camphor has also been reported. It has sometimes been employed in spasm of the stomach,

and as an adjunct to purgative medicines. Its chief use, however, appears to be as an ingredient of the extract of chamomile of the British Pharmacopoeia, to which it is added in order to supply the place of the oil driven off by the heat used in its preparation. This oil must not be confounded with that of *Matricaria Chamomilla*, employed on the continent of Europe under the name of oil of chamomile. (See *Matricaria*.)

Dose, one to three minims (0.06-0.2 mil).

OLEUM ARACHIS. Br.

ARACHIS OIL

Arachis Oil is the oil expressed from the seeds of *Arachis hypogaea*. Linn.

Earthnut Oil, Groundnut Oil, Peanut Oil.

The oil consists of the glycerides of four different fatty acids. The chief of these is oleic acid, $C_{18}H_{34}O_2$, with which are associated *linoleic acid*, $C_{18}H_{32}O_2$, *hypogaecic acid*, $C_{16}H_{30}O_2$, *arachidic acid*, $C_{20}H_{40}O_2$, and *lignoceric acid*, $C_{24}H_{48}O_2$. It should be obtained by expression without heat. It is usually of a pale yellowish or green color with a faint odor, and a more distinct taste of the nuts, although on rectification a nearly colorless and tasteless oil may be obtained. Upon exposure to the air the oil slowly thickens and becomes rancid. It is soluble in all proportions in ether, chloroform, and petroleum benzin, but insoluble in alcohol.

At 3.3° C. (38° F.) it thickens, solidifies at about -5° C. (23°F.), and at 326.6° C. (620° F.) is decomposed, giving out spontaneously inflammable vapors. Winter made experiments to ascertain how far it might be employed with advantage in pharmacy, and found that it answered well in the preparation of cerates and ointments, but would not serve as a substitute for olive oil in the preparation of lead plaster. (See *Proc. A. Ph. A.*, 1897,179.) Its use is permitted, by the British Pharmacopoeia, in India, and in the Eastern, African, and Australasian Divisions of the Empire, for making the official Liniments, Ointments, Plasters, and Soaps for which Olive Oil is directed to be used. It is a non-drying oil, and therefore will not answer for painting; but it is enormously used for adulteration (particularly of French olive oils) and for various purposes

in the arts, as for lubricating machinery, and in the manufacture of woollen cloths; in lamps it burns with a bright light. It saponifies slowly, but yields an excellent firm, white, and odorless soap.

OLEUM AURANTII. U. S.

OIL OF ORANGE

Ol. Aurant. [Oleum Aurantii Corticis, U. S. VIII Orange Oil, Oil of Sweet Orange]

"A volatile oil obtained by expression from the fresh peel of sweet orange, *Citrus Aurantium sinensis* Gallesio (Fam. *Rutaceae*), and its varieties. Preserve it in small, well-stoppered, amber-colored bottles, in a cool place, protected from light. Oil of Orange having a terebinthinate odor is not to be dispensed." *U. S.*

Oleum Aurantiorum; Essential Oil of Orange Peel, Essence of Orange; Huile volatile d'Orange, *Fr. Cod.*; Apfelsinencharenol, Pomeranzenschalenol, *G.*; Essenza di arancio amara, Ensenza delta corteccia. *It.*

This oil is used only for flavoring purposes, and has been introduced principally because of its employment in elixirs and in *Spiritus Aurantii Compositus*.

Oil of orange is prepared in Calabria and Sicily in three ways: 1, by scraping off the exterior part of the rind and submitting it to expression; 2, by putting the scrapings into hot water, depressing the pulp beneath, and skimming off the oil as it rises; 3, by distillation. The best Sicily orange oil is procured by dexterous compression, within a cask, of the fresh rind by the hand, the oil being driven out in jets. It is sometimes absorbed by a sponge. (*A. J. P.*, 1868.) It is largely made at Messina, and in the south' of France. It is also extracted by the ecuelle process, and partly from the Bigarade and partly from the sweet or Portugal orange, the scarcely ripe fruit being in either case employed. The oil made from the former is much more valuable than that obtained from the latter, and the two are distinguished in price-currents as *Essence de Bigarade* and *Essence de Portugal*.

Under the name of *Oleum Aurantii Amari* (Oil of Bitter Orange), the National Formulary IV has introduced the oil of bitter orange, which it defines as " a volatile oil obtained by expression from the fresh peel of the bitter orange, *Citrus Aurantium amara* Linne (Fam. *Rutaceae*).

Preserve it in small, well-stoppered, amber-colored bottles, in a cool place, protected from light. "Oil of Bitter Orange having a terebinthinate odor is not to be dispensed." *N. F. IV.*

The description is as follows: "Oil of Bitter Orange is a pale yellow liquid, having the characteristic, aromatic odor of the Seville orange, and an aromatic somewhat bitter taste. Soluble in 4 volumes of alcohol, the solution being neutral to litmus paper." *N. F. IV.*

This oil is supposed to have a more delicate odor than the oil from the sweet orange.

Properties.—Oil of orange peel consists, as has been shown by Wallach, of *d-limonene* to the extent of at least 90 per cent.; of the remainder, about 5 per cent. are the odorous constituents, among which are citral, traces of citronellal, and the methyl ester of *anthranilic acid*. The inner thick part of the rind contains also a bitter principle, called *hesperidin*, discovered by Lebreton in 1828, but more fully studied by Hoffmann (*Ber. d. Chem. Ges.*, 1876, pp. 26, 685). It is best prepared from the unripe bitter orange. Its formula is $C_{22}H_{25}O_{12}$, and it is a glucoside, as is shown by the reaction with diluted sulphuric acid, whereby it is decomposed into *hesperetin*, $C_{16}H_{14}O_6$, and glucose, $C_6H_{12}O_6$.

A waxy non-volatile substance is present in oil of orange, which interferes with the transparency of solution made with 90 per cent. alcohol. This oil is one of the most difficult to preserve. A method for its preservation, which we have used for years, is to shake the oil briskly with one-eighth of its volume of distilled water, and allow it to separate, then remove the essential oil, filter rapidly if necessary, and mix the filtered oil with 95 per cent. alcohol in the proportion of one volume of the oil to seven volumes of alcohol.

It may be preserved indefinitely by adding 10 per cent. of its volume of olive oil.

The oil of orange is used chiefly as a flavoring agent but Zickgraf (*M. M. W.*, 1910, lvii, p. 1070) speaks very highly of its effect in chronic bronchitis for the same class of cases in which oil of turpentine is used. It has the advantages over the latter of being much more pleasant to

take and non-irritant to the kidneys.

Dose, three to five minims (0.2-0.3 mil).

Off. Prep.—Elixir Aromaticum (from Spirit), U. S.; Spiritus Aurantii Compositus, U. S.; Elixir Cardamomi Compositum (from Compound Spirit), U. S.; Elixir Vanillini Compositum (from Compound Spirit), N. F.; Spiritus Cardamomi Compositus, N. F.; Spiritus Myrciae Compositus, N. F.; Spiritus Vanillini Compositus, N. F.

OLEUM CADINUM. U. S., Br.

OIL OF CADE Ol. Cadin. [Cade Oil Oil of Juniper Tar, Oleum Juniperi Empyreumaticum]

"An empyreumatic oil obtained by the dry distillation of the wood of *Juniperus Oxycedrus* Linne (Fam. *Pinaceae*); U. S. "Oil of Cade is an empyreumatic oily liquid obtained by the destructive distillation of the woody portions of *Juniperus Oxycedrus*. Linn." Br.

Juniper Tar Oil; Huile de Cade, Fr.; Kadeol, Kadil, G.

The *Juniperus Oxycedrus*, Linne, *prickly cedar*, or *large brown-fruited juniper*, is a common tree in the "waste places and stony hill-sides of the Mediterranean districts of Northern Africa, Spain, Portugal, and France, reaching up in its distribution as high as 3000 feet in the Apennines. It commonly attains a height of from ten to twelve feet, sometimes much more, with long spreading branches and slender drooping branchlets, covered with light-green scattered and spreading leaves of medium size, lanceolate or awl-shaped, sharply pointed, having two furrows on their upper edge. The fruits are numerous, large (half an inch in diameter), globular, shining, reddish or chestnut-brown, and marked on the apex with two white scars indicating the separation of the carpels.

From the heart-wood of this tree the oil of cade is prepared by a process of distillation in ovens *per descensum*, similar to that practised in the making of ordinary tar. It is a brownish or dark brown liquid, much more mobile and less thick than tar, having a tar-like but distinct odor, and a smoky, acrid, bitterish, disagreeable taste. In mass it is dark and

opaque, but in very thin layers clear; the oil contains phenols and a sesquiterpene termed *cadinene*, $C_{14}H_{24}$, the latter boiling at from 274° to 275° C. (525.2°-527° F.), and having a sp. gr. of 0.918 at 20° C. (68° F.).

" Oil of Cade is a dark brown, clear, thick liquid, having a tarry, empyreumatic odor and a warm, faintly aromatic, and bitter taste. It is almost insoluble in water, but imparts to it an acid reaction. It is only partially soluble in alcohol or petroleum benzin, completely soluble in 3 volumes of ether, soluble in amyli alcohol, chloroform, glacial acetic acid, or oil of turpentine. Specific gravity: 0.980 to 1.055 at 25° C. (77° F.). Shake 1 part of Oil of Cade with 20 parts of warm distilled water and filter; separate portions of this filtrate give a red coloration with a few drops of ferric chloride solution (1 in 1000) and reduce silver ammonium nitrate T.S. in the cold and alkaline cupric tartrate T.S. on heating. Agitate 1 mil of Oil of Cade with 15 mils of purified petroleum benzin, filter the benzin solution, add an equal volume of copper acetate solution (1 in 100), shake the mixture and then allow it to separate. On adding an equal volume of ether to the separated benzin solution, it produces no intensely green coloration and does not become colored more than light yellow to brown (*rosin and rosin oil*). " *U. S.*

"A dark reddish-brown or nearly black, oily liquid. Empyreumatic odor; taste aromatic, bitter and acrid. Specific gravity about 0.990. Soluble in ether, and in chloroform; partially soluble in cold, almost wholly soluble in hot alcohol (90 per cent.); very slightly soluble in water, the filtered aqueous solution being almost colorless and acid to litmus. Yields no reaction for pine tar when tested as follows: Shake 1 millilitre of the Oil vigorously with 15 milli-litres of petroleum spirit, and filter; to 10 milli-litres of the filtrate add 10 millilitres of solution of copper acetate, shake vigorously, and set aside until separation into two layers is complete; 5 millilitres of the upper layer, when mixed with 10 millilitres of ether, become pale brownish-yellow, but not green (absence of pine tar)." *Br.*

Yaucher recommends acetone for disguising the odor of oil of cade, and proposes an *oil of cade collodion* in which acetone is used to dissolve the pyroxylin instead of the usual solvents. (*C. D.*, 1897, 16.)

Uses.—Oil of cade has been used locally, by the peasantry, in the treatment of the cutaneous diseases of domestic animals almost from time immemorial. More recently it has been largely employed in the

treatment of *chronic eczema, psoriasis*, and other skin diseases of man, and has also been found to be an efficient parasiticide in *psora* and *favus*. It is applied, sometimes of full strength, sometimes diluted with a bland oil, well rubbed into the affected parts with the fingers, or with a cloth, and is also made into ointments, and especially into soaps. A glycerite is also prepared. It is very rarely, if ever, used internally, but probably resembles oil of tar in its physiological action.

Dose, one to three minims (0.06-0.2 mil).

Off. Prep.—Linimentum Saponis Mollis Compositum, *N. F.*; Petroxolinum Cadini, *N. F.*; Petroxolinum Sulphuratum Compositum, *N. F.*; Unguentum Sulphuris Compositum, *N. F.*

OLEUM CAJUPUTI. U. S., Br.

OIL OF CAJUPUT

Ol. Cajup. [Cajuput Oil Oil of Cajeput]

"A volatile oil distilled from the fresh leaves and twigs of several varieties of *Melaleuca Leucadendron* Linne, especially the var. *Cajeputi* Roxburgh and the var. *minor* Smith (Fam. *Myrtaceae*). Preserve it in well-stoppered, amber-colored bottles, in a cool place." U. S. "Oil of Cajuput is the oil distilled from the leaves of *Melaleuca Leucadendron*, Linn., and other species of *Melaleuca*." Br.

Oleum Cajeputi; Essence de Cajeput, Huile volatile de Cajeput, *Fr.*; Cajeputol, *G.*; Essenza di Cajeput, *It.*; Esencia de Cayeput, *Sp.*; Kayuputieh, *Mal.*

It was long supposed that the *oil of cajuput* was derived only from *Melaleuca Leucadendron*, but it is now well established that it is derived chiefly from one or more varieties of this species. They are trees indigenous to upper India, the Islands of the Indian Ocean, Northern Australia, Queensland and New South Wales. (See The Volatile Oils, Gildemeister and Hoffmann.) It is possible, however, that the oil may also be obtained from different species of *Melaleuca*, as Stickel of Jena, succeeded in procuring from the leaves of *M. hypericifolia*, cultivated in the botanical garden of that place, a specimen of oil not distinguishable from the cajuput oil of commerce, except by a pale-green color. (*Ann. Pharm.*, xix, 224.) *M. viridifolia* and *M. latifolia*, large trees growing

abundantly in the Island of New Caledonia, yield a volatile oil very analogous to the oil of cajuput.

Melaleuca Leucadendron Linne (*M. Cajuputi* Bumphius) grows with an erect but crooked stem, and scattered branches, the slender twigs of which droop like those of the weeping willow. The bark is of a whitish ash color, very thick, soft, spongy, and lamellated, throwing off its exterior layer from time to time in flakes. The leaves have short footstalks, are alternate, lanceolate, when young sericeous, when full-grown smooth, deep green, three- and five-nerved, slightly falcate, entire, from three to five inches long, from one-half to three-quarters of an inch broad, and when bruised exhale a strong aromatic odor. The flowers are small, white, inodorous, sessile, and disposed in terminal and axillary downy spikes, with solitary, lanceolate, three-flowered bracts. The filaments are three or four times longer than the petals, and both are inserted in the rim of the calyx. The oil is obtained from the leaves by distillation. It is prepared chiefly in Amboyna and Bouro, and is exported from the East Indies in glass bottles. The small proportion yielded by the leaves and the extensive use made of it in India render it somewhat costly.

Properties.—Cajuput oil is very fluid, transparent, of a fine green color, a lively and penetrating odor analogous to that of camphor and cardamom, and a warm, pungent taste. Upon rectification the green color disappears. It is very volatile and inflammable, burning without any residue. The sp. gr. varies from 0.914 to 0.9274. Its chief constituent has the formula $C_{10}H_{18}O$, and by repeated distillation over phosphoric oxide the hydrocarbon, $C_{10}H_{16}$, called *cajuputene*, can be obtained. The oil is, therefore, said to contain *cajuputene hydrate*, or *cajuputol*. The identity of cajuputol with *cineol* and *eucalyptol* from *Eucalyptus Globulus* in both chemical and physical properties was established by Wallach. in 1884 and by C. Jahns (*A. J. P.*, 1885, 237.) It boils at 175° C. (347° F.). A second constituent of the formula $C_{10}H_{18}O$ is the solid *terpineol*, which is present both in the free state and as acetic ester. A small amount of 1-pinene and traces of aldehydes have been found, including valeraldehyde and benzal-dehyde. (*Schimmel & Co's Report*, April, 1897.) Oil of cajuput is "a colorless or yellowish liquid having a peculiar, agreeable, distinctly camphoraceous odor, and an aromatic, slightly bitter taste. It is soluble in 1 volume of 80 per cent. alcohol. Specific gravity: 0.912 to 0.925 at 25° C. (77° F.). Its optical rotation does

not exceed -4° in a 100 mm. tube at 25° C. (77° F.)." U. S.

"Green or bluish-green. Agreeable, cam-phoraceous odor; taste aromatic, bitter and cam-phoraceous. Specific gravity 0.919 to 0.930; optical rotation not more than -4° ; refractive index at 25° C. (77° F.) 1.460 to 1.467. When 10 millilitres of the Oil are mixed with 4 to 5 millilitres of syrupy phosphoric acid in a vessel surrounded by a freezing mixture, and then pressed strongly in a piece of fine calico between folds of blotting-paper, the pressed cake, decomposed by warm water in a graduated vessel, yields an oily layer, which, on cooling to 15.5° C. (60° F.), measures not less than 4.5 millilitres (presence of not less than 45 per cent. of cineol)." Br,

The U. S. requires the oil to be colorless or yellow, but according to the Br. it has a greenish tint. When it is distilled, a light, colorless liquid first comes over, and afterwards a green and denser one. The green color has been ascribed to a salt of copper derived from the vessels in which the distillation is performed, and Guibourt obtained two grains and a half of copper oxide from a pound of the commercial oil. But neither Brande nor Goertner could detect copper in specimens examined by them, and Lesson, who witnessed the process for preparing the oil at Bouro, attributes its color to chlorophyll or some analogous principle, and states that it is rendered colorless by rectification. Guibourt, moreover, obtained a green oil by distilling the leaves of a *Melaleuca* cultivated at Paris. A fair inference is that the oil of cajuput is naturally green, but that as found in commerce it sometimes contains copper, either accidentally present or added with a view of imitating or maintaining' the fine color of the oil. The proportion of copper, however, is not so great as to forbid the internal use of the oil, and the metal may be separated by distillation with water, or by agitation with a solution of potassium ferrocyanide. This statement as to the frequent occurrence of copper in the cajuput oil of commerce, though at the same time its presence is not desirable, has been confirmed by experiments by Edward Histed, who found copper in all of six specimens of the commercial oil, obtained from different sources. When redistilled, the oil became perfectly colorless, but after a few days' exposure to copper filings reassumed its green color. (*P. J.*, 1872, p. 804.)

Oil of cajuput is said to be often adulterated with oils derived from other than the official species of *Melaleuca*, Oil of rosemary, and oil of turpentine, impregnated with camphor and colored with the resin of

milfoil, are also said to be employed as adulterants. The best test, according to Zeiler, is iodine, which, after a moderately energetic reaction, with little increase of temperature and but a slight development of orange vapors, occasions immediate inspissation into a loose coagulum, which soon becomes dry, greenish-brown, brittle mass.

Uses.—This oil is highly stimulant, producing when swallowed, a sense of heat, with an increased fulness and frequency of pulse, and exciting in some instances profuse perspiration. It is much esteemed by the Malays and other people of the East, who consider it a panacea. Formerly the oil of cajuput was used internally in *chronic rheumatism*, *low fevers*, and various other complaints, but is rarely employed at present for its alterative effects. It is useful internally as a stimulating expectorant in *chronic laryngitis* and *bronchitis*, as a urinary antiseptic in cystitis, and as an anthelmintic especially against the *round worm*. Its most frequent uses, however, are externally in the treatment of various skin diseases. For this latter group of affections it is used for its anti-parasitic effect in such diseases as *scabies*, *tinea versicolor*, etc., and for its stimulating action in *acne rosacea*, *psoriasis*, and other chronic conditions. It is also used externally as a counter-irritant in chronic rheumatism and other painful conditions. Like many other essential oils it *relieves toothache* if introduced into the hollow carious tooth.

Dose, from three to ten minims (0.2-0.6 mil).

Off. Prep.—Linimentum Crotonis, *Br.*; Spiritus Cajuputi, *Br.*; Linimentum Tiglii, *N. F.*

OLEUM CARI. U. S. (Br.)

OIL OF CARAWAY Ol. Cari [Caraway Oil]

“A volatile oil distilled from the fruit of *Carum Carvi* Linne (Fam. *Umbelliferae*), and yielding not less than 50 per cent., by volume, of carvone [$C_{10}H_{14}O = 150.11$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light.” *U. S.* “Oil of Caraway is the oil distilled from Caraway Fruit, and rectified.” *Br.*

Oleum Carul, *Br.*; Huile volatile de Carvi, *Fr. Cod.*; Essence de Carvi, *Fr.*; Oleum

Carvi, *P. G.*; Kummelol, Carvon, *G.*

This oil is prepared to a considerable extent by our distillers. The fresh fruit is cultivated in Holland yields nearly 6 per cent. of oil, while the German fruit yields about 4 per cent. The oil of caraway is somewhat viscid, of a pale yellow color, becoming brownish by age, with the odor of the fruit, and an aromatic acrid taste. Its sp. gr. is differently given at 0.946 (Baume), 0.931 (Brande), 0.916 (Buignet), and 0.900 to 0.910 at 25° C. (77° F.). (U. S. P.) It is dextrogyrate in its relation to polarized light. (Buignet, *J. P. C.*, Oct., 1861, p. 261.) It consists of two liquid oils, of different boiling points, and separable by distillation:—one a hydrocarbon called *carvene*, C₁₀H₁₆, of the specific gravity 0.849 and boiling point 176° C. (349° F.), now recognized as identical with d-limonene, the other, the valuable constituent, *d-carvone*, C₁₀H₁₄O, of the sp. gr. 0.9638 and boiling point 224° C. (435° F.). This latter constituent is often extracted from the oil and prepared in a pure state by taking advantage of the formation of a crystalline compound of carvone and hydrogen sulphide, which can then be decomposed by treatment with alcoholic potassium hydroxide.

Sulphides are found in the aqueous distillate which comes over with the oil, as are also several constituents which are ordinarily considered only to accompany destructive distillation products as methyl alcohol, acetaldehyde, etc.

Oil of caraway is used to impart flavor to medicines, and to correct their nauseating and griping effects.

Gmeiner (*B. Thier. W.*, 1909, p. 695) recommends the use of oil of caraway in the treatment of *scabies*. He employs a solution in castor oil containing five parts of alcohol and oil of caraway in seventy-five parts of castor oil.

Dose, from one to five minims (0.06-0.3 mil).

Off. Prep.—*Pilula Aloes, Br.*; *Spiritus Juniperi Compositus, U. S.*; *Elixir Cardamomi Compositum* (from Compound Spirit), *N. F.*; *Mistura Carminativa, N. F.*; *Spiritus Cardamomi Compositus, N. F.*

OLEUM CARYOPHYLLI. U. S., Br.

OIL OF CLOVE

Ol. Caryoph. [Clove Oil Oil of Cloves]

"A volatile oil distilled from the flower-buds of *Eugenia Aromatica* (Linne) O. Kuntze [*Jambosa Caryophyllus*. (Sprengel) Niedenzu] (Fam. *Myrtaceae*), and yielding not less than 82 per cent., by volume, of eugenol [$C_{10}H_{12}O_2 = 164.10$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* "Oil of Cloves is the oil distilled from Cloves." *Br.*

Huile volatile de Girofle, *Fr. Cod.*; Oleum Caryophyllorum, *P. G.*; Nelkenol, Eugenol, *G.*; Essenza di garofani, *It.*; Esencia de clavo, *Sp.*

This oil is obtained by distilling cloves with water, to which it is customary to add common salt, in order to raise the temperature of ebullition[^] and the water should be repeatedly distilled from the same cloves, in order completely to exhaust them, Scharling has found advantage from the application of superheated steam to the distillation of this oil. (*P. J.*, xi, 469.) It is essential also to use the same water over and over again, in order to avoid loss by the solution of the oil in the water. The product of good cloves is said to be about one-fifth or one-sixth of their weight. The oil was formerly brought from Holland or the East Indies, but since the introduction of the Cayenne cloves into our markets the reduced price and superior freshness of the drug have rendered the distillation of oil of clove profitable in this country, and the best now sold is of domestic extraction. The exportation of clove from Zanzibar in 1909 was over 20,000,000 pounds. We have been informed that from seven to nine pounds of clove yield to our distillers about one pound of the oil.

Properties.—Oil of cloves, when recently distilled, is very fluid, clear, and colorless (but becomes yellowish by exposure, and ultimately reddish-brown). It has the odor of cloves, a hot, acrid, aromatic taste, and a slightly acid reaction. Its sp. gr. is variously stated at from 1.034 to 1.061, the latter being given by Bonastre as the sp. gr. of the rectified oil.

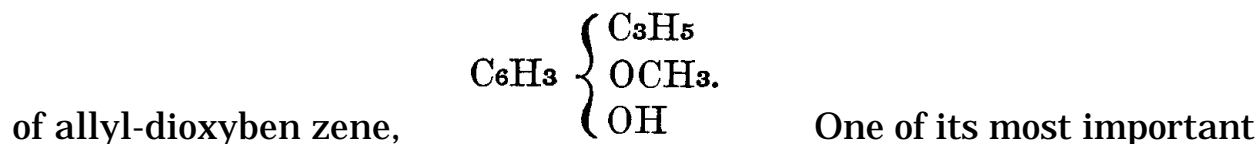
"Oil of Clove is a colorless or pale yellow liquid, becoming darker and thicker by age and exposure to the air, having the characteristic odor

and taste of clove. It is soluble in 2 volumes of 70 per cent. alcohol. Specific gravity: 1.038 to 1.060 at 25° C. (77° F.). Its optical rotation does not exceed -1° 10' in a 100 mm. tube at 25° C. (77° F.)

Oil of clove is one of the least volatile of the essential oils and requires for congelation a temperature from -17.8° to -20° C. (0° to -4° F.). It is completely soluble in alcohol, ether, and strong acetic acid. Nitric acid changes its color to a deep red, and converts it by the aid of heat into oxalic acid. The same change to red is produced by nitric acid on morphine, but in this case the red is followed by yellow, which does not happen with the oil of clove. Besides, if to a solution of morphine with nitric acid a solution of chlorinated lime be added, and the mixture be exposed for some hours to the light, the solution of morphine will retain a straw color, while if oil of clove be treated in the same manner the color disappears. (Has-elden, *B. F. M. H.*, July, 1867, 265.) It is frequent adulterated with fixed oils, and sometimes with oil of pimenta and with copaiba. When pure, it sinks in distilled water. According to E. Scherer, these adulterations may sometimes be detected by attention to the specific gravity and the boiling point, pure oil of clove varying in specific gravity from 1.03 to 1.06, and boiling at from 240° C. (464° F.) to 255° C. (491° F.). According to Zeiler, its character of congealing entirely into a crystalline mass with the alcoholic solution of potassium hydroxide, losing at the same time its peculiar odor, affords a sufficient criterion of its purity. This, however, while included among the official tests, is not sufficient, the percentage of eugenol as determined by the official assay being now a requirement.

Oil of clove contains small amounts of vanillin, methyl alcohol and furfurol, but is mainly composed of an unsaturated phenol termed eugenol which is now an official product (see *Eugenol*) and its acetic derivative and a sesquiterpene *caryophyllene*. Eugenol acetyl salicylate has also been reported. The U. S. Pharm. IX introduced an assay process for the eugenol content.

Eugenol, C₁₀H₁₂O₂ (see p. 432), has been shown to be the methyl ether



reactions is its conversion into vanillin. For this purpose it is boiled with

acetic anhydride, whereby *aceteugenol* is formed, which, oxidized in weak acid solution by potassium permanganate, yields *acetvanillic acid*, and this with weak potassium hydroxide solution is changed into vanillin, which is then extracted by acidifying and shaking up with ether. (See also *Ph. Era*, 1887, 444.) For the estimation of eugenol in the form of its crystalline benzoyl compound, see *A. J. P.*, 1892, 26 and 508; also *Schim. Rep.*, April, 1892, 28. The characteristic aromatic odor of oil of clove is due to *methyl-amylketone*, $\text{CH}_3\text{CO.C}_3\text{H}_{11}$, which has been isolated by the chemists of Schimmel & Co., and found to be present only in minute, quantity. (*Ph. Bev.*, 1897, 115.)

Uses.—By virtue of its local irritant effect oil of clove stimulates peristalsis and is frequently a useful remedy in the treatment of *flatulent colic*. It is also an active local anesthetic and is a favorite remedy for *toothache*; for this purpose a small pledget of cotton is saturated with oil and inserted into the carious cavity. It is a powerful germicide, far exceeding phenol in activity, but is not frequently used for this purpose. Eugenol has been used internally in doses of forty-five grains (3 Gm.) *per diem* as an antiseptic antipyretic. Little, however, is known of its physiological action. According to Leubuscher (*W. M. Bl.*, 1889) it is a feeble local anesthetic. Landis (*T. G.*, 1909, xxxiii, 386) has used oil of clove as a stimulant expectorant in *tuberculosis* and *bronchiectasis* with good results.

Dose, from two to six minims (0.12-0.4 mil).

Off. Prep.—Elixir Cardamomi Compositum (from Compound Spirit), *N. F.*; Elixir Glycyrrhizae Aromaticum, *N. F.*; Nebula Aromatica, *N. F.*; Spiritus Cardamomi Compositus, *N. F.*

OLEUM CASSIÆ. U. S. (Br.)

OIL OF CINNAMON

Ol. Cass. [Oleum Cinnamomi U. S. VIII Cassia Oil]

"A volatile oil distilled from *Cinnamomum Cassia* (Nees) Blume (Fam. *Lauraceae*), rectified by steam distillation and yielding not less than 80 per cent., by volume, of cinnamic aldehyde [$\text{C}_9\text{H}_8\text{O} = 132.06$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* "Oil of Cinnamon is the oil distilled from Cinnamon Bark." *Br.*

Oleum Cinnamomi, *Br.*; Oleum Cinnamomi Cassiae; Oil of Chinese Cinnamon, Essence de Cannelle de Chine, Huile volatile de Cannelle, *Fr.*; Oleum Cinnamomi, *P. G.*; Zimmtol, Zimmtkassienol, *G.*; Essenza di Cannella, *It.*

There are two oils of cinnamon in commerce, one procured from the Ceylon cinnamon, the other from the Chinese cinnamon, and often distinguished by the name of *oil of cassia*. There is no essential difference in the two oils, and that of the Chinese cinnamon, as much the cheaper and more abundant of the two, will probably continue to be generally employed, notwithstanding that the Ceylon product has the finer flavor. The U. S. P. IX and the German Pharmacopoeia recognize as oil of cinnamon only that obtained from cassia. The British Pharmacopoeia and French Codex make Oil of Ceylon Cinnamon official.

Preparation.—Oil of cinnamon of Ceylon is distilled from inferior kinds of cinnamon, of insufficient value to pay the export duty. The following account of the method of extraction is given by Marshall. The bark, having been coarsely powdered, is macerated for two days in sea water, and then submitted to distillation. A light and a heavy oil come over with the water, the former of which separates in a few hours and floats upon the surface, the latter falls to the bottom of the receiver, and continues to be deposited for ten or twelve days. In future distillations, the saturated cinnamon water is employed with sea water to macerate the cinnamon. Eighty pounds of the freshly prepared bark yield about 2.5 ounces of the lighter oil, and 5.5 of the heavier. From the same quantity kept for several years in store, about half an ounce less of each oil is obtained. The two kinds are 'probably united in the oil of commerce. The oil is also distilled in Ceylon from the leaves, but the product is said to be too small to yield a fair profit. (*C. D.*, 1888.) The exportation of cinnamon chips from Ceylon has assumed large proportions, amounting in 1904 to 2,135,220 pounds. (*Schim. Rep.*, May,

Properties.—Oil of Ceylon cinnamon is of a light-yellow color, becoming deeper by age, and ultimately red. Pereira stated that the London druggists redistilled the red oil, and thus obtained two pale-yellow oils, one lighter and the other heavier than water, with a loss of about 10 per cent. in the process. The oil has the flavor of cinnamon, and when undiluted is excessively hot and pungent. It is said sometimes to have a peppery taste, ascribable to an admixture of the leaves with

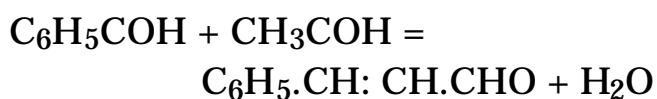
the bark in the preparation of the oil. *Oil of Ceylon cinnamon* has "a slightly acid reaction. Sp. gr. about 1.040. It is readily soluble in alcohol. When cooled to -10° C. (14° F.), it remains clear, but at a lower temperature a solid portion separates from it." U. S. 1880. To ascertain whether, in the distillation of oil of cinnamon from the bark, some of the oil is oxidized to cinnamic aldehyde in part and thus the yield lowered, H. A. Phillips (*Tr. Br. Ph. Conf.*, 1914, 371) made a thorough investigation of the subject and concludes that under the ordinary conditions of steam distillation, cinnamic aldehyde is not appreciably oxidized. The British Pharmacopoeia 1914 recognizes oil of Ceylon cinnamon only, and gives the following description and tests: "Yellow when freshly distilled, gradually becoming reddish. Odor and taste those of Cinnamon Bark. Specific gravity 1.000 to 1.030; optical rotation -0.5° to -1° ; refractive index at 25° C. (77° F.) 1.565 to 1.580. Soluble in from 3 to 4 parts of alcohol (70 per cent.). 1 drop dissolved in 5 millilitres of alcohol (90 per cent.) assumes a pale green, but not a blue or brown coloration, on the addition of 1 drop of I. Sol. of ferric chloride (absence of cinnamon leaf oil and cassia oil). Contains from 55 to 65 per cent. of cinnamic aldehyde as determined by the following test: To 10 millilitres of the Oil add 70 millilitres of an aqueous solution (1 in 5) of sodium sulphite and sufficient solution of phenolphthalein to give a well marked pink coloration. Heat the mixture on a water-bath, shake well, and neutralise with acetic acid diluted with twice its volume of water; repeat the heating and neutralisation until no further pink coloration is developed, the time occupied being from thirty to forty-five minutes. The oily layer which separates on standing, cooled to 35.5° C. (60° F.), measures not more than 4.5 or less than 3.5 millilitres (presence of 55 to 65 per cent. of cinnamic aldehyde)." *Br.*

Chinese oil of cinnamon is imported from Canton and Singapore. It is pale yellow, becoming red with age. Its flavor is similar to that of the Ceylon oil, though inferior, and it commands a much lower price. It is officially described as follows: "Oil of Cinnamon (Cassia) is a yellowish or brownish liquid, becoming darker and thicker by age and exposure to the air and having the characteristic odor and taste of cinnamon. Specific gravity: 1.045 to 1.063 at 25° C. (77° F.). The optical rotation varies from $+1^{\circ}$ to -1° in a 100 mm. tube at 25° C. (77° F.) It does not respond to the Test for heavy metals in volatile oils. Shake 2 mls of the Oil in a test tube with from 5 to 10 mls of purified petroleum benzin, and decant the latter; this liquid is colorless and does not assume a green color upon shaking it with an equal volume of (1 in 1000) copper

acetate solution (*rosin*).

The *cinnamon leaf oil*, as formerly imported into Great Britain, was of two kinds, one containing a considerable quantity of a fatty fixed oil, perhaps cinnamon-suet from the fruit, the other a pure volatile oil. The oil was said to be obtained by distilling the leaves after maceration in sea water. It resembled the oil of clove and pimento in sensible properties, having a brownish color, a penetrating, fragrant odor, and a very pungent taste. According to Stenhouse, it was of the sp. gr. 1.053, had an acid reaction, and consisted of eugenol, a neutral substance with the formula $C_{15}H_{12}O_2$, and a minute proportion of benzoic acid. (*P. J.*, xiv, 319.) Schimmel & Co. found it to have a sp. gr. 1.056 to 1.060, and contained 87 per cent. of eugenol, and about 0.1 per cent. of cinnamic aldehyde.

When exposed to the air, the oil absorbs oxygen, and is slowly converted into cinnamic acid, two distinct resins, and water. Of the two resins, one is soluble both in hot and in cold alcohol; the other readily in the former, but sparingly in the latter. *Cinnamic acid*, $C_9H_8O_2$, is colorless, crystalline, sourish, volatilizable, slightly soluble in water, readily dissolved by alcohol, and convertible by nitric acid with heat into benzoic acid. It is sometimes seen in crystals in oil of cinnamon which has been long kept. Like benzoic acid, it is said when swallowed to cause the elimination of hippuric acid by the urine. (*J. P. C.*, 3e ser., iii, 64.) It may be obtained by distilling the balsam of Tolu. Oil of cinnamon is almost wholly converted by nitric acid, slowly added, into a crystalline mass, producing a compound of the oil and the acid. These several facts are explained when it is found that oil of cinnamon contains from 75 to 90 per cent. of *cinnamic aldehyde*, C_9H_8O , which by moderate oxidation yields the corresponding cinnamic acid, $C_9H_8O_2$, but by more energetic oxidation yields benzoic acid, $C_7H_6O_2$. The oil has been produced artificially by Strecker from styrene, a derivative from styrax (see *Styrax*), and more recently from benzaldehyde and acetaldehyde, a mixture of which is saturated with hydrochloric acid gas, when a condensation takes place, as follows:



Ordinary sodium hydroxide will also bring about the reaction between the two aldehydes, and is to be preferred to hydrochloric acid for this purpose.

Oil of cinnamon is said to be frequently adulterated with oil of cloves, which, according to Ulex, cannot be detected by the odor or taste. Thus sophisticated, it is stated, on the same authority, to evolve a very acrid vapor when a drop is heated on a watch glass, to swell up and evolve red vapors if treated with fuming nitric acid, to remain liquid with concentrated potassium hydroxide, and to assume an indigo-blue color when ferrous chloride is added to its alcoholic solution, none of which reactions occur with pure oil.

Uses.—Although a very powerful germicide the oil of cinnamon, because of its irritant properties, is rarely used in medicine as an anti-bacterial. It has the cordial and carminative properties of cinnamon, without its astringency, and is much employed as an adjuvant to other medicines, the taste of which it corrects or conceals, while it conciliates the stomach. As a powerful local stimulant, it is sometimes prescribed in *gastrodynia*, *flatulent colic*, and *gastric debility*. Mitscherlich found six drachms to kill a moderate-sized dog in five hours, and two drachms one in forty hours. Inflammation and corrosion of the gastro-intestinal mucous membrane were observed after death.

Dose. one to three minims (0.06-0.2 mil).

Off. Prep.—Aqua Cinnamomi, *U. S.*; Spiritus Cinnamomi, *U. S., Br.*; Infusum Digitalis (from Water), *U. S.*; Mistura Cretae (from Water), *U. S.*; Elixir Cardamomi Compositum (from Compound Spirit), *N. F.*; Elixir Glycyrrhizae Aromaticum, *N. F.*; Elixir Vanillini Compositum (from Compound Spirit), *N. F.*; Mistura Oleo-Balsamica, *N. F.*; Nebula Aromatica, *N. F.*; Nebula Mentholis Composita, *N. F.*; Spiritus Cardamomi Compositus, *N. F.*; Spiritus Vanillini Compositus, *N. F.*

OLEUM CHAULMOOGRÆ. Br.

CHAULMOOGRA OIL

"Chaulmoogra Oil is the fatty oil expressed from the seeds of *Taraktogenos Kurzii*, King." *Br.*

Oleum Gynocardia, Gynocardia oil, Chaulmugra oil.

Under the name of chaulmoogra oil there has long been used in Southeastern portions of Asia a semi-solid fat. This was at one time believed to be derived from the *Gynocardia odorata* and has therefore been erroneously called gynocardia oil, but the investigations of Power (A. J. P., 1915, p. 493) have shown that the oil from the gynocardia seed is very different both in chemical composition and physical properties. The true chaulmoogra oil is derived from the *Taraktogenos Kurzii* King (Fam. *Bixaceae*). It is possible that some of the commercial oil may also be derived from the species of the allied genus *Hydnocarpus*. The chaulmoogra seeds are from one to one and a quarter inches long, more or less angular or flattened, and yield upon expression, from 25 to 30 per cent., to ether, about 50 per cent. of oil. The commercial oil is obtained by expression, or sometimes by boiling the crushed seeds with water. It is " a brownish-yellow oil or soft fat. Characteristic odor; taste somewhat acrid. Melting point about 22° to 30° C. (71.6°-86° F.). Specific gravity at 45° C. (113° F.) about 0.940; saponification value 198 to 213; iodine value 96 to 104; acid value 21 to 27. Soluble in ether, in chloroform, and in carbon disulphide; partially soluble in cold alcohol (90 per cent.); almost entirely soluble in hot alcohol (90 per cent.)." Br.

The genuine chaulmoogra oil is dextrorotatory, having a specific rotation of about +52°. It consists of the glycerides of cyclic organic acids of which the most important is *chaulmoogric acid*, $C_{18}H_{32}O_2$, melting at 68° C. (154.4° F.), while a homologue, *hydnocarpic acid*, $C_{18}H_{28}O_2$, melts at 60° C. (140° F.). Palmitic acid and a phytosterol are also present.

The so-called chaulmoogra oil, from gynocardia, is optically inactive and contains none of the acids peculiar to the genuine chaulmoogra oil. It consists of glycerides of linolic, palmitic, linolenic, isolinolenic and oleic acids and a phytosterol, as well as a glucoside, *gynocardin*, $C_{13}H_{19}O_9N$, which resembles amygdalin and which is associated in the seeds with an enzyme, gynocardase.

Uses.—Chaulmoogra oil was originally employed in its native countries both internally and externally in the treatment of *scrofula*, *skin diseases*, and *rheumatism*. In England it is very widely used as a counter-irritant application in *bruises*, *sprains*, and similar local inflammations both of man and beast as well as in *open sores* and

wounds. Its most important use, however, is in the treatment of *leprosy*. There seems to be little doubt that it is the most useful remedy known for this intractable infection, indeed many authorities have claimed that it will often produce complete and permanent cures. For review of the literature see Engel (*Monatsh. f. prakt. Dermat.*, 1909, xlix, p. 290.) It should be used freely both internally and externally. Donato (*Leprosy in the Philippines and Its Treatment*, Manila, 1915) believes that its action is due to the stimulation of leucocytosis. He recommends the following solution for intramuscular injection: Camphorated oil (10 per cent. camphor), chaulmoogra oil (sterilized), of each, 60 mils; resorcinol, 4 Gm.; ether, 2.5 Gm. Of this solution 1 mil (15 minims) is injected intramuscularly every alternate day, gradually increasing the dose up to 8 or 10 mils or until reaction becomes severe.

Unna has proposed, for oral administration, the use of a soap made from the oil as affecting the stomach and intestines less unpleasantly than the oil itself. (See *P. J.*, lxiv, 615.)

Dose, five to ten minims (0.3-0.6 mil) gradually increased to one fluidrachm (3.75 mils).

Off. Prep.—Unguentum Chaulmoograe, *Br.*

OLEUM CHENOPODII. U. S.

OIL OF CHENOPODIUM

Ol. Chenopod. [Oil of American Wormseed]

"A. volatile oil distilled from *Chenopodium ambrosioides anthelminticum* Linne (Fam. Chenopodiaceae). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.*

Huile volatile d'Anserine vermifuge, *Fr. Cod.*; Essence de Chenopode anthelmintique, *Fr.*; Amerikanisches Wurmsamenol, *Chenopodiumol, G.*

For description of the plant from which this oil is derived see *Chenopodium*. The oil is largely distilled in Maryland. It is of a light-yellow color when recently distilled, but becomes deeper yellow and even brownish by age. Its reaction is neutral. It has in a high degree the peculiar odor of the plant. It is officially described in the United States

Pharmacopoeia as "a colorless or pale yellowish liquid, having a characteristic, disagreeable odor and taste. It is soluble in 8 volumes of 70 per cent. alcohol. Specific gravity: 0.955 to 0.980 at 25° C. (77° F.). Its optical rotation varies between -4° and -10° in a 100 mm. tube at 25° C. (77° F.) (see Part III, Test No. 21)." *U.S.*

When freshly prepared, it has the sp. gr. 0.908, which, according to S. S. Garrigues, is increased by time to 0.960. A portion examined by him, which was of a brownish-yellow color, had the sp. gr. 0.959 at 16.1° C. (61° F.), boiled at 190° C. (374° F.), and was freely soluble in alcohol and ether. He found it to be composed of two distinct oils, separable by distillation; one of these has the formula C₁₀H₁₆, and is probably limonene; the other is heavier, and possesses the formula C₁₀H₁₆O₂. This constitutes over 50 per cent. of the commercial oil and has been given the name *ascaridol*, which is an unstable organic dioxide, decomposing with explosive violence with inorganic acids. (*A. J. P.*, xxvi, 405.)

Uses.—The oil of chenopodium is used in medicine almost exclusively as an anthelmintic. Although it has been official in the Pharmacopoeia for many years, it owes its modern popularity to the investigations of Brunning. (*Z. E. P. T.*, 1905, i, and 1906, iii, p. 564.) This author showed that one part in five thousand paralyzed although it did not kill the round worm of dogs, and that one part in two hundred had a distinct antiseptic action. In mammals, if given in sufficient dose, it depresses the spinal cord and finally kills by arrest of respiration. According to Salant and Livingston (*A. J. Phys.*, 1915, xxxviii) the oil of chenopodium in doses of 0.02 mil per kilo, or more, produces a lowering of the blood pressure through a cardiac action and diminution in the amplitude and rate of respiration. Because of its efficiency, ease of administration, and low toxicity, it is perhaps the most valuable of all the vermifuge remedies. Although originally recommended against the *ascarides* it has been shown to be also of great service against both the *tapeworm* and the *hookworm*. In the comparative studies of Schuffner and Verwoort (*M. M. W.*, 1913, lx, p. 129) it gave better results in uncinariasis than either eucalyptus, betanaphthol, or thymol.

Levy (*J. A. M. A.*, 1914, lxiii, p. 1946) has collected from the literature twelve cases of poisoning by oil of chenopodium of which nine ended fatally. The smallest dose in this series was four drops three times a day for two days, which caused death in a baby one year old. In another

case a child of two recovered from a dose of two teaspoonfuls given in the course of one afternoon. The symptoms of poisoning by oil of chenopodium—which may not appear for several hours after taking the oil—are nausea, vomiting, headache followed by drowsiness, ringing in the ears, and sometimes deafness. In the fatal cases there develop coma and convulsions. The usual method of administration is to give from ten to fifteen drops either in sugar or as an emulsion twice a day for two days and followed on the second day by an ounce of castor oil. For children between the ages of six and twelve the dose should be one drop for each year of age.

Dose, five to fifteen minims (0.3-0.9 mil).

OLEUM COPAIBÆ. Br.

OIL OF COPAIBA

Oil of Copaiva; Oleum Balsami Copaivae; Essence de Copahu, *Fr.*; Copaivaol, *G.*

Oil of copaiba was not admitted to the U.S.P. IX. The oil constitutes from one-third to one-half or more of the copaiba. From one specimen of recent copaiba as much as 80 per cent. has been obtained. (*A. J. P.*, xxii, 289.) It is prepared largely by the application of steam heat. As it first comes over it is colorless, but the later product is of a fine greenish hue. By redistillation it may be rendered wholly colorless. It has the odor and taste of copaiba, a neutral reaction, boils at 252° to 256° C. (485.6°-492.80 P.), solidifies, partly crystalline, at -26.1° C. (-15° F.) (Gmelin), is soluble in ether and in an equal weight of absolute alcohol. The oil consists chiefly of *caryophyllene*, a sesquiterpene, C₁₅H₂₄. It was officially described as "a colorless or pale yellow liquid, having the characteristic odor of copaiba, and an aromatic, slightly bitter, and pungent taste. Specific gravity: 0.895 to 0.905 at 25° C. (77° F.), increasing with age. It is laevogyrate." *U.S. VIII.*

("Colorless or pale yellow. Odor and taste those of Copaiba. Specific gravity 0.896 to 0.910; optical rotation -7° to -35°; refractive index at 25° C. (77° F.) 1.494 to 1.500. Distils between 250° and 275° C. (482° and 527° F.). A solution of 1 millilitre of the Oil in 5 millilitres of glacial acetic acid does not develop more than a faint violet coloration on the addition of 4 drops of nitric acid (absence of gurjun oil). When distilled in a vacuum the first 10 per cent. of the distillate has an optical rotation

lower than that of the original Oil (absence of oil of African copaiba,)." *Br.*

From its want of oxygen, it answers even better than naphtha for preserving potassium, a fact first observed by Durand, of Philadelphia. It dissolves sulphur and phosphorus.

Its effects on the system are those of copaiba. From the experiments of C. Mitscherlich, it is one of the least injurious of the volatile oils to the animal system, six drachms of it having been introduced into the stomach of a rabbit without causing death. Externally it produces much less irritation than does oil of turpentine. It may be used for the same purposes as copaiba.

Dose, five to fifteen minims (0.3-0.9 mil).

OLEUM CORIANDRI. U. S.. Br.

OIL OF CORIANDER Ol. Coriand. [Coriander Oil]

"A volatile oil distilled from the ripe fruit of *Coriandrum sativum* Linne (Fam. *Umbelliferae*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* " Oil of Coriander is the oil distilled from Coriander Fruit." *Br.*

Essence de Coriandre, *Fr.*; Korianderol, *G.*

This oil may be obtained by distillation with water from the bruised fruit in the manner directed in the U. S. Pharm. 1870, for volatile oils. The average yield of oil from coriander grown in different countries is from 0.2 to 1 per cent. It is pale yellow and colorless, and has the characteristic odor and taste of coriander, and a neutral reaction. Its sp. gr. is from 0.863 to 0.878 at 25° C. (77° F.), U. S., and its boiling point 150° C. (302° F.). It is an oxygenated oil, consisting chiefly of a compound, *coriandrol*, C₁₀H₁₈O. According to Semmler (*Ber. d. Chem. Ges.*, 24, 206), coriandrol boils between 194° and 198° C. (381.2° and 388.4° F.), is optically dextrogyrate, and has a sp. gr. of 0.8679 at 20° C. (68° F.). Coriandrol is now known as dextrogyrate *linalool*. Schimmel & Co. (*Schim. Eep.*, April, 1892) have also found in coriander oil about 5 per cent. of dextropinene. The characteristic odorous principle or

principles are unknown. It is officially described as "a colorless or pale yellow liquid, having the characteristic odor and taste of coriander. It is soluble in 3 volumes of 70 per cent. alcohol. Specific gravity: 0.863 to 0.875 at 25° C. (77° F.). The optical rotation varies from + 8° to +13° in a 100 mm. tube at 25° C. (77° F.)." *U.S.*

"Colorless or pale yellow. Odor and taste those of Coriander Fruit. Specific gravity 0.870 to 0.885; optical rotation +8° to +14°; refractive index at 25° C. (77° F.) 1.463 to 1.467. Soluble in 3 parts of alcohol (70 per cent.)." *Br.*

Oil of coriander is extensively adulterated with colorless rectified oil of orange, which can be detected by its insolubility in 90 per cent. alcohol, in which pure coriander oil dissolves in every proportion; equal parts of oil of orange and 90 per cent. alcohol make a turbid mixture. (*A. J. P.*, Sept., 1878.) The oil has the medicinal properties of the fruit, and, like the aromatic oils generally, may be used to cover the taste or correct the nauseating or griping properties of other medicines. It has the great advantage of being more stable and retaining its agreeable odor longer than any other oil of its class.

Dose, one to three minims (0.06-0.2 mil).

Off. Prep.—*Spiritus Aurantii Compositus*, *U. S.*; *Elixir Aromaticum* (from Spirit), *U. S.*

OLEUM CUBEBAE. U. S., Br.

OIL OF CUBEBA *Ol. Cubeb.* [Cubeb Oil]

"A volatile oil distilled from the unripe fruit of *Piper Cubeba* Linne filius (Fam. *Piperaceae*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* "Oil of Cubebs is the oil distilled from Cubebs." *Br.*

Oleum Cubeborum; Oil of Cubebs; *Huile volatile* (Essence) de Cubebe, *Fr.*; *Kubebenol*, *G.*

The oil is obtained from cubeb by grinding the berries, and then distilling with water. From ten pounds Sebonwald procured eleven ounces of oil, and this result very nearly coincides with the experiments

of Christison, who obtained 7 per cent.; but by better methods of distillation 10 to 18 per cent. have been obtained. When recently distilled from the fruit, the oil is somewhat greenish, becoming yellowish by age, but when carefully redistilled it is colorless. It has the odor of cubeb, a warm, aromatic, camphoraceous taste, and a neutral reaction, is of a consistence approaching that of almond oil, is lighter than water, having the sp. gr. 0.920 (0.910 to 0.930, *Br.*), and when exposed to the air is said to thicken without losing its odor. It is soluble in an equal weight of alcohol. It is described in the U. S. P. IX as follows: " Oil of Cubeb is a colorless or a pale green to yellowish-green liquid, having the characteristic odor and taste of cubeb. Specific gravity: 0.905 to 0.925 at 25° C. (77° F.). Its optical rotation varies from -20° to -40° in a 100 mm. tube at 25° C. (77° F.). Its alcoholic solution is neutral to litmus." *U. S.*

"Colorless, pale green, or greenish-yellow. Odor and taste those of Cubebs. Specific gravity 0.910 to 0.930; optical rotation -25° to 40°; refractive index at 25° C. (77° F.) 1.486 to 1.500. Not less than 60 per cent. distils between 250° and 280° C. (482°-536° F.)." *Br.*

The oil consists chiefly of sesquiterpenes which distil over between 250° and 280° C. (482° and 536° F.), one of which is *cadinene*, C₁₅H₂₄, with some dipentene, and probably pinene or camphene. Upon standing, it sometimes deposits rhomboidal prismatic crystals of a stearopten. The camphor of cubeb has the formula C₁₅H₂₆O, is fusible at from 66° to 68° C. (150.8°-154.4° F.), and volatilizes without change at from 148° to 150° C. (298.4°-302° F.). According to Schmidt, it does not pre-exist in the cubeb, but is formed by the prolonged action of the air and therefore does not occur in oil distilled from new berries. (*J. P. C.*, June, 1875.) The oil has the aromatic properties of cubeb, but it is probably not the sole active ingredient, as it is much less pungent than the fluidextract or the oleoresin. It may, however, often be advantageously substituted for the powder, the dose to be gradually increased until its effects are obtained, or until it proves offensive to the stomach. It may be given suspended in water by means of sugar, in the form of emulsion, or enclosed in capsules of gelatin.

Dose, five to fifteen minims (0.3-0.9 mil).

OLEUM EUCALYPTI. U. S., Br.

OIL OF EUCALYPTUS Ol. Eucalypt. [Eucalyptus Oil]

"A volatile oil distilled from the fresh leaves of *Eucalyptus Globulus* Labillardiere (Fam. *Myrtaceae*) or from some other species of *Eucalyptus*, and yielding not less than 70 per cent., by volume, of eucalyptol (cineol) [$C_{10}H_{18}O = 154.14$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* "Oil of Eucalyptus is the oil distilled from the fresh leaves of *Eucalyptus Globulus*, Labill., *Eucalyptus dumosa*, A. Cunn., and other species of *Eucalyptus*, and rectified." *Br.*

Oil of Eucalyptus Globulus; Huile volatile (Essence) de Eucalyptus, *Fr. Cod.*; Eucalyptusol, *G.*; Esencia de eucalipto, *Sp.*

Various species of the genus *Eucalyptus*, grown in Australia and Algeria, yield volatile oils in sufficient quantity to be commercial products. Probably the most important of these plants is *E. Globulus*, on account of its high cineol (eucalyptol) content. Large quantities of oil are also distilled from other species, viz., *E. odorata*, *E. oleosa*, *E. cuenfolia* and *E. dumosa*.

Oil of eucalyptus is officially described as " a colorless or pale yellow liquid, having a characteristic, aromatic, somewhat camphoraceous odor, and a pungent, spicy, and cooling taste. It is soluble in 4 volumes of 70 per cent. alcohol. Specific gravity: 0.905 to 0.925 at 25° C. (77° F.). Mix 2 mls of the Oil with 4 mls of glacial acetic acid and gradually add 3 mls of a saturated solution of sodium nitrite. When gently stirred, the mixture does not form crystals of phellandrene nitrite (*other eucalyptus oils containing large amounts of phellandrene*)." *U. S.*

"Colorless or pale yellow. Aromatic, camphoraceous odor; taste pungent, leaving a sensation of cold. Specific gravity 0.910 to 0.930; optical rotation -10" to +10°. Soluble in 5 parts of alcohol (70 per cent.). Contains not less than 55 per cent. by volume of cineol as determined by the process described under 'Oleum Cajuputi' When 1 millilitre is mixed with 2 millilitres of glacial acetic acid and 5 millilitres of petroleum spirit, 2 millilitres of a saturated aqueous solution of sodium nitrite being added, and the mixture gently shaken, no crystalline precipitate forms in the upper layer (absence of oils containing much phellandrene)." *Br.*

The valuation of eucalyptus oil being based upon its cineol (eucalyptol) content the commercial oils from other species of eucalyptus are regarded with much less favor for medicinal purposes, because of their variable quality in this respect, and the fact that the other oils contain such constituents as phellandrene, cymene, citronellal, citral and other less known constituents. Cineol being optically inactive and high in its specific gravity communicates specific properties to such oils as contain it in large amounts by which their approximate value or their genuineness may be determined irrespective of the assay for cineol, which, of course, must be the ultimate deciding factor. There is much variation in the physical constants found in the literature of the eucalyptus oils as determined by different observers, and much work yet remains to be done upon the subject.

Eudesmol, $C_{10}H_{16}O$ (possibly a ketone), is the name given to a crystalline camphor obtained from the oil from *E. piperita*; H. G. Smith and R. T. Baker isolated this product, and later H. G. Smith read a paper upon it before the Royal Society of New South Wales. It proved to be isomeric with camphor, but chemically it is shown to have its oxygen atom combined in a different way.

Uses.—In the belief that the medicinal properties of oil of eucalyptus depend upon cineol, the Pharmacopoeia rejects those oils which contain chiefly phellandrene, but as a matter of fact, we have no definite knowledge concerning the physiological action of phellandrene. Whether or not the medicinal virtues of the official oil are due entirely to its cineol is uncertain, but many prefer to use the pure eucalyptol to the oil itself.

Oil of eucalyptus is an active germicide, although surpassed in power by many of the other volatile oils. Cineol is probably a less efficient antibacterial agent than oil of eucalyptus. When taken in overdose it causes rapidity of the pulse with general excitement and restlessness, nausea, vomiting, frequently dilatation of the pupils, and symptoms of collapse. In the lower animals it reduces the arterial pressure and the bodily temperature, causes muscular weakness, irregular respiration and death from respiratory failure. It is absorbed from the intestinal tract, eliminated partially through the breath to which it imparts its odor, and also, as an oxidation product, through the urine to which it gives an odor resembling that of violets.

The oil of eucalyptus is used locally as an antiseptic, especially in the treatment of infections of the upper respiratory tract and in certain forms of *skin disease*. Internally it is used as a stimulating expectorant in *chronic bronchitis* and *tuberculosis*. In these conditions it is also frequently given by inhalation; a few drops of the oil may be added to boiling water and the mixed vapors and steam inhaled. It has been specially praised in *asthma*, given internally or preferably by inhalation by means of cigarettes, which may be made by rolling up the dried leaves, or the vapor from boiling water containing the oil may be inhaled. It is also used as a remedy against the *hookworm*, but is probably of inferior value. It possesses also some antiperiodic power and may be used in malarial fever when for any reason quinine or methylthionine are not available.

Dose, three to ten minims (0.2-0.6 mil), best administered in emulsion.

Off. Prep.—Unguentum Eucalypti, *Br.*

OLEUM FOENICULI. U. S.

OIL OF FENNEL Ol. Foenic. [Fennel Oil]

"A volatile oil distilled from the ripe fruit collected from cultivated varieties of *Foeniculum vulgare* Miller (Fam. *Umbelliferae*). If wholly or partly solidified, carefully warm the Oil until liquefied and thoroughly mix it before dispensing. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U.S.*

Huile volatile de Fenouill, *Fr. Cod.*; Essence de Fenouil, *Fr.*; Oleum Foeniculi, *P. G.*; Fenchalol, *G.*

Fennel seeds yield about 2.5 per cent., or, according to Zeiler, from 3.4 to 3.8 per cent., of oil. That used in this country is imported. "A colorless or pale yellow liquid, having the characteristic odor and taste of fennel. It is soluble in 8 volumes of 80 per cent. alcohol and in 1 volume of 90 per cent. alcohol, forming a solution neutral to litmus. Specific gravity: 0.953 to 0.973 at 25° C. (77° F.). The optical rotation varies from +12° to 4- 24° in a 100 mm. tube at 25° C. (77° F.). When tested by the method under *Oleum Anisi*, with the following modifications, the congealing

point of the Oil does not fall below 3° C. (37.4° F.). Cool the test tube containing the 10 mils of Oil of Fennel in a freezing mixture until the temperature has fallen to 0° C. (32° F.), and induce crystallization as directed." U. S.

It congeals below 10° C. (50° F.) into a crystalline mass, separable by pressure into a solid and a liquid portion, the former heavier than water, and less volatile than the latter, which rises first when the oil is distilled. It contains *anethol*, C₁₀H₁₂O (a phenol-ether forming a white solid melting at 21° C. (69.8° F.)) (see *Oleum Anisi*), the latter usually in amounts of about 60 per cent., d-pinene, phellandrene, dipentene, *fenchone*, C₁₀H₁₆O (a liquid ketone), chavicol, anisic aldehyde, and anisic acid. Fenchone is the constituent which when present gives the disagreeable bitter taste to many of the commercial oils. *Schimmel's Report* for April, 1897, mentions limonene as also at times present as a constituent. Umney finds that Japanese oil contains about 75 per cent. of anethol and 10 per cent. of fenchone, besides terpenes. (*Proc. A. Ph. A.*, 1897, 516.) There is reason to believe that much of the commercial oil is adulterated with oil from which the anethol or crystalline constituent has been separated; the official solidifying point not below 5° C. (41° F.) should be required. Fluckiger states (*Pharm. Chem.*, 2d ed., 1888, 422) that it contains more hydrocarbon than oil of anise, and notably that from Nimes, in Southern France, contains much less anethol, and hence has a milder and sweeter taste which is also probably due to the absence of the bitter fenchone. As found in commerce, therefore, the oil of fennel is not uniform, and a specimen examined by Montgomery did not congeal at -5.5° C. (22° F.).

Dose, three to five minims (0.2-0.3 mil).

Off. Prep.—Aqua Foeniculi; U. S.

OLEUM GAULTHERIA. Br.

OIL OF GAULTHERIA [Oil of Wintergreen]

"Oil of Gaultheria is the oil distilled from the leaves of *Gaultheria procumbens*, Linn., or from the bark of *Betula lenta*, Linn." Br.

Oil of Teaberry, Oil of Partridge-berry; Huile volatile (Essence) de Winter-green, *Fr. Cod.*; Essence de Gaultherie, *Fr.*; Wintergrunol, Bergtheol, *G.*

Oil of gaultheria is no longer official in the U. S. P. IX. Under *Methylis Salicylas* the Pharmacopoeia directs that oil of gaultheria and oil of betula or sweet birch may be used.

The volatile oil of gaultheria is largely obtained in the United States by distillation of the plant. It probably does not exist in the plant, but is formed by a reaction between water and a neutral principle analogous to amygdalin, to which Procter has given the name of *gaultherin*. (*A. J. P.*, xv.) This substance, which was called by Schneegans *betulase*, probably exists in all the numerous plants which yield methyl salicylate on distillation. The oil occurs in various of our native plants, and has been detected in *Polygala paucifolia*, *Spiraea Ulmaria*, *Spiraea lobata*, and *Gaultheria chiogenes*. T. E. de Vrij found it in considerable proportion in the *Gaultheria leucocarpa* and *G. punctata*, plants which are abundant in the volcanic regions of Java (*A. J. P.*, 1879); while Bourquelot (*C. R. S. B.*, iii, 1896) detected it in *Monotropa Hypopitys*, in *Polygala Senega*, and in other species of *Polygala*. (See also *A. J. P.*, 1898, 412.) Much of the so-called oil of wintergreen is obtained from *Betula lenta*, which yields a product physically indistinguishable and difficult to differentiate chemically from methyl salicylate.

The still in which oil of wintergreen is distilled is generally a wooden box, about eight feet long, four feet wide, four feet high, with a copper bottom and stayed with bolts. The head of the still is copper, and connecting with this is a circular worm of the same material or of tin, placed in a barrel. The still being filled with wintergreen to within about twelve inches of the top, a sufficient quantity of water is added, and this is allowed to macerate from ten to twelve hours. The fire being started, the distillation commences, and continues for about eight hours; but during the first two or three hours ninety per cent. of the oil has passed over. For collecting the distillate, most of the distillers use a wide-mouthed bottle, fitted with a large cork having two holes. A small funnel is put into one of the holes, so that the beak is below the shoulder of the receiving vessel, and connected with the other hole is a suitable pipe forming an outlet. The oil and the water separate, the oil going to the bottom, and the water passes into a larger receptacle, where it is reserved for a subsequent operation (cohobation).

Occasionally the oil is very highly colored, and the wholesale dealers have three ways of "cleanin " it—redistillation, filtration, and de-

colorization. In the last method the oil to be decolorized is put into a bottle, crystals of citric acid are added, and the whole is allowed to stand, agitating occasionally, until the oil is colorless, or nearly so.

Oil of gaultheria when freshly redistilled is nearly colorless, but as found in commerce has a brownish-yellow or reddish color. The U. S. P. VIII described it as "a colorless or almost colorless liquid, having a characteristic, strongly aromatic odor, and a sweetish, warm, and aromatic taste. Specific gravity: 1.172 to 1.180 at 25° C. (77° F.). Boiling point: 218° to 221° C. (424.4°-429.8° F.). It is slightly laevogyrate, up to -1° in a 100 Mm. tube, at 25° C. (77° F.). In other respects it has the same properties as, and conforms to the reactions and tests given under, Methylis Salicylas."

" Colorless or nearly colorless. Strong, characteristic odor; taste pungent. Specific gravity 1.180 to 1.187; optical rotation at 25° C. (77° F.) 0° to -1°; refractive index 1.537 to 1.539. Soluble in 6 parts of alcohol (70 per cent.) at 25° C. (77° F.). Contains not less than 99 per cent. of esters, calculated as methyl salicylate, CH₃C₇H₅O₃." Br.

It is stated to have been largely adulterated with chloroform. This and other impurities are to be detected by a comparison of the specific gravities and boiling points, or by fractional distillation. It is readily soluble in alcohol. When heated to about 80° C. (176° F.), the oil should not yield a colorless distillate having the characteristics of chloroform or of alcohol. (*A. J. P.*, 1873, p. 521.) Another distinguishing property is that in aqueous solution it gives a purple color with ferric salts. Oil of sassafras may be detected by the separation of a deep-red resinous mass on treatment with nitric acid in the cold. Japanese oil of camphor and other light volatile oils used as adulterants can be detected by simply dropping the suspected oil in water; if pure, it sinks in a few seconds; if adulterated, some minutes are required. Cahours states that one-tenth of the oil consists of a peculiar hydrocarbon, which he called *gaultherilene*, and the remaining nine-tenths of *methyl salicylate*. (*A. J. P.*, xiv, 211, xv, 241.) Trimble and Schroeter (*A. J. P.*, 1889, 398) found that the amount of the hydrocarbon *gaultherilene* was much less than that stated by Cahours—in fact, only 0.3 per cent. By analysis and vapor density, determination they fixed its formula as C₁₅H₂₄, but they state that it may consist of a solid and a liquid portion. Power and Kleber (*Fritzsche Bros. Circ.*, No. 7) assert that this hydrocarbon belongs

to the paraffin series, and state that it is probably *triacontane*, C₃₀H₆₂. They also find in the oil an aldehyde or ketone, with an odor like oenanthic aldehyde, an apparently secondary alcohol, C₆H₁₆O, and an ester, C₁₄H₂₄O₂. To the alcohol and the ester are attributed the characteristic odor of the oil. True oil of gaultheria contains about 99 per cent. of methyl salicylate. *Synthetic oil of wintergreen* is now extensively manufactured and used instead of the natural oil. For a process by H. T. Thayer. see *A. J. P.*, 1895, 244.

Uses.—The therapeutic properties of this oil are precisely the same as those of Methyl Salicylate.

Dose, ten to twenty minims (0.6-1.3 mils).

OLEUM GOSSYPII SEMINIS. U .S.

COTTONSEED OIL

Ol.Gossyp. Sem. [Cotton Seed Oil]

"A fixed oil obtained from seeds of cultivated varieties of *Gossypium herbaceum* Linne, or of other species of *Gossypium* (Fam. *Malvaceae*). Preserve it in well-closed containers." *U. S.*

Oleum Gossypii; Cotton Oil; Huile de Semences de cotonnier, *Fr.*; Baumwollsamenoel, Baumol, *G.*

This fixed oil has no other medicinal properties than those of a bland neutral oil, and has been introduced especially on account of its use in official liniments. The amount of cottonseed produced in 1914 was 7,186,000 tons, of which 5,779,665 was worked up into its various products. The oil obtained was 229,260,000 gallons. The oil cake is largely exported to England, where it is used as food for cattle, and the oil to France, Italy, and other olive growing countries of Europe, whence much of it returns to us mixed with olive oil. The exportation of cottonseed oil for 1915 amounted to 318,366,525 lbs., valued at \$21,872,948. For a description of the process of extraction, see *A. J. P.*, 1896, 42; also 1898, 497. Among the recent improvements in the purification of cottonseed oil are the processes of Chisholm using silicate of soda for clarifying and of Baskerville using a paper pulp or cellulose fiber.

This oil is obtained by expression from the seeds previously deprived of their shells. In this state they yield two gallons of oil to the bushel. As first obtained, it is thick and turbid, but it deposits a portion of its impurities on standing.

The oil is clarified by first boiling it with water, to separate the mucilage, and then heating it with a weak solution of sodium hydroxide, which combines with the coloring matter and saponifies a part of the oil. The mixture becomes filled with black flocks, which deposit on standing and leave the oil but slightly colored. The loss in refining is usually from 4 to 7.5 per cent., but occasionally amounts to 12 or 15.

Besides this crude oil, there are three varieties in commerce, more or less purified, recognized as the *clarified*, the *refined*, and the *winter bleached*. The last mentioned is of a pale straw-color, a mild peculiar odor, and a bland sweetish taste, not unlike that of almond oil. The oil is used in the preparations of woollen cloth and morocco leather, and for oiling machinery. It has been found to be an excellent substitute for almond and olive oils in most pharmaceutical preparations in which they are employed, but it does not answer so well in the formation of lead plaster. Citrine ointment carefully prepared with it, too great heat being avoided, retains a rich orange color and proper unctuous consistence.

As this oil is much used for adulterating olive oil, tests to distinguish it are very desirable. The test most depended upon is that known as Balphen's test, a mixed solution of amyl alcohol and carbon disulphide containing 1 per cent. of dissolved sulphur. This is given in the official test. It is stated that cotton seed oil, which has been heated to 250° C. (482° F.) no longer gives many of the characteristic reactions for detecting the oil.

Dose, two to six fluidrachms (7.5—22.5 mils).

Off. Prep.—Linimentum Camphorae, *U. S.*; Linimentum Ammonias, *U. S.*

OLEUM GRAMINIS CITRATI. Br.

OIL OF LEMON GRASS

"Oil of Lemon Grass is the oil distilled from *Cymbopogon citratus*, Stapf, and *Cymbopogon flexuosus*, Stapf." Br.

Lemon-grass Oil.

The *East Indian Lemon Grass Oil* comes from Malabar, Cochin, India and the Malay Peninsula. A product of the *C. citratus* comes from Ceylon, Burma and adjacent countries, as well as from Mexico and the West Indies.

It is officially described in the British Pharmacopoeia, 1914, as " Dark yellow. Odor resembling that of verbena. Specific gravity 0.880 to 0.905; optical rotation -3° to $+3^{\circ}$. Contains not less than 70 per cent. of aldehydes as determined by the process described under 'Oleum Cinnamomi." Br.

The chief aldehyde present is citral, of which it contains 70 to 85 per cent. Linalool, geraniol and methyl peptenone are also reported present in small amounts. The principal use of the oil is in perfuming cheap soaps, (See also *Oil of Citronella*.)

Oil of lemon grass is sometimes used in Eastern countries as a carminative and stimulant in doses of one-half to three minims (0.03-0.2 mil). Its chief use is in perfumery.

OLEUM JUNIPERI. U. S., Br.

OIL OF JUNIPER

Ol. Junip. [Juniper Oil, Oil of Juniper Berries]

" A volatile oil distilled from the ripe fruit of *Juniperus communis*, Linne (Fam. *Pinaceae*). Preserve it in well-stoppered, amber-colored bottles in, a cool place, protected from light." U. S. " Oil of Juniper is the oil distilled from the ripe fruit of *Juniperus communis*, Linn., and rectified." Br.

Oleum Fructus (vel Baccae) Juniperi; Huile volatile (Essence) de Genievre, Fr.; Oleum Juniperi, P. G.; Wachhold-erol, Wachholderbeerol, G.; Essenza di ginepro, It.

The proportion of oil which juniper berries afford is stated very differently by different authors. Trommsdorff obtained 1 per cent. The highest quantity given in the table of Re-cluz is 2.34^ the lowest 0.31 per cent. Zeiler gives as the product of the fresh ripe fruit 1.3 per cent., of that a year old 0.86 per cent. The berries are most productive when bruised. The oil of juniper consumed in this country is brought from Europe, and is believed to be procured chiefly from the tops of the plant, being sold for a price which is altogether incompatible with the idea that it is prepared from the fruit alone. "A colorless or faintly green or yellow liquid, having the characteristic odor and taste of juniper fruit. It is soluble in 4 volumes of alcohol with not more than a slight cloudiness. Specific gravity: 0.854 to 0.879 at 25° C. (77° F.). The optical rotation varies from 0° to -15°, in a 100 mm. tube at 25° C. (77° F)." *U.S.*

"Colorless or pale yellowish-green. Odor that of the fruit; taste warm, aromatic and bitter. Specific gravity 0.862 to 0.890, increasing with age; optical rotation -3° to -15°; refractive index at 25° C. (77° F.) 1.472 to 1.488. Soluble, when freshly distilled, in 4 parts of a mixture of equal volumes of alcohol (90 per cent.) and absolute alcohol/ becoming less soluble with age." *Br.*

According to Fluckiger (*Pharm. Chem.*, 2d ed., 1888, 402), it is composed essentially of two hydrocarbons, the more abundant of which, boiling at 160° C. (320° F.), has been shown by Wallach to be pinene, C₁₀H₁₆. Above 175° C. (347° F.) another oil is obtained, which seems to be cadinene, C₁₅H₂₄. It also contains a small amount of an ester to which the peculiar juniper-like odor and taste was supposed to be due, but this cannot be the case, as the odor persists after the complete saponification of the small amount of ester. *Juniper camphor* is also present, its melting point is 165° to 166° C. (329°-330.8° F.). Oil of turpentine is often fraudulently added, but may be detected by the specific gravity of the mixture being less than that of the unadulterated oil of juniper.

Uses.—Oil of juniper is occasionally used as a carminative in *intestinal flatulence*, but is more popularly employed for its diuretic effect. Because of its local irritant action it should never be used when there is an active inflammatory process in the kidney or urinary tract. It is frequently combined with potassium bitartrate. To it gin owes its peculiar flavor as well as its diuretic effects.

Dose, two to ten minims (0.12-0.6 mil).

Off. Prep.—*Spiritus Juniperi, U. S., Br.; Spiritus Juniperi Compositus, U. S.; Acetum Aromaticum, N. F.*

OLEUM LAVANDULA. U. S., Br.

OIL OF LAVENDER

Ol. Lavand. [Oleum Lavandulae Florum, U.S. P. VIII]

"A volatile oil distilled from the fresh flowering tops of *Lavandula vera* De Candolle (*Lavandula officinalis* Chaix, *Lavandula spica* Linne) (Fam. Labiatae). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* "The oil distilled from the flowers of *Lavandula vera*, DC." *Br.*

Huile volatile de Lavande officinale, Fr. Cod.; Essence de Lavande, Fr.; Oleum Lavandulae, P. G.; Lavandelol, G.; Essenza di lavanda, It.; Esencia de espliego, Sp.

This oil is usually distilled from the flowers and flower stems conjointly, though of finer quality when obtained from the former exclusively. Dried lavender flowers are said to yield from 1 to 1.5 per cent. of oil. According to Zeiler, the fresh flowers yield 1.03, the dried 4.3, the whole fresh herb in flower 0.76 per cent. It is stated that the lavender produced by an acre of ground under cultivation will yield from 10 to 12 pounds of the oil. (*P. J.*, 1864, p. 257.) The oil is very fluid, of a lemon-yellow color, with the fragrance of the flowers and an aromatic, burning taste. That met with in commerce has the sp. gr. 0.898 at 20° C. (68° F.), which is reduced to 0.877 by rectification (Berzelius), or 0.886 (Buignet). It is laevogyrate. According to Brande, the sp. gr. of the oil obtained from the whole herb is 0.9206. Alcohol of 0.830 dissolves oil of lavender in all proportions, that of 0.877 only 42 per cent. (Berzelius.) Proust states that when allowed to stand in imperfectly stoppered bottles it lets fall a crystalline deposit, which often amounts to one-fourth of its weight. This has been found by Dumas to have the same point of volatilization and the same composition as true camphor, but to differ in the total want of rotatory power. It is said that the portion of oil first distilled is most fragrant, and is often kept separate, and sold at a higher price. "Oil of Lavender is a colorless or yellow liquid, having the characteristic odor and taste of lavender flowers. It is soluble in 3 volumes of 70 per cent. alcohol. Specific gravity: 0.875 to 0.888 at 25° C. (77° F.). The optical rotation varies from -1° to -10° in a 100 mm. tube at

25° C. (77° F.). When shaken in a narrow glass cylinder with an equal volume of distilled water, its volume does not diminish (alcohol). Shake 20 mls of the Oil with 40 mls of 5 per cent. alcohol and, when the mixture has cleared, withdraw 30 mls of the alcoholic solution. Neutralize this with (half-normal potassium hydroxide V.S., using phenolphthalein T.S. as indicator, then add 5 mls of half-normal potassium hydroxide V.S. and heat the mixture on a water-bath, under a reflux condenser, during one hour. Not less than 4.7 mls of half-normal hydrochloric acid V.S. is required for neutralization (foreign esters)." *U. S.*

" Pale yellow or yellowish-green. Odor that of the flowers; taste pungent, slightly bitter. Specific gravity 0.883 to 0.900; optical rotation -3° to -10°. Soluble in 4 parts of alcohol (70 per cent.). Contains from 7 to 11 per cent. of esters (English oil), or not less than 30 per cent. of esters (foreign oil), calculated as linalyl acetate, $C_{10}H_{17}C_2H_3O_2$." *Br.*

The principal constituent is an alcohol, $C_{10}H_{18}O$, identical with the linalool. Besides linalool, lavender oil contains linalyl acetate (from 30 to 45 per cent. in the oil from French flowers, and from 7 to 10 per cent. in the oil from English flowers), the butyric ester of the same alcohol, geraniol, a very small amount of cineol (more in the English than in the French oil), and sometimes traces of pinene, limonene, and a sesquiterpene.

Oil of Spike is procured from the broad leaved variety of lavender which grows wild in Europe, the *Lavandula Spica* of De Cavanilles. Its odor is less fragrant than that of common oil of lavender, and is somewhat analogous to that of oil of turpentine, with which it is said to be often adulterated. It is used by artists in the preparation of varnishes. The oil of spike contains about 30 per cent. of cineol and but small quantities of esters. Oil of lavender is used chiefly as a perfume, though possessed of carminative and stimulant properties, and sometimes useful in cases of *nervous languor* and *headache*.

Dose, from one to five minims (0.06-0.3 mil).

Off. Prep.—*Spiritus Lavandulae, U. S., Br.*; *Tinctura Lavandulae Composita, U. S., Br.*; *Acetum Aromaticum, N. F.*; *Spiritus Odoratus, N. F.*

OLEUM LIMONIS. U. S., Br.

OIL OF LEMON Ol. Limon. [Lemon Oil]

"A volatile oil obtained by expression from the fresh peel of the ripe fruit of *Citrus medica Limonum* (Risso) Hooker filius (Fam. *Rutaceae*), and yielding not less than 4 per cent. of the aldehydes from Oil of Lemon, calculated as citral [C₁₀H₁₆O =152.13]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light. Oil of Lemon having a terebinthinate odor is not to be dispensed." *U. S.* " Oil of Lemon is the oil obtained from Lemon Peel by various methods of expression." *Br.*

Oleum Limonum; Huile volatile de Citron, *Fr. Cod.*; Essence de Citron, *Fr.*; Oleum Citri, *P. G.*; Citronenol, *G.*; Olio da limone, *It.*; Esencia de limon, *Sp.*

The exterior rind of the lemon abounds in a volatile oil, which, being contained in distinct cells, may be separated by simple expression. The rind is first grated from the fruit, and then submitted to pressure in a bag of fine cloth. The oil thus obtained is allowed to stand till it becomes clear, when it is decanted, and kept in stoppered bottles. By a similar process, the oil called by the French *huile de cedrat* is procured from the citron. (See *Oil of Bergamot* and *Succus Limonis*.) These oils may also be obtained by distillation, but thus procured, though clearer, and, in consequence of the absence of mucilage, less liable to change on keeping, they have less of the peculiar flavor of the fruit, and the mode by expression is generally preferred. A third method of separating the oil, used in Calabria and Sicily, is to put the grated rind into hot water and skim off the oil as it rises to the surface. (*A. J. P.*, 1868, p. 27.) The method employed to obtain the finest oil is, however, that known as the *ecuelle* process. The *ecuelle* is an instrument usually made of tinned copper, bowl-shaped, and armed with concentric rows of short spikes. Attached to the bottom of the bowl is a hollow handle, closed at the bottom. This acts as a reservoir for the oil as the fruit is rubbed by the workmen over the sharp teeth. The oils are brought from Italy, Portugal, or Southern France.

The oils of lemons and oranges, as well as those of the other *Aurantiaceae*, will keep indefinitely upon admixture with a small proportion of alcohol (one ounce to a pound of the oil). When wanted for

use, a quantity of water equal to that of alcohol, added to the mixture, will unite with the alcohol, and subside, leaving the oil free of the alcohol for all practical purposes. (Carl Fruh, *A. J. P.*, 1871, 201.) E. J. Parry (*Ch. & Dr.*, 1913, p. 378) discusses at some length the relative advantages of terpene-less and sesquiterpeneless oils and normal oils. The ordinary terpeneless oils contain from 42 to 45 per cent. of citral, while those that are sold as sesquiterpeneless contain from 65 to 72 per cent. citral. He states that the latter products lack the sweetness and softness of odor of those containing less citral, the overpowering odor of the latter constituent destroying the balance of harmony in the odor of the oil. He states that users of these products claim to get the best results from oils containing slightly less than 40 per cent. of citral and from which the whole of the terpenes have not been removed. The characters of the commercial terpeneless oil are as follows: sp. gr. at 15° C. (59° F.), 0.8935 to 0.899; optical rotation, -5° to -8° 30'; refractive index, 1.4810; citral, 42 to 48 per cent. The sesquiterpeneless oils are slightly higher in specific gravity, lower in optical rotation and always run above 65 per cent. of citral.

The great extent of the production and export of Sicilian and Calabrian essential oils (lemon, orange, bergamot, etc.) may be seen from the Italian official statistics, according to which the number of trees producing in 1896 was 17,084,569, yielding 3,337,000,000 fruits. Of these 1,897,000,000 were exported, leaving 1,439,555,000 fruits for home consumption inclusive of those used in the manufacture of essences. (*Schim. Rep.*, Oct., 1897, 23.)

Parry (*Schim. Rep.*, Apr., 1912, p. 78) reports several shipments of lemon oil which upon investigation were found to be adulterated with Greek turpentine oil. They were noted by their low optical rotation, +50° to +54°, and their low citral content, 3.3 to 4.1 per cent.

Oil of lemon contains a small amount of pinene, with dextrogyrate limonene, about 7 to .8 per cent. of *citral*, C₁₀H₁₆O, an aldehyde yielding geraniol upon reduction, and a small amount of *citronellal*, C₁₀H₁₈O, also an aldehyde. Pinene, phellandrene, higher aldehydes, as octyl and nonyl, terpineol and geranyl acetate have also been reported in small amounts. Of these the citral is the constituent to which the oil chiefly owes its aroma and value. Umney and Swinton (*P. J.*, 1898, 196) state that citral, citronellal, and an ester of geraniol are all necessary to form the true odor of oil of lemon. Citral boils under normal atmospheric

pressure ,at from 228° to 229° C. (442.4°-444.2° F.) without decomposition if pure, and, like aldehydes, forms stable compounds with alkaline bisulphites. Schimmel & Co. now prepare the citral in a pure state, and recommend its use for enriching the ordinary oil of lemon.

Oil of lemon is often adulterated by the fixed oils and by alcohol, and sometimes with purified oil of turpentine, which is difficult of detection from its similar composition and specific gravity except with the polariscope. One of the tests for the presence of this oil is the terebinthinate odor produced when the adulterated oil is evaporated from heated paper; the official quantitative test defining the percentage of citral will be of service in detecting these adulterations. The most dangerous adulteration of oil of lemon is the use of *citrene*, the terpene left after the extraction of citral from oil of lemon which has been used in making terpene-less oil. Oil of lemon procured 'by expression is apt to precipitate and to undergo chemical change. J. S. Cobb has found no method so effectual to obviate this result, and at the same time to retain unimpaired the flavor of the oil, as to shake it with a little boiling water and allow the mixture to stand. A mucilaginous matter separates, and floats on the surface of the water, from which the purified oil may be decanted. (*Ann. Pharm.*, ii, 86.) The best method of preservation is to add 10 per cent. of a bland fixed oil such as olive or cottonseed, which must subsequently be allowed for in measuring the oil for use.

Adulteration of Lemon Oil with Pinene.—In consequence of some seizures of lemon oil alleged to be adulterated with turpentine, in 1906, a number of importers stated their belief that pinene was normally present in appreciable amounts in some lemon oils. In consequence of this the U. S. Dept. of Agriculture undertook a special investigation of the subject, sending a trained observer and analyst to the producing countries, and published the results of the investigation in a special bulletin called "Circular 46, by E. M. Chace." The investigation showed conclusively that lemon oil shows no appreciable amount of pinene.

Spirit of Lemon (*Spiritus Limonis*, U. S. 1890) is no longer official. It was made by dissolving 50 mils of oil of lemon in 900 mils of deodorized alcohol, to which 50 Gm. of freshly grated lemon peel were added, the whole macerated for twenty-four hours, filtered, and enough deodorized alcohol added through the filter to make the whole measure 1000 mils.

Uses.—The oil of lemon is much less active than most of the other

official volatile oils, and is used almost exclusively for its flavoring properties.

Dose, two to five minims (0.12-0.3 mil).

Off. Prep.—Elixir Aromaticum (from Spirit), *U. S.*; Spiritus Aurantii Oompositus, *U. S.*; Acetum Aromaticum, *N. F.*; Spiritus Odoratus, *N.F.*

OLEUM LINI. U. S., Br.

LINSEED OIL

Ol. Lini. [Oil of Flaxseed Raw Linseed Oil]

"A fixed oil obtained from Linseed. Preserve it in well-stoppered containers. Linseed Oil which has been 'boiled' must not be used nor dispensed." *U. S.* "Linseed Oil is the oil expressed from Linseed." *Br.*

Huile de Semence de Lin, *Fr.*; Oleum Lini, *P. G.*; Leinol, Leinsamenol, *G.*; Olio di lino, *It.*; Aceite de linaza, *Sp.*

This oil is obtained by expression from the seeds of *Linum, usitatissimum*, or common flax, which, according to Berjot, contain 34 per cent. (*J. P. C.*, April, 1863. p. 277.) In its preparation on a large scale, the seeds are usually roasted before being pressed, in order to destroy the gummy matter contained in their coating. The oil is thus obtained more free from mucilage, but more highly colored and acrid than when procured by cold expression. For medicinal use, therefore, it should be prepared without heat, and, as it is apt to become rancid quickly on exposure, it should be used as soon after expression as possible. It may, however, be rendered sweet again by agitation with warm water, rest, and decantation. It is said to be obtained purer and in larger proportion by treating the crushed seeds with carbon disulphide than by expression. (*A. J. P.*, xxvi, 265.)

Oil of flaxseed is a yellowish, oily liquid, having a peculiar odor and a bland taste. When exposed to the air, it gradually thickens, darkens in color, and acquires a strong odor and taste. It is slightly soluble in alcohol, miscible with ether, chloroform, petroleum benzin, carbon disulphide, or oil of turpentine. Specific gravity: 0.925 to 0.935 at 25° C. (77° F.). It is not more than slightly acid to litmus paper which has previously been moistened with alcohol (*free acid*). Linseed Oil when

spread in a thin layer on a glass plate and allowed to stand in a warm place is gradually converted into a hard, transparent resin (*non-drying oils*). To 10 mls of the Oil add 3 Gm. of potassium hydroxide, 10 mls of alcohol and 10 mls of distilled water, and heat the mixture on a water bath with frequent agitation, until a clear solution results. The addition of 100 mls of distilled water to this solution yields a clear liquid free from oily drops (*mineral or rosin oils*). Warm 2 mls of the Oil with frequent agitation in a test tube with an equal volume of glacial acetic acid, and, after cooling, add to the mixture 1 drop of sulphuric acid. A greenish color is produced (a violet color under these circumstances indicates the presence of rosin or rosin oils). Saponification value: not less than 187 nor more than 195. Iodine value: not less than 170." *U. S.*

"Yellowish-brown. Characteristic odor; taste bland. Specific gravity 0.930 to 0.940; saponification value 187 to 195; iodine value not less than 170; acid value not more than 3.0; unsaponifiable matter not more than 1.0 per cent.; refractive index at 40° C. (104° F.) 1.4725 to 1.4748. Does not congeal at temperatures higher than -20° C. (-4° F.). Gradually thickens on exposure to the air, forming, when spread in thin layers, a hard transparent varnish. A mixture of 2 millilitres of the Oil with an equal volume of acetic anhydride, warmed and shaken, and then cooled to 15.5° C. (60° F.), is not colored violet by the addition of 2 drops of a cooled mixture of 2 parts by weight of sulphuric acid and 1 part by weight of water (absence of resin and resin oils)." *Br.*

It has the property of drying or becoming solid on exposure to the air, acquiring during the process a strong odor and taste, and increasing as much as 12 per cent. of its weight, owing to the formation of *linoxyn* by atmospheric oxidation. The drying property resides in a constituent which, to distinguish it from the olein of the non-drying oils, is named *linolein*, and is the glyceride of *linoleic acid*. Linseed oil contains about 10 to 15 per cent. of glycerides of solid fatty acids, palmitic, myristic, and stearic, and 85 to 90 per cent. of liquid glycerides. Hazura (*J. Soc. Chem. Ind.*, 1888, 506) states that the liquid fatty acids consist of about 5 per cent. of oleic acid, $C_{18}H_{34}O_2$, 15 per cent. of *linoleic acid*, $C_{18}H_{32}O_2$, 65 per cent. of *isolinolenic acid*, $C_{18}H_{30}O_2$, and 15 per cent. of *linolenic acid*, $C_{18}H_{30}O_2$. Boiled with litharge, red lead, manganese dioxide, and other so-called "driers," it absorbs oxygen still more rapidly, and gains 14 per cent. in weight. Its acidity is owing to the presence of a small proportion of an acrid oleoresin. From its drying property, it is

useful in painting and in making printers' ink and in linoleum and oil cloth manufacture. The chief adulteration of linseed oil is with mineral oils and rosin oil. For their detection, see official tests already given.

It is said that crude cod liver oil has been used for the adulteration of the oil of flaxseed, especially where the latter is intended for preparing printers' ink. Aug. Morell detects this adulteration by the following method. Take 10 parts by weight of the suspected oil, mix it in a small cylindrical glass tube with 3 parts of crude nitric acid, agitate the mixture well, and allow it to rest. If cod liver oil be present, the oily layer at top will assume a dark-brown to blackish-brown color, while the acid at bottom will vary from bright orange to orange or dark yellow. So little as 3 per cent. of cod liver oil may thus be detected. If the flaxseed oil be pure, it will become, during the agitation, first sea green, and afterwards dirty greenish-yellow, the acid being bright yellow. The prohibition of the use of boiled linseed oil for medicinal purposes has its origin in the fact that much of the boiled linseed oil of commerce contains a compound of lead or manganese as a drying agent. Instances are on record where lead-containing boiled linseed oils caused the death of cattle to which the oil had been administered;

Uses.—The oil is laxative in the dose of a fluidounce (30 mils), but, on account of its disagreeable taste, is seldom given internally. It has, however, been highly recommended as a cure for *piles*, in the dose of two fluidounces (60 mils) of the fresh oil, morning and evening. It is sometimes added to purgative enemata. Particular care must be observed not to use boiled linseed oil for any medicinal purposes, as the latter frequently contains compounds of lead which give it poisonous properties.

Dose, one to two fluidounces (30-60 mils).

Off. Prep.—Linimentum Calcis, *U. S.*; Ceratum Resinae Compositum, *N. F.*

OLEUM MENTHÆ PIPERITA. U. S., Br.

OIL OF PEPPERMINT Ol. Menth. Pip. [Peppermint Oil]

“A. volatile oil distilled from the flowering plant of *Mentha piperita*

Linne (Fam. *Labiatae*), rectified by steam distillation, and yielding not less than 5 per cent. of esters, calculated as menthyl acetate [$C_{10}H_{19}C_2H_3O_2 = 198.18$], and not less than 50 per cent. of total menthol [$C_{10}H_{19}OH = 156.16$], free and as esters. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* "Oil of Peppermint is the oil distilled from fresh flowering peppermint, *Mentha piperita*, Sm., and rectified, if necessary." Br.

Huile volatile de Menthe poivree, *Fr. Cod.*; Essence de Menthe poivree, *Fr.*; Oleum Menthae piperitae, *P. G.*; Pfeffer-minzol, *G.*; Essenza di menta, *It.*; Esencia de menta piperita, *Sp.*

Peppermint varies exceedingly in the quantity of oil which it affords. Four pounds of the fresh herb yield, according to Baume, from a drachm and a half to three drachms of the oil. Zeiler gives as the product of the fresh herb, from 0.37 to 0.68 per cent., of the dried 1.14 per cent. The yield is generally less than 1 per cent. This oil is largely distilled in the States of Michigan, Indiana, and New York. For a valuable account of its method of production in Michigan, by A. M. Todd, see *A. J. P.*, 1888, 328. The oil is also largely produced in Japan. (See illustrated paper, *C. D.*, 1896, 601.) Gildemeister and Hoffmann (*Aetherische Oele*, p. 836) estimate the world's production of peppermint oil at 175,000 kilos, of which the United States furnishes 90,000 kilos, and Japan 70,000 kilos. It is officially described as "a colorless liquid, having a strong odor of peppermint, and a pungent taste, followed by a sensation of cold when air is drawn into the mouth. It is soluble in 4 volumes of 70 per cent. alcohol, showing not more than slight opalescence and no separation of oil globules. Specific gravity: 0.896 to 0.908 at 25° C. (77° F.). The optical rotation varies between -23° and -33° in a 100 mm. tube at 25° C. (77° F.). Distil about 1 mil from 25 mils of the Oil and pour the distillate on 5 mils of mercuric chloride T.S.; a white film does not form at the zone of contact within one minute (*dimethyl sulphide* found in non-rectified oils)." *U. S.*

Upon cooling or long standing it deposits a stearopten. Berzelius stated that at -13.3° C. (-8° F.) the oil deposits small capillary crystals. These are called *peppermint camphor* or *menthol*, $C_{10}H_{19}OH$. A complete summary of the composition of American peppermint oil, on the authority of Power and Kleber, given in *Schimmel & Co.'s Report* for April, 1897, shows the following constituents: acetaldehyde, isovaleraldehyde, dimethyl sulphide, amyli alcohol, isovalerie acid,

pinene, phellandrene, cineol, limonene, *menthone*, $C_{10}H_{18}O$, menthol, the acetate and iso-valerate of menthyl, *a-lactone*, $C_{10}H_{16}O_2$, and cadinene. Menthol, its oxidation product men-thone, and the acetic and isovalerie esters of menthyl have been identified as present in English and French peppermint oils, which probably also contain most of the other constituents mentioned above. Menthol and its esters are regarded as the main constituents of oil of peppermint and an official assay for determining the percentage of menthol will be found above. The dimethyl sulphide and some of the other constituents are objectionable from the flavoring standpoint, and are largely removed by the steam distillation which is required for rectification. The polariscope has been shown to be an uncertain guide in determining the quality of oil of peppermint. (A. B. Stevens, *Proc. A. Ph. A.*, 1888, p. 97.)

Fluckiger discovered that from 50 to 70 drops of peppermint oil, shaken with one drop of nitric acid, sp. gr. 1.2, turn faintly yellowish brown, and after an hour or two a most beautiful blue-violet or greenish-blue by transmitted light, or copper color by reflected light. Either a greater amount of acid or heating hastens the reaction. The color is very persistent. The presence of 5 per cent. of turpentine does not interfere with the reaction. (*P. J.*, Feb., 1871.)

Since menthol has been prepared largely from American peppermint oil, much of the latter has been put upon the market deprived of its menthol. To detect this fraud, Fritzsche Brothers recommend that a test tube partially filled with the oil and corked should be placed in a freezing mixture of ice and salt for ten or fifteen minutes. At the end of that time, if the oil has not been tampered with, it will have become cloudy, thick, or of a jelly-like consistence. If then four or five small crystals of menthol be added, and the tube be replaced in the freezing mixture, the oil will in a very short time form a solid mass of crystals. For another method of testing dementholized oil, see a paper by E. C. Federer, *Ph. Era*, 1887, 36; also 1887, 97.

Power and Kleber first proposed (*Ph. Rund.*, 1894, 157) to estimate the menthol in oil of peppermint by acetylizing a sample and saponifying an exactly weighed portion of the acetyl-ized oil after washing, drying, and filtering the same. Kleber (*A. J. P.*, 1897, 192) proposed to take instead a weighed quantity of the oil, acetylate it, and then saponify the product after washing and neutralizing it. In Schimmel & Co.'s *Report for October*, 1897, Kleber criticizes Kebler's modification, and claims greater

accuracy for the original method. Of course, this determination gives the total menthol; a determination of the combined menthol is had by titrating with alcoholic alkali.

Peppermint oil has been variously mixed and adulterated with the following substances: alcohol, oil of turpentine, oil of copaiba, oil of erigeron (from the erigeron plant growing with the peppermint plant, and being collected with it for distillation), oil of eucalyptus, oil of pennyroyal, and others. Most of these are detectable by the official tests, or when present lower the assay strength, or are readily recognized by the odor or taste, which they communicate to the oil. For further details concerning some of these adulterants and their detection, see *U. S. D.*, 19th ed., p. 854, 855.

Chinese Oil of Peppermint has not found its way to any extent into commerce, yet it has at times attracted much attention. According to John Mackey, some of it has reached London in cylindrical tin canisters, and it is to be obtained in San Francisco. Some specimens resemble the ordinary oil, but become solid in cold weather; others remain liquid and show no tendency to deposit a camphor, while others are solid crystalline masses at all temperatures. It seems probable that the original Chinese oil contains a great excess of menthol, and constitutes the variety first spoken of, and that the solid and liquid oils are prepared by separating it into its two constituents. The solid oil Fluckiger states not to differ from American menthol. (See *P. J.*, v, 366, 825.)

Uses.—Oil of peppermint possesses the physiological properties and therapeutic virtues of menthol, and may be used for practically all those conditions in which menthol is of service. It is generally preferred for internal use because of its more pleasant taste. It is an excellent carminative and gastric stimulant, and is widely employed in *flatulence*, *nausea*, and *gastralgia*. It adds to a stimulating effect upon the alimentary canal an antiseptic and local anesthetic influence. As a local application for *coryza* it may be used in strengths of from five to ten minims to an ounce of liquid petrolatum or olive oil. Incorporated into a lozenge it offers a pleasant and efficient antiseptic and anesthetic in *pharyngitis*. Internally it may be given either rubbed up with sugar and then dissolved in water, or more commonly in the form of the spirit. It is extremely popular as a flavoring agent.

Dose, one to five minims (0.06-0.3 mil).

Off. Prep.—Aqua Menthae Piperitae, *U. S.*, Br.; Spiritus Menthae Piperitae, *U. S.*, Br.

OLEUM MENTHAE VIRIDIS. U. S., Br.

OIL OF SPEARMINT

Ol. Menth. Vir. [Spearmint Oil]

"A volatile oil distilled from the flowering plant of *Mentha spicata* Linne (*Mentha viridis* Linne) (Fam. *Labiatae*), and yielding not less than 43 per cent., by volume, of carvone [$C_{10}H_{14}O = 150.11$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* "Oil of Spearmint is the oil distilled from fresh flowering spearmint, *Mentha viridis*, Linn., or *mentha crispa*, Roth." *Br.*

Hulle volatile (Essence) de Menthe verte, *Fr.*; Romisch-minzol, Krauseminzol, *G.*

According to Lewis, ten pounds of spearmint yield an ounce of oil; by others the product is stated not to exceed one part from five hundred. The oil is largely distilled in this country, the whole plant being used. It is pale yellow or greenish when recently prepared, but becomes red with age, and ultimately almost of a mahogany color. It is officially described as "a colorless yellow or greenish-yellow liquid, having the characteristic odor and taste of spearmint. It is soluble in 1 volume of 80 per cent. alcohol, forming a clear solution; on further dilution, it usually becomes cloudy. Specific gravity: 0.917 to 0.934 at 25° C. (77° P.). The optical rotation varies between -38° and -55° in a 100 mm. tube at 25° C. (77° F.).

The peculiar odor of spearmint oil has not yet been definitely associated with any of its constituents. It was for a time thought to be due to an acetic derivative of dihydrocumyl, but this has recently been denied so far as the oil of American origin is concerned.

Dose, one to six minims (0.06-0.4 mil).

Off. Prep.—Aqua Menthae Viridis, *U. S.*, Br.; Spiritus Menthae Viridis, *U. S.*

OLEUM MORRHUA. U. S., Br.

COD LIVER OIL

Ol. Morr. [Oleum Jecoris Aselli]

"A fixed oil obtained from the fresh livers of *Gadus morrhua* Linne and of other species of *Gadus* (Fam. *Gadidae*). Preserve it in a cool place, in well-closed containers, which have been thoroughly dried before filling." U. S. "Cod-liver Oil is the oil expressed from the fresh liver of the cod, *Gadus morrhua*, Linn., at a temperature not exceeding 85° C. (185° F.), and from which solid fat has been separated by filtration at about -5° C. (23° F)." Br.

Oleum Hepatis Morrhuæ; Cod Oil; Huile da Foie de Morue, *Fr.* *Cod.*; Huile de Morue, *Fr.*; Oleum Jecoris Aselli, *P. G.*; Leberthran, Stockfischleberthran, Dorschleberthran, Kablianleberthran, *G.*; Olio di fegato di merluzzo, *It.*; Aceite de higado de bacalao, *Sp.*

Gadus morrhua, Linn.; *Morrhua vulgaris* Storer.—The *common cod* is between two and three feet long, with brown or yellowish spots on the back. The body is moderately elongated and somewhat compressed, and covered with soft, rather small scales, being quite conspicuous also on the head. Of the fins, which are soft, there are three on the back (dorsal), two anal, and a distinct caudal, and the fin (ventral) under the throat is narrow and pointed. The jaws are furnished with pointed irregular teeth, in several ranks. The gilla are large, with seven rays. This species of cod inhabits the cold waters of the Northern Atlantic, and is especially abundant on the Banks of Newfoundland, where it finds food adapted to its wants.

Besides the common cod, several other species of *Gadus*, frequenting the seas of Northern Europe and America, contribute to furnish the cod liver oil of commerce. Among these De Jongh mentions *Gadus callarias*, or *dorsch* (*Morrhua americana* of Storer), *G. molva*, or *ling*, *G. carbonarius*, or *coal fish*, and *G. pollachius*, or *pollack*, as affording the oil on the coast of Norway, where from 17,000,000 to 35,000,000. of codfish are annually taken. For an account of the mode of fishing for cod and of preparing the oil practised in Norway and Denmark, see *P. J.*, April, 1877, p. 810; *N. R.*, March, 1878; *Ph. Ztg.*, 1900, 261; *Ph. Era*, 1904, 111; *C. D.*, 1904, 21.

On the American coast, in addition to the pollack above mentioned, it is obtained also from the *hake* (*G. merluccius*) and the *haddock* (*G.*

aeglefinus). It is produced on our coast north of Boston. The oil is also largely produced in Newfoundland, Great Britain, Norway, and to some extent in Iceland.

Preparation.—Fishermen were for a long time in the habit of collecting this oil, which was largely consumed in the arts, particularly in the preparation of leather. Upon the coasts of Newfoundland, Nova Scotia, and New England, the boats which fish near the shore, being small, soon obtain a load, and, running in to land, deliver their cargoes to persons whose business it is to cleanse and salt the fish. The oil was formerly prepared in the huts of the fishermen, but is now prepared more largely at establishments to which the livers are conveyed in quantities. These are put into a boiler with water, and heated until they are broken up into a pultaceous mass, which is thrown upon a strainer covering the top of a cask or tub. The liquid portion passes, and upon standing separates into two parts, the oil rising to the surface of the water. The oil is then drawn off, and, having been again strained, is prepared for the market. Another and improved method, which has come into use since the extensive employment of the oil as a medicine, is to heat the livers in a wooden butt by means of low pressure steam. The pultaceous mass resulting is drained as before mentioned—the livers themselves containing, besides oil, a considerable portion of aqueous fluid, which passes off with it in the form of emulsion and separates on standing. In the case of the finest American varieties, the oil, which is made only in the winter months, is drawn off by taps from the bottom of the cooking butt, and then put into a cooling house to freeze. The solid frozen mass is put into canvas bags, and submitted, while at a low temperature, to severe pressure, whereby the pure liquid oil is forced out, leaving a whitish, tallow-like mass, composed of stearin and liver debris. This residue is sold to the soap makers, and the oil bottled without further process. The oil thus variously procured was called shore oil, and is the purest kind. The manufacture of refined oil by improved processes is developing rapidly in Newfoundland. (See *West. Drug.*, 1897, 13.)

Formerly the crews of the larger boats, which fish upon banks far from land, cleansed the fish on board, and, throwing the offal into the sea, put the livers into barrels or other receptacles, where they underwent a gradual decomposition, the oil rising to the surface as it escaped from the disintegrating tissue. From this was obtained the so-called "Straits oil" and "banks oil." The method is, however, no longer in vogue and

these forms of the oil are unknown in commerce. For further details see *U. S. D.*, 19th edition, p. 857, and *A. J. P.*, xxiii, 97; xxvi, 1. Large quantities of Norwegian cod liver oil are sold in the United States; the method of extraction depending on the action of steam does not differ greatly from that used in America. Another oil is made by the cold process and B. Ranitz, *Ph. Ztg.*, 1900, 261, furnishes the following account: The fresh livers, separated from the gall-bladder, are placed in a wooden tub, 5 feet in height by 7 feet in diameter, until the tub is nearly full, which is then left exposed to the action of the sun, shining day and night in these high latitudes. After about three weeks the extraction is completed, and, owing to the favorable atmospheric conditions' and the evident absence of germs in this far polar region, not the slightest evidence of decomposition manifests itself during this process. The oil runs off pure and simply has the odor characteristic of cod liver oil, and while the "steam cod liver oil" requires refining, that obtained by the "cold process" described is ready for the market as run off from the tubs. This explains why in more southerly latitudes it is impossible to prepare a satisfactory cod liver oil; the cold process is not available, while the steam process does not yield a desirable oil.

The oil is sometimes procured by expression. Donovan recommends the following plan, which affords a very fine oil. The livers, perfectly sound and fresh, are to be placed in a clean iron pot over a slow fire, and stirred until they assume the condition of a pulp, care being taken that the mass be not heated beyond 88.9° C. (192° F.). When this temperature is attained, the pot is to be removed from the fire, and its contents introduced into a canvas bag, through which water and oil will flow into a vessel beneath. After twenty-four hours, the oil is to be decanted and filtered through paper. In this state it is pale yellow, with little odor, and a bland not disagreeable taste.

The chemical composition of the glycerides in cod liver oil is very complicated. Palmitic and stearic acids are present. But the so-called "stearin" separating from cod liver oil on cooling contains some unknown unsaturated compounds, as the cod liver stearin has a very high iodine value (113.4, Heyerdahl; 94, Lewkowitsch). The glycerides of the lower fatty acids, such as acetic, butyric, valeric, and capric acids, stated by various authors to occur in cod liver oil, are according to Salkowski and Steenbuch, secondary products due to the putrefaction of the livers. The researches of Heyerdahl (*Cod Liver Oil and Chemistry*, P. Moller, London, 1895) give as present in the mixed fatty acids about 4 per cent.

of palmitic acid, 20 per cent. of *jecoleic acid*, $C_{19}H_{36}O_2$, and 20 per cent. of *therapic acid*, $C_{17}H_{26}O_2$, *morrhuc acid*, $C_9H_{13}O_3N$, and *asellic acid*, $C_{17}H_{32}O_2$, have also been reported. The former is a nitrogenous compound and is supposed to be identical with a basic substance named *gaduine* which had been reported. Heyerdahl states that in the fresh state cod liver oil contains no hydroxy-acids.

A characteristic constituent of cod liver oil is *cholesterol*, which can be isolated by saponifying the oil and exhausting the soap with ether. The quantity of cholesterol, according to Alien and Thomson, is from 0.46 to 1.32 per cent. By reaction with ammonia in distillation the oil yields a volatile alkaloid, *trimethylamine*, C_3H_9N , which has a strong pungent odor, recalling that of herring pickle, of which the same alkaloid is an ingredient. No other official fatty oil yields a similar product. (See *A. J. P.*, xxiv, 343.) Gautier has obtained from cod liver oil the leucomaines *butylamine*, *iso-amylamine*, *hexylamine*, and *dihydrolutidine*, and two fixed bases, *aselline*, $C_{25}H_{32}N_4$, and *morrhucine*, $C_{19}H_{27}N_3$. Aselline was found by its discoverer to be relatively feeble physiologically; morrhucine, of which about 2 milligrammes are believed to exist in a tablespoonful of ordinary cod liver oil, is affirmed to have the properties of exciting the appetite and acting as a powerful diuretic and diaphoretic. Besides these bases, an acid containing nitrogen has been found. This acid, morrhucic acid, $C_eH_{ia}NO_a$, is probably identical with De Jongh's *gaduine*. Some have been disposed to ascribe the virtues of cod liver oil to its iodine and bromine, but these are in too small proportion for any effect, and the oil has produced results which have never been obtained from iodine and bromine themselves. The presence of iodine cannot be detected by the usual tests. It is necessary to convert the oil into a soap, and to carbonize this, before it will give evidence of iodine. The proportion never exceeds 0.05 per cent., or 1 part in 2000, and it is by no means certain that iodine is always, if ever, present in pure oil. The proportion of iodine present has been investigated by E. C. Stanford (*P. J.* [3], xiv, 353), who found it to be extremely minute, ranging from 0.00138 to 0.00433 per cent., with an average of 0.00322 per cent. The oil is capable of dissolving a larger proportion of iodine, and, if any specimen contain more than 0.05 per cent., there is reason to suspect that iodine has been added. Cod liver oil becomes rancid so easily that it contains varying amounts of free fatty acids, frequently showing their presence, even when freshly rendered. Medicinal oils, however, should not show more than from 0.3 to 0.7 per cent. of free add, calculated as oleic acid.

The so-called active principles of cod liver oil which are found in the market under various names indicative of their origin are usually made by alcoholic extraction of the oil or of the livers themselves. They consist almost entirely of crude fatty acids, no iodine, bromine or phosphorus is detectable, the bases which are sometimes present are in very minute amount, and are probably of the ptomaine type, derived from partly decomposed products. These so-called alcoholic extracts or active principles are themselves scarcely soluble in diluted alcoholic' menstrua, such as are used in preparing the so-called "tasteless" preparations of cod liver oil, so that such preparations can possess little or no activity due to cod liver products.

Uses.—Dr. Owen T. Williams (*P. J.*, 1912, p. 806), in discussing the subject of cod liver oil from the pharmacological and biochemic standpoint, states that the idea that the value of cod liver oil is due to the presence of infinitesimal amounts of constituents, such as sulphur, iodine, phosphorus, etc., is not true, but that its peculiar effectiveness in *tuberculosis* is intimately associated with its food value and is due to the fat itself, which being free from phosphates and consisting almost entirely of unsaturated fatty compounds is a different type of fat from those usually administered or found in foods of the oils on the market. He states that those have the greatest value which have been prepared under the most favorable conditions to prevent oxidation.

The questions of the way in which cod liver oil exercises its beneficent influence in morbid conditions, 'and to which of its numerous ingredients it owes its therapeutic value, are still matters of difference of opinion. Formerly many attributed its actions to the traces of iodine, phosphorus, or organic bases it contained. This view has, however, been generally abandoned; the extracts containing these principles separated from the oil have not yielded the same results. The therapeutic virtues, therefore, apparently reside in some of the constituents of the oil itself. Whether or not it acts simply as a foodstuff or whether it has some direct influence on the bodily metabolism, is open to dispute. It seems pretty well established that not only is cod liver oil absorbed from the intestinal tract better than any other fats, but that it actually increases the utilization of other forms of fatty foods. An interesting observation has been made by Osborne and Mendel that young rats who have been fed on a diet containing no form of fat but lard until their growth has ceased, will immediately recommence growing when cod liver oil is

substituted for the lard. Williams (*B. M. J.*, 1912, ii, p. 700) believes that the unsaturated fatty acids have -a direct inhibiting effect on the growth of the tubercle bacilli which may in part explain its action in tuberculosis.

Cod liver oil is used in all forms of *malnutrition*, especially, however, in various forms of *tuberculosis*. The old idea that it had a specific influence in this infection is probably incorrect, but in the reaction against its use the pendulum has swung too far and it is oftentimes neglected or even condemned in cases in which it might be well employed. It is often of service in those types of *chronic rheumatism* or *gout* which are associated with malnutrition, and has been highly lauded in *rickets* and other diseases of the bones. It is unique among the oils in that it is absorbable through the skin, at least by young infants, in sufficient quantity to have a perceptible influence upon nutrition.

Various measures have been recommended for overcoming the objectionable taste which is a great obstacle to the wider use of this remedy. None of these, however, are entirely successful. It is most frequently exhibited in the form of one of the numerous emulsions upon the market, of which that with malt extract is one of the best. It is sometimes given in flexible capsules, but these have the objection that they can only hold comparatively small doses. Dufourmantel (*J. P. C.*, June, 1864) prepared a jelly by dissolving half a drachm of ichthyo-colla in as little hot water as possible, and then gradually mixing with it a fluidounce of the oil with four drops of the oil of anise, taking care that the temperature should not rise above 24° C. (75.2° F.).

Phosphorized cod liver oil may be made by-dissolving one grain of phosphorus in four fluid-ounces of cod liver oil.

Glyconin Emulsion of Cod Liver Oil.—The formula proposed by Close, and at one time largely used 'by Andrews, Beard, and others, is as follows: Cod liver oil, 4 fluidounces; glyconin, 9 fluidrachms; aromatic spirit of ammonia, 1 fluidrachm; sherry wine, 2 fluidounces, diluted phosphoric acid, 4 fluidrachms, essence of bitter almond (made by dissolving 1 fluidrachm of the volatile oil in half a pint of alcohol) 2 fluidrachms. The cod liver oil is to be added *very slowly* to the glyconin with brisk stirring, and the other ingredients added in the order named. *Glyconin* or *Glyceritum Vitelli* is made by mixing 45 Gm. of fresh yolk of egg with 55 Gm. of glycerin.

The following is Carlo Pavesi's formula for deodorized cod liver oil. Cod liver oil, 1000 parts; ground roasted coffee, 50 parts; animal charcoal, 25 parts. Place the ingredients in a flask, which is to be well closed, and digest on a. water bath during the space of one hour; then set it aside for three days, occasionally shaking' the contents, and filter. This preparation has; a peculiar coffee flavor, and is quite pleasant to take, 'the only objection being the liability to cultivate in the patient a distaste for using coffee as a beverage. (*N. R.*, Jan., 1876.)

The *olein* of cod liver oil has been recommended by Arthur Leared, when the oil itself disagrees with the stomach. He has found it to produce the same remedial effects, and to be borne much better. It may be given in the same dose. A *solution of quinine in the oil* may be made by heating the freshly precipitated alkaloid with the oil, in the proportion of two grains to a fluidounce, by means of a water bath, until the mixture becomes quite clear.

Dose, one to four fluidraehms (3.75-15 mils).

Off. Prep.—Emulsum Olei Morrhuæ, *U. S.*, Emulsum Olei Morrhuæ cum Calcii Lactophosphate, *N. F.*; Emulsum Olei Morrhuæ cum Calcii Phosphate, *N. F.*; Emulsum Olei Morrhuæ cum Malto, *N. F.*; Emulsum Olei Morrhuæ cum Hypophosphitibus, *N. F.*; Emulsum Olei Morrhuæ cum Pruno Virginiana, *N. F.*; Emulsum Olei Morrhuas cum Vitello, *N. F.*

OLEUM MYRISTICÆ. U. S., Br.

OIL OF MYRISTICA

Ol. Myrist. [Myristica Oil, Oil of Nutmeg]

" A volatile oil distilled from the kernel of the ripe seed of *Myristica fragrans* Houttuyn (Fam. *Myristicaceae*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* "Oil of Nutmeg is the oil distilled from Nutmeg, and rectified." *Br.*

Volatile oil of Nutmeg; Oleum Myristicæ Æthereum, Oleum. Nucis Moschati, Oleum Nucistæ Æthereum; Huile volatile (Essence) de Muscade, *Fr.*; Oleum Macidis, *P. G.*; Aetherisches Muskatol, Aetherisches Muskatnussol, *G.*

This oil is obtained from nutmegs after powdering them by distillation with water. A better method, according to J. Cloez, is to exhaust the

powder with carbon disulphide or ether, distil off the solvent by means of a water bath, and expose the butter-like residue to a current of steam, the vapor being conveyed into a refrigerated receiver, where it condenses. (*J. P. C.*, Fev., 1864.) Schimmel & Co. (1899) state that oil of nutmeg is made from the light, worm-eaten nuts, of which large quantities are rejected in sorting the different qualities in Holland. The worm most strangely robs the nutmeg of its fat oil, while the essential oil remains in the nut in full. Oil of myristica is colorless or of a pale straw color, limpid, lighter than water, soluble in an equal volume of glacial acetic acid, in alcohol and ether, with a neutral reaction, a pungent spicy taste, and a strong odor of nutmeg. It is officially described in the United States Pharmacopoeia (Ninth Revision) as a colorless or pale yellow liquid, having the characteristic odor and taste of nutmeg. It is soluble in an equal volume of alcohol; also soluble in 3 volumes of 90 per cent. alcohol. Specific gravity: 0.859 to 0.924 at 25° C. (77° F.).

The mixture of volatile and fixed oils obtained by powerfully expressing nutmegs between heated plates may be separated by agitation with water. Upon standing, the latter deposits a crystalline solid, which was called by Playfair *myristin*. From its solution, in alcohol he obtained it in extremely light crystalline scales, which, after repeated crystallization, had still the odor of nutmeg, were fusible at 31° C. (87.8° F.), soluble in the ordinary menstrua of substances of the same class, and, as just said, insoluble in water. By glacial acetic acid it was first colored red. (*P. J.*, March, 1874, 714.) It was identified as the glyceride of *myristic acid*, $C_{14}H_{28}O_2$, and had, therefore, the formula $C_3H_5(C_{14}H_{27}O_2)_3$. Besides the myristin or solid fat, there is present about an equal amount of a liquid fat containing free acid. The essential oil consists chiefly of pinene with probably some dipentene, also *myristicol*, $C_{10}H_{16}O$, and *myristicin*, $C_{11}H_{12}O_3$, linalool, borneol, terpineol, geraniol, eugenol, and a number of organic acids. Semmler (*Ber. d. Chem. Ges.*, 1890, 1803) examined an oil of myristica of sp. gr. 0.8611 which contained only terpenes; these boiled at about 50° C. (122° F.) under a pressure of 8 mm.

Uses.—The oil of nutmeg unites to the common properties of the aromatics considerable narcotic power. It causes in the lower animals dilatation of the pupils, unsteadiness of the gait followed by sleepiness, with slow respiration, and, if the dose be large enough, loss of reflexes. According to Dale (*Proc. Royal Soc. Med.*, Feb., 1909) doses large enough

to produce narcosis in the cats are invariably fatal through fatty degeneration of the liver. A number of fatal cases of nutmeg poisoning have been reported in human beings. The symptoms have been the same as those which are observed in the lower animals. The toxic ingredient is myristicin.

The oil of nutmeg is used to correct the taste of various drugs and as a local stimulant to the gastro-intestinal tract.

Dose, one to five minims (0.06-0.3 mil).

Off. Prep.—Spiritus Myristicae, *Br.*; Elixir Glycyrrhizae Aromaticum, *N. F.*; Elixir Pepsini et Rennini Compositum, *N. F.*; Mistura Oleo-Balsamica, *N. F.*

OLEUM OLIVÆ. U. S., Br.

OLIVE OIL Ol. Oliv.

"A fixed oil obtained from the ripe fruit of *Olea europaea* Linne (Fam. *Oleaceae*). Preserve it in well-closed containers, in a cool place." *U. S.*
"Olive Oil is the oil expressed from the ripe fruit of *Olea europaea*, Linn., and refined." *Br.*

Sweet Oil; Huile d'Olive, *Fr. Cod.*; Oleum Olivarum, *P. G.*; Olivenol, *G.*; Olio di olive, *It.*; Aceite de olivas, *Sp.*

Olea europaea L. is one of the leading fruit trees of the world. It is usually from fifteen to twenty-five feet in height, though sometimes much larger, especially in Greece and the Levant. It has a solid, erect, unequal stem, with numerous straight branches, covered with a grayish bark. The leaves, which stand opposite to each other on short footstalks, are evergreen, firm, lanceolate, entire, two or three inches in length, with the edges somewhat reverted, smooth and of a dark green color on their upper surface, whitish and almost silvery beneath. The flowers are small, yellowish-white, and disposed in opposite axillary clusters, about half as long as the leaves, and accompanied with small, obtuse, hoary bracts. The fruit, or olive, is a smooth, oblong or oval drupe, greenish at first, but of a deep violet color when ripe, with a fleshy pericarp, and a very hard nut of a similar shape. Clusters of not less than thirty flowers

yield only two or three ripe olives.

The olive tree, though believed by some to have been originally from the Levant, flourishes at present in all the countries bordering on the Mediterranean, and has been cultivated from time immemorial in Spain, the south of France, and Italy. It begins to bear fruit after the second year, is in full bearing at six years, and continues to flourish for a century. There are forty varieties, distinguished by the form of the leaves and the shape, color, and size of the fruit. The variety *longifolia* of Willdenow is said to be chiefly cultivated in Italy and the south of France, and the *latifolia* in Spain. The latter bears much larger fruit than the former, but the oil is less esteemed. The olive is largely cultivated in the north of Africa, especially in the vicinity of Tunis, and considerable quantities of the oil are exported from that city. (*P. J.*, Sept., 1873, 204.) The tree has been introduced into South Australia, and the oil will probably become of commercial importance there.

Olives are cultivated especially in Spain in the district of Cadiz. Two classes are produced, the one known as the "Queen olive," a large olive, which is mostly exported to the United States; the other the Manzanillo, or small olive, which is chiefly consumed in Spain, South America and Cuba. The Spanish production for 1916 amounted to 1,146,599 metric tons of olives and the oil to 207,115 tons. The olive is largely cultivated in California, where it grows luxuriantly. The production of olive oil in the United States in 1916 was 1,336,674 lbs. produced in 22 establishments. The importation of edible olive oil amounted to 7,382,353 gallons.

There are many varieties of the olive grown in California. J. L. Howland, of Pomona, reports the following percentage of oil yielded by each variety as cultivated in California as the result of two years' test; Pendulina, 21; Rubra, 18.5; Oblonga, 18; Mission, 17.9; Uvaria, 17.5; Nevadillo Blanco, 16.5; Columella, 16.5; Precox, 14; Picholine, 10; Manzanillo, 8.5. For further information concerning the subject the reader is referred to the various Proceedings of the California State Convention of Olive Growers.

Pickled olives, made by soaking green olives first in dilute solution of sodium hydroxide and then in salt water, are largely used as an article of food; the ordinary green olive of commerce has been picked before ripening. The ripe olive, which, in the United States, is chiefly obtained

from California, is dark-purple, often almost black, very different in taste from the ordinary unripe pickled fruit, and is said to contain about 50 per cent. of olive oil, so that it affords an excellent method of administering fat.

The leaves and bark of the olive tree have an acrid and bitterish taste, and have been employed as substitutes for cinchona, though with no great success. Attention has been called, in France, to a hydro-alcoholic extract of the leaves, as having considerable febrifuge powers. In the quantity of from ten to twenty grains daily, in divided doses, it has been found useful in preventing the hectic paroxysms. In hot countries, a substance resembling the gum-resins exudes spontaneously from the bark. It was thought by the ancients to possess useful medicinal properties, but is not now employed. Analyzed by Pelletier, it was found to contain resin, a little benzoic acid, and a peculiar principle analogous to gum, which has been named *olivile*. But the fruit is by far the most useful product. In the unripe state it is hard and insupportably acrid, but when macerated in water or an alkaline solution, and afterwards introduced into a solution of common salt it loses these properties, and becomes a pleasant and highly esteemed article of diet. Mannite has been found in all parts of the tree while in vital activity, as in the green leaves and unripe fruit, but cannot be detected in the yellow fallen leaves or in the perfectly ripe fruit. (*A. J. P.*, 1866, p. 179.) The pericarp, or fleshy part of the ripe olive, abounds in a fixed oil, which constitutes its greatest value, and for which the tree is chiefly cultivated in Southern Europe. In the unripe olive a peculiar green substance, together with mannite, has been found by S. de Lutz, both of which disappear as the fruit ripens, being probably converted into oil, which now takes their place. (*J. P. C.*, June and Dec., 1862.) The olives ripen from November to March, and the oil is obtained by first bruising them in a mill and then submitting them to pressure. The product varies much, according to the state of the fruit and the circumstances of the process. The best, called *virgin oil*, is obtained from the fruit picked before perfect maturity, and immediately pressed. It is distinguished by its greenish hue. The common oil used for culinary purposes and in the manufacture of the finest soaps is procured from very ripe olives, or from the pulp of those which have yielded the virgin oil. In the latter case the pulp is thrown into boiling water, and the oil removed as it rises. An inferior kind, employed in the arts, especially in the preparation of the coarser soaps, plasters, unguents, etc., is afforded by fruit which has been thrown into heaps, and allowed to ferment for

several days, or by the marc left after the expression of the finer kinds of oil, broken up, allowed to ferment, and again introduced into the press. The remarks made under the head of *Oleum Myristicae* in relation to the extraction of the fixed oils by means of solvents are applicable also to olive oil.

The greenish color is owing to the presence of a trace of chlorophyll, and a trace of cholesterin is also extracted by repeated agitation with glacial acetic acid.

Olive oil, when exposed to the air, is prone to become rancid, acquiring a disagreeable odor, a sharp taste, and a thicker consistence; it also loses its color, and the change is promoted by heating it.

It is frequently adulterated with the cheaper fixed oils, especially with cottonseed oil, arachis oil, sesame oil and poppy seed oil; the adulteration may sometimes be detected by reducing the temperature to the freezing point. As other oils are less readily congealed than is the olive oil, the degree of its purity will be indicated by the degree of concretion. Another mode has been indicated by Poutet, founded on the property possessed by mercuric nitrate of solidifying the oil of olives, without a similar influence upon other oils. Six parts of mercury are dissolved at a low temperature in seven and a half parts of nitric acid of the sp. gr. 1.35, and this solution is mixed with the suspected oil in the proportion of one part to twelve, the mixture being occasionally shaken. If the oil is pure, it will be converted after some hours into a yellow solid mass; if it contains a minute proportion, even so small as a twentieth, of poppy or cottonseed oil, the resulting mass will be much less firm, and a tenth will prevent a greater degree of consistence than oils usually acquire when they concreate by cold. Lewkowitsch (*Chemical Analysis of Oils, Fats, and Waxes*, 2d ed., 1898, 462) says that the color reactions proposed by various authors are altogether unreliable and yield no definite results, with the exception of the color test (Baudoin's test, see *Oleum Sesami*) for sesame oil and perhaps Bechi's and Milliau's or Halphen's for cottonseed oil. For a method of detecting the *oil of arachis* (*ground nut oil*) in olive oil, see J. P. C., Jan., 1872, 48. Bulletin 77 (1905), of the Bureau of Chemistry, United States Department of Agriculture, showed that most of the spurious and adulterated olive oil in the United States was of domestic origin and that the oil as imported in original packages was mostly genuine. This has been verified by numerous other investigators during recent years. Since the passage of

the Food and Drugs Act in 1906 it is rare to find a labeled container of olive oil adulterated, although much that is sold in bulk is still found to be spurious. In several states it has been judicially decided that the synonyms "sweet oil" and "salad oil" when unqualified mean olive oil. A low grade of olive oil used for soap making and other technical purposes is imported at a less rate duty than is collected on edible olive oil. The frequent use of such low grade oil for table purposes by those who are not particular about quality and flavor led to the requirement on the Part of the U. S. Treasury Department that such "technical oil" must be denatured for admission. There are three alternative and optional methods of denaturing. They consist in adding to the oil a small portion of oleoresin of capsicum, of oil of rosemary or of kerosene. Arachis oil, which is produced in large quantities in Marseilles, has been found in numerous samples of imported olive oil. According to Tambon, the present-day adulterations do not consist in the addition of a single cheaper oil, but of ingeniously prepared mixtures of different oils in such proportions to each other that on analysis it becomes difficult or impossible to distinguish the adulterated from the genuine oil by the chemical and physical constants accepted for the latter. The chief adulterants are benne, peanut and cottonseed oils. Of these, benne is easily recognized, for peanut oil there is as yet no reliable color reaction, and while Bechi's reaction may, under certain conditions, answer well for the detection of cottonseed oil, this, under others, has also proven unreliable. (*Ph. Ztg.*, 1904, 104.) According to Kreis and Grob (*S. W. P.*, 1901, 88) Billier's test is very sensitive. It is carried out by shaking the suspected oil with a solution of resorcinol in benzene and afterwards with nitric acid. Olive oil under these circumstances remains unchanged in color, cottonseed and nut oil become red violet and maw seed oil is turned brown red. Bechi's test for ascertaining the admixture of cottonseed oil with olive oil has received the approval of the Commission of Florence after most exhaustive experiments, and is as follows: One grain (0.065 Gm.) of silver nitrate is dissolved in fifteen minims (0.9 mil) of water, and six and a half fluidounces (195 mils) of alcohol are added. Two fluidounces (or 60 mils) of ether may be added to render the solution more easily miscible with the oil, but it is not absolutely necessary. A solution of eighty-five parts of amyl alcohol and fifteen parts of rape seed oil is prepared. These reagents should not be kept on hand any length of time. To ten mils of the oil to be examined one mil of the solution of silver nitrate is added, and then from eight to ten mils of the amyl alcohol reagent; the mixture is agitated strongly, and heated on a water bath for five or ten minutes. In the case of pure oils the color

is unaltered by the addition of the reagents ; if cottonseed oil be present, a brownish color or turbidity, varying from a light brown to a deep maroon or black (according to the extent of the adulteration), will be produced. (A. J. P., 1887.) See also the official silver nitrate test. Milliau's test is a modification of the foregoing. If the fatty acids instead of the oil itself are treated with the same reagents, the same reduction of the silver salts occurs and the same brown color as in the Bechi test. Halphen's test with a mixture of amyl alcohol and carbon disulphide containing about 1 per cent. of sulphur in solution is now regarded as the most distinctive for cottonseed oil. For details see the official test.

Uses.—Olive oil is nutritious and mildly laxative and is often used in milder cases of chronic *constipation*, especially when associated with malnutrition. In the form of enema it is often a useful remedy in *fecal impaction*. It has also been recommended as a remedy for worms, but is of doubtful value. It was formerly largely used in the treatment of *gall stones* with the idea that it stimulated the secretion of bile. The concretions which were passed by these patients, however, were shown to be masses of hardened soap and it is extremely questionable whether the oil has any real value in this disease. Externally it is useful to soften and relax the skin and to protect it against the action of the air. The most extensive use of olive oil is in pharmacy as a constituent of liniments, ointments, cerates, and plasters.

Dose, as a laxative, from one to two fluid-ounces (30-60 mls).

Off. Prep.—Linimentum Ammoniae, *Br.*; Linimentum Calcis, *Br.*; Linimentum Camphorae, *Br.*; Oleum Phenolatum, *N. F.*; Unguentum Fuscum, *N. F.*

OLEUM PIMENTÆ. U. S.

OIL OF PIMENTA

Ol. Piment. [Oil of Allspice Pimento Oil]

"A volatile oil distilled from the fruit of *Pimenta officinalis* Lindley (Fam. *Myrtaceae*), yielding not less than 65 per cent., by volume, of eugenol [$C_{10}H_{12}O_2 = 164.10$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.*

Oleum Amomi; Oil of Pimento; Huile volatile (Essence) de Piment de la Jamaïque, *Fr.*;

Nelkenpfefferol, Pimentol, G.

Oil of pimenta was deleted from the British Pharmacopoeia 1914.

The berries yield from 1 to more than 4 per cent. of the volatile oil, which as found in commerce is brownish-red, and has the odor and taste of pimenta, though warmer and more pungent. It has a slightly acid reaction.

"Oil of Pimenta is a colorless, yellow or reddish liquid, becoming darker with age and having the characteristic odor and taste of allspice. It is soluble in an equal volume of 90 per cent. alcohol; also soluble in 2 volumes of 70 per cent. alcohol. Specific gravity: 1.018 to 1.048 at 25° C. (77° F.). The optical rotation varies from 0° to -4° in a 100 mm. tube at 25° C. (77° F.).

It consists, like oil of clove, of two distinct portions, one a sesquiterpene, C₁₅H₂₄, and the other a phenol, *eugenol*, capable of extraction by shaking out with alkaline hydroxide solution. They may be separated by distilling the oil from potassium hydroxide solution. After the hydrocarbon is distilled off the phenol may be obtained by liberation from its combination with sulphuric acid and distilling. It is readily recognized as eugenol, so that oil of pimenta is analogous in its constitution to oil of clove (see *Oleum Caryophylli*). Nothing is known of the constituents which give oil of pimenta its characteristic odor.

Oil of pimenta is given for the same purposes as are the other stimulant aromatic oils.

Dose, from three to six minims (0.2-0.4 mil).

Off. Prep.—Liquor Pepsini Aromaticus, *N. F.*; Spiritus Myrciae Compositus, *N. F.*

OLEUM PINI PUMILIONIS. U. S.

OIL OF DWARF PINE NEEDLES Ol. Pin. Pumil. [Dwarf Pine Oil]

"A volatile oil distilled from the fresh leaves of *Pinus montana* Miller (*Pinus Pumilio* Haenke) (Fam. *Pinaceae*). Preserve it in well-stoppered,

amber-colored bottles, in a cool place, protected from light." U. S.

Oleum Pini, Br., 1898; Oil of Pine; Pine Needle Oil; Latchenkieferol, Krummholzöl, G.; Oleum templinum, Pumiline.

The British Pharmacopoeia 1898 replaced fir wood oil by making oil of pine official. This was largely due to the investigations of J. C. Umney (P. 3., 1895, 161, 173, 542), who found that the *Pinus Pumilio* (now recognized as *P. montana* Miller) (*Mountain Pine*) furnished an oil of fairly constant character and superior to that from the *Pinus sylvestris* (*Scotch Fir*) of the British Pharmacopoeia 1885. It was not included in the Br. 1914 but is recognized by the U. S. IX. It " is a colorless or faintly yellowish oil having a pleasant, aromatic odor, and a bitter and pungent taste. Specific gravity: 0.853 to 0.869 at 25° C. (77° F.). No portion of the Oil distils below 170° C. (338° F.)." It resinifies on exposure, and in medicinal qualities resembles oil of turpentine, but is milder. Pine oil contains laevopinene, levo-phellandrene, sylvestrene, *bornyl acetate*, and in the last portions of the distillate, cadinene. (Gildemeister and Hoffmann, *Aetherische Oele*, p. 338.) It is supposed that the pine oil owes its odor to the presence of the acetic ester of borneol, which is ordinarily present to the amount of about 3.5 per cent., and Schimmel & Co. (*Schim. Rep.* for Oct., 1897) found in a sample of American fir oil as much as 12.1 per cent.

Uses.—In medicine it may be employed for many of the purposes for which oil of turpentine has been used. As an expectorant in *chronic bronchitis* it may be administered by the mouth but is especially prized as an inhalant because of its pleasant odor. For this purpose a few drops may be placed in boiling water and the vapors inhaled. It has also been employed internally in the treatment of *chronic rheumatism*.

The leaves of the *Pinus sylvestris*, with those of other European firs and pines, by pounding are converted into a fibrous substance, known as *fir wool* (*Fichtenwolle*), which is much used in Germany as a local application in *chronic rheumatism*, the affected part being enveloped in a thick batting of the fir wool, which is also sometimes made into clothing for rheumatic persons. An extract of the leaves is also sold under the name of *fir wool extract*, for use in rheumatism.

Dose of oil of pine needles five to ten minims (0.3-0.6 mil).

OLEUM RICINI. U. S., Br.

CASTOR OIL Ol. Ricin.

"A fixed oil obtained from the seeds of *Ricinus communis* Linne (Fam. *Euphorbiaceae*). Preserve it in well-closed containers." *U. S.* "Castor Oil is the oil expressed from the seeds of *Ricinus communis*, Linn." *Br.*

Huile de Ricin, *Fr. Cod.*; Oleum e semine Ricini, *Fr.*; Oleum Ricini, *P. G.*; Ricinusol, *G.*; Olio di ricino, *It.*; Aceite de ricino; Oleum Palmae Christi, *Sp.*

The castor oil plant, or *palma Christi*, is a native of India and is now extensively cultivated in the warmer regions throughout the world. In India there are about seventeen different varieties grown which are grouped into two types. (1) The one consisting of tall shrubs or small trees, being usually planted as a shade for other crops and yielding large seeds which contain an abundance of inferior oil. (2) The second type includes the herbaceous annuals, which, while they produce small yields, yield a much better grade of fixed oil.

The following description applies to the plant as cultivated in cool latitudes. The stem is of vigorous growth, erect, round, hollow, smooth, glaucous, somewhat purplish towards the top, branching, and from three to eight feet or more in height. The leaves are alternate, peltate, palmately six to eleven lobed, the lobes acute or acuminate and serrate, smooth on both sides, and of a bluish-green color. The flowers are monoecious, stand upon jointed peduncles, and form a pyramidal terminal raceme, of which the lower portion is occupied by the male flowers, the upper by the female. Both are destitute of corolla. In the staminate flowers the calyx is divided into five oval, concave, pointed, reflected, purplish segments, and encloses numerous stamens, united into fasciculi at their base. In the pistillate the calyx has three or five narrow lanceolate segments, and the ovary, which is roundish and three-sided, supports three linear, reddish stigmas, forked at their apex. The fruit is a roundish, glaucous capsule, with three projecting sides, covered with tough spines, and divided into three loculi, each containing one seed, which is expelled by the bursting of the capsule. This species of *Ricinus* is a native of the East Indies and Northern Africa, naturalized in the West Indies, and cultivated in various parts of the world, in few countries more largely than in the Middle and Western United States. The flowers appear in July, and the seeds ripen

successively in August and September. A decoction or poultice of the leaves is sometimes used as a local galactagogue, and an infusion has been given internally for a similar purpose. (*L. L.*, Dec., 1859.)

1. THE SEEDS.—These are from 8 to 18 mm. long and 4 to 12 mm. broad, oval, compressed, obtuse at the extremities, very smooth and shining, and of a grayish or ash color, marbled with reddish-brown spots and veins. At one end of the seed is a small yellowish caruncle, from which an obscure longitudinal ridge proceeds to the opposite extremity, known as the raphe. In its general appearance the seed is thought to resemble the insect called the tick, the Latin name of which has been adopted as the generic title of the plant. Its variegated color depends upon a very thin pellicle closely investing a hard, brittle, blackish, tasteless, easily separated shell, within which is the kernel, highly oleaginous, of a white color, and of a sweetish taste succeeded by a slight degree of acrimony. The seeds easily become rancid, and are then unfit for the extraction of the oil, which is acrid and irritating. In 100 parts Geiger found, exclusive of moisture, 23.82 parts of envelope, and 69.09 of kernel. These 69.09 parts contained 46.19 of fixed oil, 2.40 of gum, 20.00 of starch and lignin, and 0.50 of albumen. Henry Bower could find no starch, but separated from the seeds an albuminoid principle, which acted with amygdalin and water like emulsin, producing the odor of oil of bitter almond, though in a less degree. (*A. J. P.*, xxvi, 208.) It is highly probable that it is this principle which, acting as an enzyme on the oily matter of the seeds, gives rise to changes in its nature which render them rancid. (See *Olea Fixa*, p. 810.) G. J. Scattergood found the odor of castor oil to be developed in the beans when bruised with water, and much more powerfully in those long kept than in the fresh. The water distilled from the seeds has a peculiar nauseous odor, quite distinct from that of the oil. (*A. J. P.*, xxvii, 207.)

Taken internally the seeds are powerfully cathartic, and often emetic. Two are sufficient to purge with great violence, and three have produced fatal gastro-enteritis in the adult. After expression of the oil, and treatment with pure alcohol, Calloud found the residue to be powerfully emetic in the quantity of 30 grains, taken in two doses. (*J. P. C.*, 3e ser., xiv, 190.) According to Guibourt, the toxic property pervades the whole kernel, the integuments being inert. The experiments of Scattergood, who found that the water distilled from the seeds is emetic and cathartic, would seem to show that the active principle is volatile, but the researches of Stillmark indicate that it is an enzyme, new,

which is a so-called phytalbumose and has been obtained as a white amorphous powder, and is best dissolved in a 10 per cent. salt solution. The aqueous solution of the pure ricin has a neutral reaction. It is a violent poison. E. L. Boerner (A. J. P., 1876, p. 481) obtained butyric acid by macerating the exhausted marc of the seeds with water until decomposed.

2. THE OIL.—This may be extracted from the seeds in three ways: 1, by decoction; 2, by expression; 3, by the agency of alcohol or other solvent.

The process by decoction, which has been practised in the East and West Indies, consists in bruising the seeds, previously deprived of their husk, and then boiling them in water. The oil, rising to the surface, is skimmed or strained off, and afterwards again boiled with a small quantity of water to dissipate the acrid principle. The seeds, it is said, are sometimes roasted, to increase the yield. But by a temperature much above 100° C. (212° F.) the oil is rendered brownish and acrid, and the same result takes place in the second boiling, if care is not taken to suspend the process soon after the water has been evaporated; hence it happens that the West India oil has generally a brownish color, an acrid taste, and irritating properties.

The oil is obtained in this country by expression. The following, we have been informed, are the outlines of the process usually employed by those who prepare it on a large scale. The seeds, having been thoroughly cleansed from the dust and fragments of the capsules with which they are mixed, are conveyed into a shallow iron reservoir, where they are submitted to a gentle heat insufficient to scorch or decompose them, and not greater than can be readily borne by the hand. The object of this step is to render the oil sufficiently liquid for easy expression. The seeds are then introduced into a powerful hydraulic press. A whitish oily liquid is thus obtained, which is transferred to clean iron boilers supplied with a considerable quantity of water. The mixture is boiled for some time, and, the impurities being skimmed off as they rise to the surface, a clear oil is at length left upon the top of the water, the mucilage and starch having been dissolved by this liquid, and the albumen coagulated by the heat. The latter ingredient forms a whitish layer between the oil and the water. The clear oil is now carefully removed, and the process is completed by boiling with a minute proportion of water, and continuing the application of heat until aqueous vapor ceases to rise, and until a small portion of the liquid,

taken out in a vial, continues perfectly transparent when it cools. The effect of this last operation is to clarify the oil, and to render it less irritating by driving off the acrid volatile matter. But much care is requisite not to push the heat too far, as the oil then acquires a brownish hue and an acrid peppery taste. After the completion of the process, the oil is put into barrels and sent into the market. See article on the preparation of castor oil. (*A. J. P.*, 1879, p. 481.) There is reason, however, to believe that much of the American oil is prepared by merely allowing it to stand for some time after expression, and then drawing off the supernatant liquid. One bushel of good seeds yields five or six quarts, or about 25 per cent. of the best oil. If not carefully prepared, it is prone to deposit a sediment upon standing, and the apothecary may find it necessary to filter it through coarse paper before dispensing it. Perhaps this may be owing to the plan just alluded to of purifying the oil by rest and decantation. We have been told that the oil in barrels usually deposits in cold weather a copious whitish sediment, which is redissolved when the temperature rises. A large proportion of the oil consumed in the eastern section of the Union has been derived, by the way of New Orleans, from Illinois and the neighboring States, where it has been at times so abundant that it has been used for burning in lamps and for lubricating machinery.

The process for obtaining castor oil by means of alcohol has been practised in France, but the product is said to become rancid more speedily than that procured in the ordinary mode. Such a preparation has been employed in Italy, and is asserted to be less disagreeable to the taste, and more effective, than the common oil obtained by expression. According to Parola, an ethero-alcoholic extract and an ethereal or alcoholic tincture of the seeds operate in much smaller doses than the oil, and with less disposition to irritate the bowels or to cause vomiting. (See *Am. J. M. S.*, N. S., xiii, 143.)

Owing to the presence of ricin, "*castor pomace*" or the oil cake obtained by the extraction of castor oil, is unfit for animal food. For the process of removing the poisonous principle see *P. J.*, lxviii, 213.

Italian Castor Oil.—The castor oil plant is cultivated throughout Italy, but especially in the neighborhood of Verona, where the oil is prepared with great care and is remarkably free from the peculiar odor and taste which render this medicine so repulsive to many palates. As it is highly desirable, for certain purposes, that the oil should be as free from these

properties as possible, it is a point worthy of investigation, why it is that the Italian oil is superior to most commercial varieties of the oil in these respects. The following facts in relation to the mode of preparing the oil practised at Verona, published by H. Groves, of Florence, acquire on this account a special value. One point of importance is that the seeds are used fresh, as 'the oil rapidly becomes rancid in them when kept. Another fact is that the seeds are entirely deprived of their coating before being submitted to pressure. This is effected by passing them between two revolving wooden rollers, with a winnowing machine beneath, and, to secure the complete absence of integument, they are afterwards assorted by the hand, all being rejected which are not perfectly decorticated. They are then put into hempen bags, which are arranged in layers with a sheet of iron heated to 32.2° C. (90° F.) between them, so as to enable the oil to flow. Lastly, they are submitted to pressure by hydraulic presses. The oil which now flows is of the finest quality. An inferior kind is obtained by pressing the marc at a somewhat higher heat. An interesting and valuable article on the cultivation of the castor bean in the United States appears in the *Proc. P. Ph. A.*, 1916, p. 209, by Joseph L. Lemberger.

Properties.—Pure castor oil is a thick, viscid, colorless liquid, with little odor, and a mild though somewhat nauseous taste, followed by a slight sense of acrimony. As found in commerce it is often tinged with yellow and has an unpleasant odor, and parcels are sometimes, though rarely, met with of a brownish color and hot acrid taste. It does not readily congeal by cold. When exposed to the air it slowly thickens, without becoming opaque. When exposed to the air in a thin layer, it slowly dries to a varnish-like film. It is heavier than most of the other fixed oils. It differs also from most other fixed oils in being soluble in all proportions in cold absolute alcohol. "Castor Oil is a pale yellowish or almost colorless, transparent, viscid liquid, having a faint, mild odor, and a bland, afterwards slightly acrid and generally nauseating taste. It is miscible with dehydrated alcohol or glacial acetic acid. Specific gravity: 0.945 to 0.965 at 25° C. (77° F.). Castor Oil is only partly soluble in petroleum benzin (distinction from *most other fixed oils*). Castor Oil produces a clear liquid with an equal volume of alcohol (foreign oils). Saponification value: not less than 179 nor more than 185 (see Part III, Test No. 9). Iodine value: not less than 83 nor more than 88." U. S.

Weaker alcohol, of the sp. gr. 0.8425, takes up about three-fifths of its weight. It has been supposed that adulterations with other fixed oils

might thus be detected, as the latter are much less soluble in that fluid, but Pereira has shown that castor oil has the property of rendering a portion of other fixed oils soluble in alcohol, so that the test cannot be relied on. (*P. J.*) ix, 498.) Such adulterations, however, are seldom practised in this country. Castor oil is soluble also in ether, and in its weight of glacial acetic acid. Its proximate composition has been repeatedly investigated. The bulk of it is *ricinolein*, $C_3H_5(C_{18}H_{33}O_3)_3$, which is the *ricinoleic acid* ($C_{18}H_{34}O_3$) glyceride. At the same time it also contains a small quantity of tristearin and of the glyceride of dihydroxy-stearic acid, together with from 0.30 to 0.37 per cent. of unsaponifiable matter. Ricinoleic acid, as obtained from the decomposition of the glyceride, is a viscid oil, which solidifies below $0^\circ C.$ ($32^\circ F.$), does not solidify in contact with the air by absorption of oxygen, and is not homologous with oleic or linoleic acid, neither of which is found in castor oil. On warming with 1 part of starch and 5 parts of nitric acid (sp. gr. 1.25) castor oil thickens, owing to the formation of *ricinelaidin*. From this *ricinelaidic acid* may be obtained in brilliant crystals. Ricinoleic acid is converted by potassium hydroxide into caprylic alcohol and sebacic acid, with disengagement of hydrogen, and the same products are obtained by the reaction of potassium hydroxide with the oil itself. (See *J. P. C.*, Aout, 1885, 113.) Its purgative property is supposed by Bussy and Lecanu to belong essentially to the oil, and not to any distinct principle which it may hold in solution. According to O. Popp, castor oil differs from most other fixed oils in turning the plane of polarized light to the right. (*A. J. P.*, Aug., 1871, 354; from *A. Pharm.*, 1871.) Various substances containing coloring principles, which they yield to castor oil, produce beautiful fluorescence in that fluid when heated with it, such as logwood, turmeric, camwood, etc. (Charles Horner, *P. J.*, Oct., 1874, p. 282.)

Ricinine is a basic substance, $C_8H_8O_2N_2$, which is soluble in all of the ordinary solvents and which occurs as colorless crystals optically inactive and neutral in reaction. It is precipitated from aqueous solutions by Mayor's reagent and Wagner's reagent, showing alkaloidal properties thereby. It is not especially toxic.

Buchheim believes the active principle of castor oil to be *ricinoleic acid*; this has been confirmed by the experiments of Hans Meyer (*A. E. P. P.*, xxviii, 1890), who finds that both pure ricinoleic acid and the ricinoleate of glyc-eryl are active purgatives. Ricinelaidic acid, which Buchheim

believed to be inactive, Meyer finds when given in fine emulsion to act as powerfully as does castor oil.

By the action of concentrated sulphuric acid upon castor oil is formed a valuable product known as "*Turkey-red oil*," much used in dyeing and printing with madder and alizarine. The water-soluble portion of this Turkey-red oil is *ricinoleo-sulphuric acid*, $C_{13}H_{33}O.O.HSO_3$. Turkey-red oil acts as a fixing agent, imparting a superior luster to the fiber dyed with its aid.

Castor oil which is acrid to the taste may sometimes be rendered mild by boiling it with a small proportion of water. If turbid, it should be clarified by filtration through coarse paper. On exposure to the air it is apt to become rancid, and is then unfit for use.

Twombly finds that the best method for removing the odor and taste of castor oil is by washing a cold pressed oil several times with boiling water. After separating, the oil is filtered cold very slowly through a thick layer of powdered animal charcoal. Any effort to quicken the method gives poor results.

Commercially ricin has been employed for the detection of pepsin. For details of the method see Solms. (*Z. K. M.*, 1907.)

Uses.—The cathartic effects of castor oil are due to its ricinoleic acid which is split off in the intestinal tract. This, by gentle irritation of the mucous membrane, excites active peristalsis in the upper bowel and probably also somewhat increases the intestinal secretions, although the main action appears to be due to the increased peristalsis. Because of the thoroughness with which it empties the enteric canal there is on the following day an insufficient accumulation of intestinal contents and hence constipation is liable to follow. Because it cleans out the whole alimentary system and that with relatively small degree of irritation, it is especially valuable in conditions of irritation or inflammation of the bowels, as *colic*, *enteritis*, or *dysentery*; on account of the tendency to subsequent constipation it is not to be recommended as a habitual laxative. It is habitually resorted to in cases of *pregnant* and puerperal women, and is decidedly, as a rule, the best and safest cathartic for children. Infants usually require a larger relative dose than adults.

Externally it is useful for its emollient effects in *seborrhea* and other

skin diseases, having the advantage over other oils of being soluble in alcohol.

The dose for an infant is from one to three or four fluidrachms (3.75-11.25-15 mils). It is difficult of administration, from its peculiarly disagreeable taste and from its clamminess and adhesiveness to the mouth. In a few cases, the disgust which it excites is utterly unconquerable by any effort of resolution. A common method of disguising the taste is to give it floating in mint or cinnamon water, but that which we have found, upon the whole, the least offensive is to give it floating on the froth of sarsaparilla syrup mixed with carbonic acid water. Some take it in wine, or spirituous liquors, or the froth of porter, but these are often contra-indicated by their stimulant property. When the stomach is unusually delicate, the oil may be made into an emulsion with mucilage or the yolk of an egg, loaf sugar, and an aromatic water. Tragacanth has been recommended as producing a better emulsion than gum arabic. Tincture of opium may be added in cases of intestinal irritation. A *castor oil jelly* containing over 90 per cent. of the oil may be made by adding a little stearic acid to the melted oil and then saponifying with a very small amount of an alcoholic solution of sodium hydroxide. This forms a jelly-like preparation which may be sweetened with saccharin and flavored with any desired volatile oil. Castor oil may also be beneficially used as an enema, in the quantity of two or three fluidounces (60 or 90 mils), mixed with some mucilaginous liquid. It has been recommended as a local application to the breasts of nursing women, to promote the secretion of milk.

Though prone to become rancid by itself, it loses much of its susceptibility when mixed with lard, and some druggists are said to use it as a substitute for olive oil in ointments and cerates.

Dose, half a fluidounce to two fluidounces (15-60 mils).

Off. Prep.—Mistura Olei Ricini, *Br.*; Emulsum Olei Ricini, *N. F.*; Oleum Ricini Aromaticum, *N. F.*; Pilulae Antimonii Compositae, *N. F.*

OLEUM ROSÆ. Br.

OIL OF ROSE

" Oil of Rose is the oil distilled from the fresh flowers of *Rosa damascena*,

Linn." *Br.*

Oleum Rosarum; Attar or Otto of Rose; Huile volatile de Rose pale, *Fr. Cod.*; Essence de Rose, *Fr.*; Oleum Rosae, *P. G.*; Rosenol, *G.*; Essenza de rose. *It.*

Oil of Rose was not admitted to the U. S. P. IX. Fats and oils saturated with the rose perfume have been used since the earliest times. Of the seven thousand or more cultivated varieties of rose only a few are used for the production of oil. The chief of these is *Rosa damascena*, which is supposed to be a hybrid between *B. gallica* and *R. canina*. The volatile oil from this species is commonly called *attar*, *otto*, or *essence of roses*. It is prepared on a large scale in Turkey in Europe, especially in the Balkan Mountains, in Egypt, Persia, Cashmere, India, and other countries of the East, but European and American commerce is at present supplied chiefly from the region constituting the southern slope of the Balkans, and to some extent, from flowers cultivated in Germany. Synthetic Oil of Rose has entered commerce. The Bulgarian production of rose oil for 1913 amounted to 3600 kilos. (*Schim. Rep.*, Oct., 1913.) The roses are gathered in May, and are distilled with the green leaves of the calyx. From thirty to sixty pounds are put into a tinned copper boiler, of the capacity of about 150 pounds, nearly filled with water. The heat is applied over an open fire, and a boiling temperature is continued for two hours, when the first part of the distilled fluid is returned to the boiler, and the process is continued to completion. The oil collects on the top of the water in the receiver, when it is removed from time to time as it accumulates. (*P. J.*, June, 1872, p. 1051.) In the south of France a small quantity of oil of rose is prepared by distilling the petals with water and separating the oil which floats to the surface. The annual output of the oil is small, most of it being marketed in the form of rose water of which over 3,600,000 liters are produced annually. (*Schim. Rep.*, Oct., 1907.)

Oil of rose is furnished in very minute proportion, not more than three drachms having been obtained by Polier in Hindostan, from 100 pounds of the petals. It is usually imported in small bottles, and is very costly. Oil of rose was at one time prepared in Macedonia by crushing the petals in mills, expressing the fluid part, filtering it, and then exposing it to the sun in small glass vessels. The oil gradually collects on the surface of the liquid, and is removed. (*Ph. Cb.*, 1847, p. 783.) Landerer states that at Damascus and in other parts of Asia Minor the oil is prepared by dry distillation. The buds, being collected before sunrise,

are placed in a glass retort, and the distillation is effected by a salt water bath, care being taken so to regulate the heat as not to scorch the petals. The water of the fresh roses and their oil come over together, and the latter, floating on the top, is readily separated.

For an account by R. Bauer of Constantinople, of oil of rose, its production, properties, adulteration, etc., see *P. J.*, Dec., 1867, 286; also *A. J. P.*, 1881, 367.

The experiments of Schimmel are said to indicate that the oil of rose can be prepared from German-grown flowers with commercial success. It is affirmed that the product is superior to the Turkish oil in fineness and strength of aroma, and also that it differs in having a higher congealing point, German oil solidifying at 32° C. (89.6° F.), Turkish oil at 20° C. (68° F.). For an account of its production, see *P. J.*, Aug., 1886; also *P. J.*, 1893, 262.

Oil of rose is nearly colorless, or presents some shade of green, yellow, or red, but, according to Polier, the color is no criterion of its value. Its odor is very powerful and diffusive. At 32.2° C. (90° F.) its sp. gr. is 0.832. Alcohol dissolves it, though not freely when cold. It was officially described in U. S. P. VIII as if a pale yellowish, transparent liquid, having the strong, fragrant odor of rose, and a mild, slightly sweetish taste. Specific gravity: 0.855 to 0.865 at 25° C. (77° F.). The addition of 70 per cent. alcohol precipitates the paraffin hydrocarbons of the Oil, but forms a clear solution with its other constituents, the solution being slightly acid to litmus T.G. The congealing point, when determined according to the following method, should be between 18° and 22° C. (64.4° and 71.6° F.). Introduce about 10 mls of Oil into a test-tube of about 15 Mm. diameter; insert a thermometer in such a manner that it touches neither the bottom nor the sides of the tube. Raise the temperature of the Oil in the tube from 4° to 5° above the saturation point by grasping it in the hand, and shake the tube gently. Allow the Oil to cool, and when the first crystals appear, note the temperature. This is regarded as the congealing point; a second test should be made for confirmation." *U. S. VIII.*

"A pale yellow or yellowish-green crystalline mass, semi-solid at ordinary temperatures. Strong, fragrant, rose-like odor; taste sweetish. Specific gravity at 30° C. (86° F.) (compared with water at 15.5° C. (60° F.)) 0.854 to 0.862; optical rotation —2° to -4°; refractive index at 25° C.

(77° F.) 1.456 to 1.465; melting point 20° to 23° C. (68°-73.4° F.)." *Br.*

Oil of rose consists of two portions, one liquid, the other solid at ordinary temperatures. These may be separated by freezing the oil and compressing it between folds of blotting paper, which absorbs the liquid oil and leaves the concrete stearopten. The liquid portion is oxygenated, while the solid portion, which is odorless when pure, consists of a mixture of several hydrocarbons, one of which melts at from 35.5° to 36.5° C. (96°-97.7° F.), and is a paraffin of the formula $C_{16}H_{34}$. A sample of oil of rose distilled in Leipsic in 1884 yielded 28 per cent. of this stearopten, an inferior oil distilled in London gave 68 per cent., and a very good oil from the Balkans gave 9.20 per cent. The oxygenated portion consists of the two alcohols, $C_{10}H_{18}O$ geraniol, and $C_{10}H_{20}O$ citronellol, the former constituting 75 per cent. of the oil. The rhodinol of Eckart was a mixture of these two alcohols. (*Schim. Rep.*, April, 1898, 40.) While these two alcohols are mainly found in rose oil in the free state, esters of the same are also present in amounts varying from 2.5 to 3.5 per cent. (Gildemeister and Hoffmann, *Aetherische Oele*, p. 565.) Linalool, citral and phenyl ethyl alcohol are also present in small amounts.

Oil of santal, other volatile oils, fixed oils, spermaceti, etc., are said to be added almost universally as adulterations. The volatile additions may be detected by their not being concrete; the fixed, by the greasy stain they leave on paper when heated. Guibourt has offered certain tests by which he thinks the purity of the oil may be determined. (See *A. J. P.*, xxi, 318.) A. Ganswindt recommends the following tests. Agitate 1 drop of the oil with 45 Gm. of warm water, and sprinkle the solution in a moderately warm room, which will soon be filled ' with a rose odor, in which foreign odors may be detected without difficulty. An adulteration with a fixed oil produces a permanent grease stain upon paper, and spermaceti is left behind on the evaporation of a few drops of the oil from a watch crystal in a water bath. On mixing a few drops of pure oil of rose with an equal bulk of sulphuric acid, the rose odor is not changed, but oils used for adulteration change their odor, which becomes apparent in the rose odor. Or 5 drops of the oil are mixed in a dry test tube with 20 drops of pure concentrated sulphuric acid; when the mixture is cool it is agitated with 20 Gm. of absolute alcohol, when a nearly clear solution should be obtained, which, heated to boiling, remains clear yellowish-brown on cooling. In the presence of the oil of rose geranium, palmarosa, etc., the alcoholic mixture is turbid, and on

standing separates a deposit without becoming clear. (*Seifens. Ztg.*, 1881, p. 32; *A. J. P.*, May, 1881.) The oil of one of the sweet scented *Pelargoniums*, perhaps the *rose geranium*, is much employed in Turkey for the purpose of adulteration. According to Hanbury, who appears to have thoroughly investigated the subject, two substances especially are used in Constantinople for adulterating' the oil— one spermaceti, the other a volatile oil produced by certain grasses in the East Indies belonging to the genus *Andropogon*, large quantities of which are exported from Bombay, partly directly to Europe, partly through the Arabian Gulf, whence it reaches Constantinople. The same oil is imported into London under the name of *Turkish essence of geranium*, or *geranium oil*.

Tedermann (*Zeit. An. Chem*; 1895, 5) reached the conclusion, after much experimenting, that there is no reliable chemical or physical test for the adulteration of oil of rose with geranium oil. The sense of smell, according to Conroy, furnishes the best means of determining the quality; he recommends the dissolving of one drop of oil of rose in twenty drops of alcohol, pouring the solution in one fluidounce of warm water, shaking, and comparing the odor with that of a standard sample treated in the same way. (*P. J.*, 1896, 474; see also *C. D.*, 1897, 53.) O. Helm (*A. Pharm.*, 1885) states that the test with a mixture of five parts of chloroform and twenty parts of alcohol cannot be relied upon, as no separation of crystalline scales took place in four different rose oils which were doubtless genuine. But Fliiekiger, on the other hand, stated that in an experience of many years it had never failed. According to Bauer, the best tests of the purity of the oil are found in its congealing, in five minutes, at a temperature of 12.5° C. (54.5° F.), and its crystallizing, as a solid mass, in light, shiny plates, present everywhere throughout the liquid. These crystals are truncated semi-sided prisms, the angles of which are unequal, and which must be classed in the rhombic system. This stearoptene melted and allowed to cool, crystallizes in a manner so complete that the microscope can readily reveal the presence of foreign substances, such as spermaceti, fatty bodies, wax, and other analogous amorphous substances.

Oil of rhodium (Oleum ligni Rhodii, Aspalathum). This oil was attributed by Lewis to the *Convolvulus Scoparius*, but according to Holvaes (*Perfume and Essential Oil Record*, 1911, ii, p. 29) is the product of a species of *Genista*, either *G. canariensis* or *virgata*. It is used to adulterate oil of rose. Guaiac wood oil is also occasionally used for the

same purpose. A factitious oil of rhodium is sometimes sold as a lure for rats and other animals. It is made from oil of copaiba flavored with a trace of oil of rose. The synthetic oil of rose has largely replaced that obtained by distillation.

Oil of rose may be added, as a grateful perfume, to various spirituous preparations for internal use, and to cerates and ointments.

Off. Prep.—Unguentum Aquae Rosas, *Br.*

OLEUM ROSMARINI. U. S., Br.

OIL OF ROSEMARY

Ol. Rosmar. [Rosemary Oil]

" A volatile oil distilled from the fresh flowering tops of *Rosmarinus officinalis* Linne (Fam. *Labiatae*), yielding not less than 2.5 per cent. of ester, calculated as bornyl acetate [$C_{10}H_{17}C_2H_3O_2 = 196.16$], and not less than 10 per cent. of total borneol [$C_{10}H_{17}OH = 154.14$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* " Oil of Rosemary is the oil distilled from the flowering tops of *Rosmarinus officinalis*, Linn." *Br.*

Oleum Rosmarini, Oleum Anthos; Huile volatile de Romarin, *Fr. Cod.*; Essence de Romarin, *Fr.*; Oleum Rosmarini, *P. G.*; Rosmarinol, *G.*; Essenza di rosmarino, *It.*; Esencia de romero, *Sp.*

The fresh leaves of rosemary yield, according to Baume, 0.26 per cent. of volatile oil, but the percentage is rated much higher by others. Schimmel & Co. obtained by distillation from, dry French rosemary flowers 1.4 per cent. of oil.

This oil is colorless, with an odor similar to that of the plant, though less agreeable. Its sp. gr. is said to be 0.911, but reduced to 0.8886 by rectification (0.894 to 0.912, *U. S.*). Buig-net gives the sp. gr. of the rectified oil at 0.896, and states that it is moderately dextrogyrate. Its reaction is neutral. It is soluble in all proportions in alcohol of 0.830, but requires for solution at 17.7° C. (64° F.) forty parte of alcohol of 0.887. (Berzelius.) It is officially described as "a colorless or pale yellow liquid, having the characteristic odor of rosemary, and a camphoraceous taste.

It is soluble in 10 volumes of 80 per cent. alcohol. Specific gravity: 0.894 to 0.912 at 25° C. (77° F.)." U.S.

"Colorless or pale yellow. Odor that of rosemary; taste warm, camphoraceous. Specific gravity 0.895 to 0.920; optical rotation -2° to 4-15°; refractive index at 25° C. (77° F.) 1.463 to 1.473. Soluble in 1 part of alcohol (90 per cent.), and in 5 to 10 parts of a mixture of equal volumes of alcohol (90 per cent.) and alcohol (70 per cent.). Contains not less than 10 per cent. of total alcohols, calculated as borneol, C₁₀H₁₈O, and not less than 1.8 per cent. of esters, calculated as bornyl acetate, C₁₀H₁₇C₂H₃O₂." *Br.*

Kane gives its sp. gr. at 0.897, its boiling point at 185° C. (365° F.). Kept in bottles imperfectly stoppered, it deposits a stearopten, sometimes amounting, according to Proust, to one-tenth of the oil. Both Gladstone and Fluckiger find that most of the oil consists of a hydrocarbon of the composition C₁₀H₁₆, boiling at 165° C. (329° F.), and Schimmel & Co. (*Schim. Rep*; Oct., 1889) identified this hydrocarbon as pinene, but there is a smaller fraction boiling at from 200° to 210° C. (392°-410° F.), which at low temperatures deposits a camphor, C₁₀H₁₈O, identified as borneol. Weber examined oil of rosemary in Wallaces laboratory (*Ann. Ch. Ph.*, ccxxxviii, 89), and found that the fraction boiling between 176° and 182° C. (348.8°-359.6° F.) contains cineol, C₁₀H₁₈O. The oil is therefore recognized at present as containing d-pinene, camphene, cineol, borneol (10-15 per cent.), and camphor. According to Fluckiger (*A. J. P.*, 1885, 132), from 20,000 to 25,000 kilogrammes of oil of rosemary were produced in Grasse every year. It is said to be sometimes adulterated with oil of turpentine, which may be detected by mixing the suspected liquid with an equal volume of pure alcohol, the oil of rosemary is dissolved, and that of turpentine left. This oil is stimulant, but is employed chiefly as an ingredient in rubefacient liniments. For a case of fatal poisoning, see *A. J. P.*, xxiii, 286.

Dose, three to six minims (0.2-0.4 mil).

Off. Prep.—*Spiritus Rosmarini, Br.*; *Tinctura Lavandulae Composita, U. S., Br.*; *Spiritus Odoratus, N. F.*

OLEUM SANTALI. U. S., Br.

OIL OF SANTAL

Ol. Santal. [Oil of Sandalwood Santalwood Oil]

"A. volatile oil distilled from the wood of *Santalum album* Linne (Fam. *Santalaceae*), yielding not less than 90 per cent. of alcohols, calculated as santalol [$C_{15}H_{26}O = 222.21$]. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* " Oil of Sandal Wood is the oil distilled from the wood of *Santalum album*, Linn." *Br.*

Oleum Ligni Santali; Oleum Santali Flavi; Oil of Sandal Wood; Huile volatile (Essence) de Santal, *Fr.*; Oleum Santali, *P. G.*; Ostindisches Sandelholzöl, Santelöl, *G.*; Esencia de sandalo, *Sp.*

Under the name of sandalwood various drugs of diverse origin and character find their way into commerce. Of these, the wood of the *Pterocarpus santalinus* is described in this book under its official name of *Santalum Rubrum*, or *Red Saunders. Sandal wood bark*, which is believed by H. Stieren to be obtained from some species of *Myroxylon* or *Myrospermum*, is described as occurring in irregular, more or less smooth or unevenly corrugated pieces, of a light, whitish-cinnamon color, with dark, hard epidermis, and of an agreeable, custard-like odor, and an aromatic, slightly acrid, balsamic, bitterish taste. From it Stieren obtained over fifteen per cent. of a clear substance resembling Peruvian balsam. This bark is used for burning in churches as a substitute for frankincense, and bears no relation to sandalwood proper. (*P. J.*, xv, 680.) A sandal wood is yielded by the *Fusanus spicatus* (*S. Cygnorum*) and *F. acuminatus* (*S. acuminatum*) of Australia, whence it is shipped in large quantities to China. An oil distilled from this wood, now coming into the European market, is said to be less odorous than the official product.

Other varieties of sandal wood are collected in the Hawaiian Islands from *Santalum Freycinetianum* Gaud., and *S. pyrularium* A. Gray; in the Fiji Islands from *S. Tasi* Seem.; in New Caledonia from *S. austrocaledonicum* Vieillb.; and in Queensland from *Eremophila Mitchellii* Benth. (Fam. *Myoporaceae*). For an account of the sandal wood oil industry of Western Australia, see *C. D.*, 1898, 708. For elaborate microscopic descriptions of the sandal-woods, method of obtaining the oily etc., see various papers in the *P. J.*, vol. xvi; also *Bull. Pharm.*,

1895, 55. West Australian sandalwood is derived, according to Parry (*C. D.*, 1898, 11), from four species of *Santalum*, *S. Cygnorum* Miq. (*Fusanus spicatus* R. Br.), *S. lanceolatum* Schlecht (*F. spicatus* R. Br.), *S. acuminatum* A.DC. (*F. acuminatus* R. Br.), and *S. persicarum* F. Muell. (*F. persicarius* F. Muell.), *Venezuelan sandal wood*) the source of the so-called *West Indian sandal wood* of commerce, is, according to E. M. Holmes (*P. J.*, lxii), obtained from the *Schimmelia oleifera* Holmes, now recognized as *Amyris Balsamifera* L. (Fam. *Rubaceae*). A tree-like shrub, *Osyris tenuifolia* EngL, belonging to the *Santalaceae*, and a native of East Africa, is said to yield a wood which is very similar to that of the genuine Indian sandal wood. (*P. J.*, 60.)

The *Santalum album*, which yields the official oil, is a small tree twenty or thirty feet high, a native of the mountainous portions of India and of various islands of the Eastern Archipelago, but cultivated in India for the sake of its oil. J. L. Pigot furnished an interesting account of sandalwood cultivation accompanied by a map. (*Schimmel's Report*, 1900.)

Oil of santal is distilled in the United States, Germany, England, and India, the ordinary method of steam distillation being applied after the wood has been reduced to small particles by chipping or grinding. According to the Indian Pharmacopoeia the yield of oil is about 2.5 per cent. Oil of santal is habitually adulterated, castor oil and other fixed oils being added, and on the continent of Europe by the volatile *oil of cedar*, which is obtained by distilling the chips left in the making of lead pencils. Chapoteaut (*Bull. Soc. Chim.*, 37, p. 353) found two constituents, one of which he calls *santalol*, $C_{15}H_{26}O$, boiling at $310^{\circ} C.$ ($590^{\circ} F.$), and the other *santalal*, $C_{15}H_{24}O$, boiling at $300^{\circ} C.$ ($572^{\circ} F.$). Both of these are decomposed by distilling over phosphoric anhydride, the one yielding $C_{15}H_{24}$, boiling point $260^{\circ} C.$ ($500^{\circ} F.$), and the other $C_{15}H_{22}$, boiling point $245^{\circ} C.$ ($473^{\circ} F.$). Sesquiterpenes are also believed to be present in oil of santal. A specimen of oil of santal from South Australia, examined by Schimmel & Co. (*Schim. Rep.*, Oct., 1891), afforded a white crystalline principle, melting at 104° to $105^{\circ} C.$ (219.2° - $221^{\circ} F.$), which crystallized out in the oil. Parry (*P. J.*, lv, p. 118) found that a portion of the oil was eaponifiable, so he assumed the presence of esters of santalol.

In a number of specimens examined by Holmes (*P. J.*, xvi, 821) the sp.

gr. varied from 0.96 to 0.99. The sp. gr. of the oil of cedar wood, according to Ince, is 0.948. A large percentage of it may be added to the oil of santal without affecting its density sufficiently to be detected. Holmes states that the presence of more than 10 per cent. of the cedar oil can be recognized through the different solubilities of the oils in alcohol. (See *P. J.*, xvi, 820.) R. A. Cripps, after a thorough examination of the oils in the London market (see *P. J.*, 1892, 461), gives this test: "Two drops of the oil added to six drops of nitric acid, sp. gr. 1.5, on a white tile, should give a yellow to bright reddish-brown coloration, without any green, indigo, or violet tint at the edges during five minutes. For complete saponification in alcoholic solution, it requires not more than 1 per cent. of potassium hydrate." (See also *A. J. P.*, 1893, 20; *Schim. Rep.*, Oct., 1893; *P. J.*, 1895, 118; *West. Drug.*, 1897, 262.) West India oil can be distinguished from the genuine oil by its deviating the plane of polarization to the *right* instead of to the *left*. (*Pharmacographia*.) In two specimens of oil of santal, sp. gr. 0.9649 and 0.9573, F. H. Alcock found strong fluorescence. (*P. J.*, 1886, 923.)

Oil of amyris is the name commercially applied to the "so-called" West Indian sandal-wood oil. This adulterant and substitute (which may be added in amounts up to 5 per cent. without fear of detection) has a sp. gr. of 0.955 to 0.965, an optical rotation of + 25° to + 30° and contains from 30 to 40 per cent. of alcohols capable of being estimated and calculated as santalol by the official method of assay. One of its principal characteristics in a state of purity is its insolubility in 70 per cent. alcohol. Van-soden (*Ph. Ztg.*, 1900, 45, 878) reports the presence of a sesquiterpene alcohol named by him *amyrol*, and having the composition C₁₅H₂₆O.

Uses.—The oil of sandalwood is used largely as a perfume. In medicine its chief use is in *gonorrhoeal urethritis*, although it is sometimes employed in *chronic bronchitis* and *cystitis*. Its general antibacterial power is comparatively weak, but it has special relations towards certain micro-organisms; thus in the experiments of Jordan (*B. M. J.*, Sept. 13, 1913) twenty minims of oil of sandal wood three times a day had practically no effect on the growth of *B. coli* in the urine, but markedly retarded the multiplication of staphylococci. It was first recommended in medicine by Thomas B. Henderson who, however, is said to have used the oil of *S. myrtifolium*.

Dose, five to twenty minims (0.6-1.3 mls), in emulsion, or in capsule,

three or four times a day.

OLEUM SASSAFRAS. U. S.

OIL OF SASSAFRAS Ol. Sassaf. [Sassafras Oil]

"A volatile oil distilled from the root of *Sassafras variifolium* (Salisbury) O. Kuntze (Fam. *Lauraceae*). Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.*

Huile volatile (Essence) de Sassafras, *Fr.*; Sassafrasol, *G.*; Esencia de sasafras, *Sp.*

The proportion of oil yielded by the root of sassafras is variously stated at from less than 1 to somewhat more than 2 per cent. The bark of the root, directed by the U. S. Pharmacopoeia, would afford a larger amount. The usual yield is said by Sharp to be one pound from three bushels of the root. From fifteen to twenty thousand pounds were sent annually, before 1861, to the Baltimore market. (*A. J. P.*, Jan., 1863, p. 53.) The root, chopped fine by machinery, has steam forced through it in a closed tub, and the oil is then distilled in the ordinary way. 800 pounds of unrectified oil are said to be obtained from 40,000 pounds of root. (*M. S. Rep.*, Aug. 26, 1871.) The oil is of a yellow color or colorless, becoming reddish by age. It has the fragrant odor of sassafras, with a warm, pungent, aromatic taste, and a neutral reaction. It is among the heaviest of the volatile oils, having the sp. gr. of 1.094, or 1.087 at 15° C. (59° F.) on the authority of Buignet, who states also that it is very slightly dextrogyrate. Oil of sassafras is officially described in the United States Pharmacopoeia IX as " a yellow or reddish-yellow liquid, having the characteristic odor and taste of sassafras. It is soluble in 2 volumes of 90 per cent. alcohol, forming a solution neutral to litmus. Specific gravity: 1.065 to 1.077 at 25° C. (77° F.). The optical rotation varies from -3° to $+4^{\circ}$ in a 100 mm. tube at 25° C. (77° F.)" *U. S.*

The most complete investigation of sassafras oil is that made by Power and Kleber in 1896. (*Schim. Rep.*, April, 1896.) They find it to have the following composition: safrol, $C_{10}H_{10}O_2$, about 80 per cent; pinene and phellandrene, $C_{10}H_{16}$, about 10 per cent.; dextrogyrate camphor, $C_{10}H_{16}O$, about 6.8 per cent.; eugenol, $C_{10}H_{12}O_2$, about 0.5 per cent.; a

high boiling portion consisting of cadinene and residue, 3 per cent. They say that the hydrocarbon constituent of sassafras oil, to which Grimaux and Kuotte gave the name of *safrene*, is, as just stated, a mixture of pinene and phellandrene. *Safrol* crystallizes well in hard four- or six-sided prisms, with the odor of sassafras. It liquefies at 11° C. (51.8° F.), boils at 232° C. (449.6° F.), has a sp. gr. of 1.106, and is destitute of rotatory power. Variation in the sp. gr. of oil of sassafras may often arise through the congelation and separation of safrol, or through stratification. (LaWall and Pursel, *A. J. P.*, 1898, 340.) Fluckiger ascertained that safrol was one of those remarkable bodies which are capable of existing either in a solid or in a fluid condition long after they have passed their freezing or their melting point. Chemically, it has been found to be the *methylene ether of allyl-dioxybenzene*. Safrol appears to be widely distributed in the vegetable kingdom, probably existing in the bark of the *Mespilodaphne Sassafras*, also in the Puchury or Sassafras nuts (see *Pichurim Beans*), both of Brazil, as well as in the barks of *Atherosperma moschatum* and of *Beilschmiedia obtusifolia* of Australia, and in the bark of *Doryphora Sassafras* of New Caledonia. The bark described by Dymock as that of *Beilschmiedia fagifolia*, according to the researches of E. S. Hooper, contains saponin and probably is not derived from *Beilschmiedia* or any other genus of the *Lauraceae*. (*P. J.*, lxxii.) Safrol is now commercially extracted from oil of camphor, and it probably could be obtained from the oil of various species of the genus *Cinnamomum*. (See *P. J.*, June, 1887.)

Uses.—Oil of sassafras is chiefly used for flavoring purposes, but has physiological properties similar to those of the oil of clove and other allied volatile oils, and may be used for similar purposes. It is a powerful antiseptic and has been highly praised by Peck (*J. A. M. A.*, 1899, xxxii, 6) as a dental disinfectant.

A teaspoonful of it produced in a young man vomiting, collapse, somewhat dilated pupils, and pronounced stupor. (*Cincinnati Lancet-Clinic*, Dec., 3888.) According to the experiments of A. Heffter (*Atti Dell' XI. Congres. Med. Internaz.*, iii, 1894), safrol is slowly absorbed from the alimentary canal, and escapes through the lungs unaltered and through the kidneys oxidized into piperonic acid. When taken in sufficient dose, it quickly kills by a centric paralysis of respiration, preceded by great depression of the circulation, and when taken in smaller yet toxic amount, it causes death by widespread fatty degeneration of the heart, liver, kidneys, etc. Its isomer, *isosafrol*, is in

warm-blooded animals much less active as a poison than is safrol, and is chiefly eliminated as *piperonalic acid*.

Dose, of oil of sassafras, two to six minims (0.12-0.4 mil).

Off. Prep.—Trochisci Cubebae, *U. S.*; Linimentum Tiglii Compositum, *N. F.*; Mistura Opii et Sassafras, *N. F.*

OLEUM SESAMI. U. S., Br.

SESAME OIL

Ol. Sesam. [Teel Oil, Benne Oil]

"A fixed oil obtained from the seeds of one or more cultivated varieties of *Sesamum indicum* Linne (Fam. *Pedaliaceae*). Preserve it in well-closed containers." *U. S.* "Sesame Oil is the oil expressed from the seeds of *Sesamum indicum*, Linn." *Br.*

Sesame oil, which was official in the U. S. P. 1890, was restored to an official position by the U. S. P. IX. It is reputed by many pharmacists to resist rancidity better than other fixed oils of its class. It is especially recommended by Prof. Otto Raubenheimer, of Brooklyn. It is officially described in the U. S. Pharmacopoeia as "a pale yellow, oily liquid, almost odorless, and having a bland taste. It is slightly soluble in alcohol, miscible with ether, chloroform, petroleum benzin, or carbon disulphide. Specific gravity: 0.916 to 0.921 at 25° C. (77° F.). .

In India, and in the Eastern, African, and North American Divisions of the Empire, Sesame Oil may be employed in making the official Liniments, Ointments, Plasters, and Soaps for which Olive Oil is directed to be used." *Br.*

Benne Oil, or *Teel Oil*, is inodorous, of a bland, sweetish taste and a neutral reaction, and will keep long without becoming rancid. Fluckiger found that 76 per cent. of the oil consists of olein, and that the solid portions yield on saponification palmitic, stearic, and myristic acids. Linoleic acid was afterward discovered in the oil. The oil also contains a small quantity of what is probably a resinoid substance, which may be removed by glacial acetic acid or alcohol. It bears some resemblance to olive oil in its properties, and may be used for similar purposes. It is not

a drying oil. Villavecehia and Fabris (*Zeit. fur Ang. Chem.*, 1893, 505) have investigated sesame oil, and find, in addition to the main constituents before mentioned, a higher alcohol of the formula $C_{25}H_{44}O$, fusing at $137^{\circ} C.$ ($278.6^{\circ} F.$), a finely crystallizing substance of the formula $C_{11}H_{12}O_3$, fusing at $123^{\circ} C.$ ($253.4^{\circ} F.$), which substance they name *sesamin*, and a thick uncrystallizable oil, non-nitrogenous, which is the cause of the cherry-red coloration which sesame oil shows with hydrochloric acid and sugar. Tocher (P. J., 1893, 700), after analyzing *sesamin* and determining its molecular weight by Raoult's method in benzene and glacial acetic acid, maintains that its formula should be $C_{18}H_{18}O_5$. Tocher, as quoted by Lewkowitsch (*Chem. Anal. of Oils, Fats, and Waxes*, 2d ed., 389), also believes that the higher alcohol mentioned is cholesterol. When cooled to $-3^{\circ} C.$ ($26.6^{\circ} F.$) it becomes thick, and at $-5^{\circ} C.$ ($23^{\circ} F.$) it congeals to a yellowish-white mass. Concentrated sulphuric acid converts it into a brownish-red jelly. If 5 mils of the Oil be shaken with an equal volume of concentrated hydrochloric acid, the latter will usually assume a bright emerald-green color, especially if the Oil has been exposed for some time to the action of air and light." Soltzien recommends stannous chloride solution for testing benne oil. (*Proc. A. Ph. A.*, 1897, 195.) According to Schaedler, if one mil of pure benne oil is shaken with one mil of pure hydrochloric acid, sp. gr. 1.125, and one gramme of cane sugar, a rose-red color is developed in fifteen minutes, changing to violet in twenty-five minutes, and increasing in intensity until, after five hours, the acid has assumed a violet color corresponding in intensity to that of a solution of iodine in carbon disulphide or in chloroform. In the case of all other fixed oils, this color reaction does not begin until after three-quarters of an hour. Olive and almond oils containing as little as one-fourth per cent. of benne oil exhibit the reaction in from twenty to twenty-five minutes. The failure of some experimenters to find the reactions available rests upon the fact that they searched for the color in the oil, and not, as they should have done, in the acid. (*A. Pharm.*, 1887, p. 185.) Benne oil was known to the ancient Persians and Egyptians, and is esteemed by the modern Arabs and other people of the East both as food and as an external application to promote softness of the skin. It is laxative in large doses.

The name sesame oil is also sometimes applied to the oil from the cruciferous seed of *Camelina sativa*.

OLEUM SINAPIS VOLATILE. U. S., Br.

VOLATILE OIL OF MUSTARD Ol. Sinap. Vol. [Mustard Oil]

"A volatile oil produced synthetically or obtained from the seed of *Brassica nigra* (Linne) Koch (Fam. *Cruciferae*) (freed from fatty oil) by maceration with water and subsequent distillation. It yields not less than 92 per cent. of allyl isothiocyanate [$C_3H_5SCN = 99.12$]. The label must indicate whether the Oil has been made synthetically or obtained from black mustard. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.* "Volatile Oil of Mustard is the oil obtained by distillation from black mustard seeds, deprived of most of their fixed oil and macerated in water for several hours." *Br.*

Oleum Sinapis, *Br.* 1885; Oleum Sinapis Æthereum; Oil of Mustard; Huile volatile (Essence) de Moutarde, *Fr.*; Oleum Sinapis, *P. G.*; Senfol, Aetherisches Senfol, *G.*; Essenza di senape, *It.*; Esencia de mostaza negra, *Sp.*

The volatile oil of mustard is usually obtained from seeds which have been deprived of their fixed oil by pressure. It is "a colorless or pale yellow, strongly refractive liquid, having a very pungent and irritating odor and an acrid taste. *Great caution should be exercised in smelling this Oil. It should not be tasted except when highly diluted.* Specific gravity: 1.013 to 1.020 at 25° C. (77° F.). It is optically inactive. The Oil distils completely between 148° and 154° C. (298.4°-309.2° F.), and both the first and last portions of the distillate have nearly the same specific gravity as the original Oil." *U. S.*

Will considers volatile oil of mustard to be *allyl isosulphocyanate*, $CSNC_3H_5$ (*allyl isothiocyanate*), it being related to oil of garlic, which is sulphide of allyl. It sometimes contains allyl cyanide and traces of carbon disulphide. (*Chem. Gaz.*, Nos. 62 and 64.) It is the principle upon which black mustard seeds depend for their activity. Volatile oil of mustard was first produced artificially by Berthelot and S. de Luca, by treating allyl iodide, C_3H_5I , with an alcoholic solution of potassium sulphocyanate. It is now extensively manufactured artificially by this method. What first forms is allyl sulphocyanate, which is not identical with, but only an isomer of, mustard oil (allyl isosulphocyanate). But if

the sulphocyanate be heated to its boiling point 161° C. (321.8° F.) the thermometer sinks rapidly to 150° C. (302° F.), because of the change into the isosulphocyanate, or mustard oil. This change also takes place spontaneously at summer temperature. A small quantity of carbon disulphide seems always to be produced at the same time. Allyl iodide is procured by treating glycerin with phosphorus iodide. According to Zeiler, the seeds yield from 0.33 to 0.63 per cent. of the oil. Will and Koemer in 1863 explained the occurrence of this allyl isosulphocyanate in mustard oil. It does not occur ready formed in the seeds, but is produced by the decomposition of a compound, *sinigrin* (*potassium myronate*), occurring there. This sinigrin, $C_{10}H_{18}KNS_2O_{10}$, is decomposed under the influence of *myrosin*, an albuminous ferment which is present, and yields as products of decomposition C_3H_5CNS (allyl isosulphocyanate), $HKSO_4$ (acid potassium sulphate), and $C_6H_{12}O_6$ (glucose). "The aqueous solution of myrosin coagulates at 60° C. (140° F.), and then becomes inactive; hence mustard seed which has been heated to 100° C. (212° F.), or has been roasted, yields no volatile oil, nor does it yield any if powdered and introduced at once into boiling

White mustard seeds yield different products. When deprived of fatty oil they yield to boiling alcohol colorless crystals of *sinalbin*, an indifferent substance readily soluble in cold water, but sparingly so in cold alcohol. According to Will, it breaks up under the action of myrosin into *acrinyl sulphocyanate*, $C_7H_7O.CNS$, sinapine sulphate, $C_{16}H_{25}NSO_9$, and glucose, $C_6H_{12}O_6$. This acrinyl sulphocyanate is a nearly colorless, non-volatile oil, and the rubefacient and vesicating principle of white mustard. *Sinapine* has not yet been isolated, but it is an unstable alkaloid.

Uses.—Oil of mustard is a powerful rubefacient, although liable to blister unless used with much caution. Diluted, either with alcohol or lard, it is used as a counter-irritant application in *sprains*, *rheumatism* and like conditions. It may employed in strengths of from two to four per cent.

The volatile oil of mustard has been employed as a substitute for the mustard plaster. For this purpose one part may be mixed with sixty parts of alcohol, and the mixture sprinkled, not too thickly, on piline or muslin, covered with waxed paper. It acts speedily and efficiently.

The oil is too pungent and irritating to be given internally.

Off. Prep.—Linimentum Sinapis, *Br.*; Linimentum Sinapis Compositum, *N. F.*; Spiritus Sinapis, *N. F.*

OLEUM TEREBINTHINÆ. U. S.

OIL OF TURPENTINE

Ol. Tereb. [Turpentine Oil "Spirits of Turpentine"]

"The volatile oil distilled with water from the concrete oleoresin obtained from *Pinus palustris* Miller or from other species of *Pinus* (Fam. *Pinaceae*). Preserve it in well-closed containers." *U. S.*

Essence de Terebenthine, *Fr. Cod.*; Huile volatile de Terebenthine, *Fr.*; Oleum Terebinthinse, *P. G.*; Terpentinol, *G.*

Essenza di trementina, *It.*; Esencia de trementina, Aceite volatil de trementina, *Sp.*

This oil is commonly called *spirits* (or *spirit*) of turpentine. It is prepared by distillation from our common turpentine, though equally afforded by other varieties. It may be distilled either with or without water, but in the latter case a much higher temperature is required, and the product is liable to be empyreumatic. To obtain it quite pure it should be redistilled from a solution of potassium hydroxide. The turpentine of *Pinus palustris* is said to yield about 17 per cent. of oil, while that from *Pinus Pinaster* affords 25 per cent., and that from *Pinus sylvestris* 32 per cent. Large quantities are distilled in North Carolina. The exportations of turpentine oil from the United States in 1913 amounted to 21,039,597 gallons, valued at \$8,794,656; and in 1914, 18,900,704 gallons, valued at \$8,095,958.

Pure oil of turpentine is " a colorless liquid having a characteristic odor and taste, both of which become stronger and less pleasant on aging or exposure to the air. Soluble in 5 volumes of alcohol. Specific gravity: 0.860 to 0.870 at 25° C. (77° F.). Optical rotation variable. Distil 200 mils of the Oil, at the rate of two drops per second, from a 300 mil globe flask, having the side tube 8 cm. above the bulb. Ninety per cent. of the Oil distils between 154° and 170° C. (309.2° and 338° F.), the

temperature being read with the mercury column of the thermometer immersed in the vapor. Five mils of the Oil, shaken with an equal volume of potassium hydroxide T.S., does not become darker than a light straw yellow after standing twenty-four hours. Five mils of the Oil, evaporated in a small dish on a water bath, leaves not more than 0.1 Grm. of residue. Three drops of the Oil, placed on unsized, white paper, and exposed to the air, evaporates entirely without leaving a permanent stain (*fixed oils*). Five mils of the Oil shaken vigorously with an equal volume of hydrochloric acid in a test tube, and allowed to stand for a few minutes, does not produce a brownish or greenish color. Into a flask of from 35 to 50 mils capacity, having a long graduated neck (cassia flask), and containing 25 mils of fuming sulphuric acid, introduce very slowly, *drop by drop*, with constant shaking 5 mils of Oil of Turpentine, keeping the temperature just below 65° C. (149° F.) by immersion in cold water during the addition of the oil, and for five minutes thereafter, in the meantime frequently agitating the mixture cautiously but vigorously. Then cool, and add sulphuric acid until the flask is filled to the upper graduation on the neck. The clear, reddish, viscous layer, which forms after the dark mass has settled for two hours, does not exceed 1 per cent. of the volume of Oil taken. A large layer of colorless liquid with a refractive index of less than 1.5 at 20° C. (68° F.) shows the presence of mineral oil.

"*Caution.*—The addition of the Oil of Turpentine to the fuming sulphuric acid, drop by drop, is necessary because of the violence of the reaction." *U. S.*

As found in commerce, it is always somewhat ozonized, but when perfectly pure it consists exclusively of carbon and hydrogen, and is composed of one or more *terpenes*, among which are pinene, which constitutes the major portion of the oil, and small amounts of camphene and fenchene with derivatives of pinene. The English or American oil (prepared from *Pinus australis*) is composed of *dextro-pinene*, while the French oil (prepared from *Pinus Pinaster*) is composed of *laevo-pinene*. On the other hand, the Russian turpentine contains, in addition to *pinene*, *dipentene* (or *cinene*) and *sylvestrene*, and the Swedish turpentine contains *pinene* and *sylvestrene*. Both the American and the French oil of turpentine boil at about 156° C. (312.8° F.). On heating oil of turpentine to about 300° C. (572° F.) in a sealed tube for several hours it is converted into a polymer called *iso-terebenthene*, C₂₀H₃₂, which is so oxidizable that it is converted into a viscid mass on exposure

to the air for a few hours. It has, moreover, a marked odor, resembling oil of lemon, and boils at 176° to 177° C. (348.8°-350.6° F.). On treatment with a small portion of sulphuric acid, oil of turpentine yields an optically inactive liquid, which boils at 160° C. (320° F.). This is a mixture resolvable by repeated fractional distillation into *terebene*, C₁₀H₁₆, boiling at 150° C. (302° F.); *cymene*, C₁₀H₁₄, boiling at 175° C. (347° F.); a small quantity of a camphor-like body, boiling at 200° C. (392° F.); *colophene*, C₂₀H₃₂, boiling at 318° C. (604.4° F.), and a mixture of semisolid products of higher boiling point. Oil of turpentine absorbs hydrochloric acid gas, forming with it two compounds, one a red dense liquid, the other a white crystalline substance resembling camphor, and hence called *artificial camphor*. Both are monohydrochlorides, C₁₀H₁₆.HCl, but the latter is much more stable, and can be purified by crystallization from alcohol or ether. When turpentine oil is left in contact with concentrated hydrochloric acid a dihydrochloride is formed, C₁₀H₁₆.2HCl. This forms rhombic plates, insoluble in water, and decomposed by boiling with alcoholic potash, with formation of *terpinol* (C₁₀H₁₆)₂.H₂O. (Allen, *Corn. Org. Anal.*, vol. ii, p. 51.) Nitric acid converts oil of turpentine into resin, and by long boiling into *terebic acid*, C₇H₁₀O₄. Mixed with water and chlorinated lime, and then distilled, the oil yields a liquid which Chautard found to be identical with chloroform (*J. P. C.*, 3e ser., xxi, 88). Turpentine oil and other terpenes unite with water to form crystals of *terpin hydrate*, C₁₀H₁₈(OH)₂.H₂O, which sublimes often from turpentine oil which has long stood in contact with water and has then been heated to water bath temperature. These crystals are sometimes found in the natural oil also. The presence of alcohol with the water and turpentine oil facilitates their formation. Thus, a mixture of 1 part of nitric acid, 1 part of alcohol, and 4 parts of turpentine oil, spread out in flat dishes, will yield within a few days crystals amounting to 20 per cent. of the oil taken. If these crystals be fused at 116° C. (240.8° F.) they will lose water, and *terpin*, C₁₀H₁₈(OH)₂, will remain in crystalline needles, fusing at 104° C. (219.2° F.), and boiling at 258° C. (496.4° F.). If either of the hydrates just mentioned be boiled with sulphuric, phosphoric, or glacial acetic acid, *terpineol*, C₁₀H₁₇OH, will be formed along with hydrocarbons of the formula C₁₀H₁₆, such as *terpinene*, *terpinolene*, and *dipentene*. Terpineol is a thick, colorless, optically inactive liquid, with a pleasant hyacinthine odor and a bitter, feebly pungent taste. It is used extensively in perfumery. Baeyer (*Ber. d. Chem. Ges.*, xxvi, p. 826) has

also prepared the methyl ether of terpineol. Oil of turpentine may be made to yield cymene identical with that existing in the oil of cumin and with that obtained by dehydrating camphor. (See *Cumin Seed*; also see under *Olea Volatilia*.) Exposed to the air the oil absorbs oxygen, becomes thicker and yellowish, and loses much of its activity, owing to the formation of resin. A small proportion of formic acid is said also to be generated. Hence the older pharmacopoeias directed the oil to be rectified by distilling it with about four measures of water. But the process is difficult, in consequence of the great inflammability of the vapor, and its rapid formation, which causes the liquid to boil over. In this country it is scarcely necessary, as the recent oil can be obtained at an expense less than that which would be incurred by redistillation on a small scale. Another mode of purifying the oil is to agitate it with one-eighth of alcohol, which dissolves the resinous portion. About one-fifth of the alcohol is retained by the oil, but is readily separated by agitation with water. (See *Oleum Terebinthinae Rectificatum*.) For tests, see *Proc. A. Ph. A.*, 1893, 156.

C. T. Kingzett has shown that the atmospheric oxidation of turpentine is accompanied by the formation of a body having the formula $C_{10}H_{14}O_4$, which he regards as *camphoric peroxide*. This substance, by the action of water, is converted into hydrogen peroxide and camphoric acid. The disinfectant known as "*sanitas*" is produced by passing air through Russian oil of turpentine in contact with warm water. Berthe-lot has shown that oil of turpentine has, under certain conditions, the power, while undergoing oxidation itself, of causing the oxidation of other bodies, to which it imparts a portion of the oxygen absorbed from the air. All that is necessary to give this power to the oil is that soon after distillation it should be exposed to the air, as in a bottle half filled. Sunlight assists, but is not essential to, the change, which goes on even in the dark. The oil retains indefinitely the property thus acquired, but may be deprived of it by exposure to a boiling heat, or by agitation with reducing substances. No other chemical or physical change can be detected in the oil. (*J. P. C.*, May, 1860, 351.)

In this country the oil of turpentine is frequently adulterated with petroleum distillates. The adulteration is best detected by the treatment with sulphuric acid followed by steam distillation of the oil layer remaining above the sludge acid; this treatment with acid and after-distillation to be repeated if necessary. The sulphuric acid will thus completely polymerize the essential oil, leaving the paraffin

hydrocarbons unaffected in the residual oily layer. A shorter and more readily executed test with sulphuric acid, though not so complete, is now given in the official test of the U. S. P. IX.

Considerable quantities of a turpentine obtained by steam distillation of the so-called "lightwood," or resin saturated stumps and pieces of pine wood, have been offered in recent years. For an experimental study of this process and an account of the product see an article by Walker, Wiggins and Smith. (*Chemical Engineer*, Dec., 1905, p. 78.)

The several species of pine indigenous to California and the slopes of the Sierra Nevada appear to yield quite different products. Wenzel (*A. J. P.*, March, 1872) described, under the name of *abietene*, an oil distilled from the exudation of the *Pinus sabiniana* (*Nut Pine* or *Digger Pine*). He found it to have a sp. gr. of 0.694, and to boil at 101° C. (213.8° P.). Sadtler (*A. J. P.*, April, 1879, p. 176) examined an oil of turpentine from California said to have been obtained from the *Pinus ponderosa* (*Heavy Pine*), and found it to agree substantially with Wenzel's abietene. It had a sp. gr. at 16.5° C. (62° F.) of 0.6974, boiled at 101° C. (213.8° F.), and was slightly laevogyrate. It gave negative results when treated with hydrochloric acid for the formation of a hydrochloride, did not form a hydrate, and was not acted upon by sulphuric acid or by nitrosyl chloride. These anomalous results were at once explained by the publication of a study of the abietene which had been made by Thorpe, who showed (*A. J. P.*, 1879, p. 293) that this exudation of the California pine is almost pure heptane, C₇H₁₆, one of the chief constituents of American petroleum. His results were also confirmed by Schorlemmer, who established the identity of the pine heptane with that from petroleum naphtha.

Uses.—The oil of turpentine is locally irritant and feebly antiseptic. It is absorbed through the mucous membrane of the alimentary canal and apparently also of the respiratory tract, and is eliminated partly with the breath to which it imparts its own odor, and through the urine to which it gives an odor resembling that of violets. After the ingestion of large doses it produces a sense of warmth in the stomach, accelerates the circulation, and causes a feeling of exhilaration associated with more or less vertigo and a sense of fullness in the head. These symptoms are attended frequently with nausea and frequently, although not always, succeeded by brisk catharsis. When given in small doses frequently repeated it at first stimulates the kidneys, augmenting the

secretion of urine, but if the administration is continued too long it produces painful irritation of the urinary vessels amounting at times to violent strangury and may cause inflammation of the kidney with scanty, albuminous, or even bloody urine. In some constitutions it produces, even when taken internally, an ery-thematous eruption of the skin. Apparently enough may be absorbed after the inhalation of its vapor to irritate the urinary organs and it is stated that seamer of vessels loaded with turpentine sometimes develop strangury and hematuria.

Most of the therapeutic uses of the oil of turpentine may be attributed to its local irritant influence; thus during its elimination through the mucous membrane of the lungs it acts as a stimulant expectorant and is a useful remedy in *chronic bronchitis*. In the same way it acts as a stimulant to the kidney and is occasionally used as a diuretic, although this employment has largely passed out of vogue. As a carminative in *flatulent colic* it is one of the most valuable remedies we possess. It is sometimes of service for its local stimulant action for *chronic diarrheas* or *dysentery*. In *typhoid fever* it is useful not merely in tympanitic states for its carminative effects, but appears to have a direct influence upon the disease itself. According to the observations of Omelchenko (*B. G. T.*, 1891), while it is very feeble in its general antibacterial properties it has a special toxicity for the typhoid bacillus and this organism will not grow in an atmosphere saturated with turpentine vapor.

Oil of turpentine has been used for many years in the treatment of *hemoptysis*. Of its mode of action we have no knowledge, but there is considerable clinical evidence as to its power to check bleeding; Smith (*B. M. J.*, 1908, i, p. 1218) has even recommended it in *purpura hemorrhagica*. Among other conditions in which it has been from time to time recommended with more or less reasonableness, are *helminthiasis*, *leucorrhoea*, *chronic rheumatism*, *amenorrhoea*, and *puerperal fever*.

For ordinary purposes the dose is from 5 to 10 minims (0.3-0.6 mil) repeated every two to six hours as may be necessary. As a remedy against the *tapeworm*, the dose is from one-half to one fluidounce (15-30 mils), followed in half an hour by castor oil; the safety of these large doses is dependent upon the catharsis sweeping out 'the bowel before the turpentine can be absorbed. It is best administered in the form of an emulsion, although it is frequently given by dropping into a teaspoonful

of sugar. The use of gelatin-coated capsules is not to be recommended because as soon as the gelatin dissolves in the stomach the undiluted oil comes in contact with the gastric mucosa and is liable to produce an undue degree of irritation. La-cambre gives the following process for making a pill of the oil. Take of oil of turpentine 8 grammes, white wax 20 grammes, powdered sugar 9 grammes, oil of lemon, 2 drops. Melt the wax in the oil of turpentine, pour into a mortar, allow to cool, then add the sugar and oil of lemon, and form a mass to be divided into pills of 0.2 or 0.25 Gm. (3 or 4 gr.) each. Roll them in powdered starch, and keep in a well-stoppered bottle. (*J. P. C.*, Sept., 1873, p. 223.)

In the form of an enema the oil of turpentine is highly useful in obstinate *constipation*, *tympanitis*, and *seat-worms*. From one-half to two fluidounces (15-60 mils) may be added to a pint of warm soapsuds.

Externally it is an excellent rubefacient and is widely employed in the form of liniments in various rheumatic affections as *lumbago*, *arthritis*, *neuralgias*, and the like. For this purpose it should be diluted with from one to three parts of cottonseed or other bland oil. In the form of turpentine stupe it is advantageously employed as a counter-irritant in various deep-seated inflammations, especially of the abdomen. The turpentine stupe is made as follows: a piece of flannel is wrung out in hot water and then dipped in previously warmed turpentine, quickly wrung out and applied to the part. It was also formerly employed as a local application to burns in which it was supposed to allay the pain and promote healing. For this purpose it was usually mixed with the rosin cerate so as to form a liniment capable of being spread upon linen (see *Linimentum Terebinthinae*).

The following is the formula adopted many years ago by the Philadelphia College of Pharmacy for the rubefacient liniment known as *British Oil*, which is still in use in some parts of the country as a popular remedy. Oil of Turpentine, Linseed Oil, of each, 8 fl. oz., Oil of Amber, Oil of Juniper, of each, 4 fl. oz., Barbados Petroleum 3 fl. oz., Crude American Petroleum 1 fl. oz.

It has likewise been recommended as a local application in parasitic *skin diseases*, especially *pediculus capitis*. The inhalation of its vapors has been employed in *chronic bronchitis* and has been especially recommended by Skoda in *gangrene of the lungs*.

For internal use the rectified oil should be used. (See *Oleum Terebinthinae Rectificatum*.)

Dose, five to ten minims (0.3-0.6 mil).

Off. Prep.—Linimentum Terebinthinae, *U. S.*; Oleum Terebinthinae Rectificatum, *U. S.*; Linimentum Opii Compositum, *N. F.*; Linimentum Terebinthinae Aceticum, *N. F.*; Linimentum Tigllii Compositum, *N. F.*; Petroxolinum Sulphuratum Compositum, *N. F.*

OLEUM TEREBINTHINÆ RECTIFICATUM. U. S., Br.

RECTIFIED OIL OF TURPENTINE Ol. Tereb. Rect. [Rectified Turpentine Oil]

"Rectified Oil of Turpentine is the oil distilled from the oleo-resin (turpentine) obtained from various species of *Pinus*, and rectified." Br.

Essence de Terebenthine purifiée, *Fr.*; Oleum Terebinthinae Rectificatum, *P. G.*, Gereinigtes Terpentinol, *G.*

"Oil of Turpentine, a convenient quantity; Solution of Sodium Hydroxide, a sufficient quantity. Shake the oil of turpentine thoroughly with an equal volume of solution of sodium hydroxide, and introduce the mixture into a still connected with a well-cooled condenser. Recover about three-fourths of the oil by distillation, separate the clear oil from the water, dry it by shaking with anhydrous calcium chloride, filter and preserve. Keep the product in well-stoppered, amber-colored bottles, in a cool place. Rectified Oil of Turpentine is to be dispensed when oil of turpentine is required for internal use." *U. S.*

When oil of turpentine is distilled in contact with sodium hydroxide solution, the distillate comes over purified and freed from the decomposition products which give the commercial oil the disagreeable odor and taste which are inseparable by ordinary distillation without alkali; hence this rectified oil is much preferable for internal administration. In the *U. S. P.* VIII and IX solution of sodium hydroxide was preferred to lime water, which was used in the *U. S. P.* 1890 to furnish an alkali to combine with resinous substances in commercial oil of turpentine. It has in other respects the same properties as *Oleum Terebinthinae*. "Rectified Oil of Turpentine is a colorless liquid which

conforms to the properties and tests under *Oleum Terebinthinae*, specific gravity excepted. Specific gravity: 0.856 to 0.865 at 25° C. (77° F.). Evaporate 5 mils of the Oil rapidly in a tared dish on a water bath; not more than 0.015 Gm. of residue remains. U. S.

"A colorless, limpid liquid. Characteristic odor; taste pungent, somewhat bitter. Specific gravity 0.860 to 0.870; refractive index at 25° C. (77° F.) 1.465 to 1.480. Distils almost entirely between 156° and 180° C. (312.8 and 356° F.), leaving no appreciable residue." *Br.*

Dose, five to ten minims (0.3-0.6 mil).

Off. Prep.—Emulsum Olei Terebinthinae, *U. S.*; Linimentum Terebinthinae, *Br.*; Linimentum Terebinthinae Aceticum, *Br.*

OLEUM THEOBROMATIS. U. S., Br.

OIL OF THEOBROMA

Ol. Theobrom. [Butter of Cacao, Cacao Butter]

"A. concrete fixed oil obtained from the roasted seeds of *Theobroma Cacao* Linne (Fam. *Sterculiaceae*)." U. S. "Oil of Theobroma is a solid fat expressed from the seeds of *Theobroma Cacao*, Linn." *Br.*

Oleum Theobroma, *U. S.* 1880; Cocoa butter (improperly); Beurre de Cacao, *Fr. Cod.*; *Oleum concretum e semine Theobromae Cacao*, *Fr.*; *Oleum Cacao*, *P. G.*; Kakaobutter, *G.*; Manteca de coco, Aceite de coco, *Sp.*

Theobroma Cacao Linn. is a handsome tree, from twelve to twenty feet in height, growing in Mexico, the West Indies, and South America. It is largely cultivated in all tropical countries, particularly in Guayaquil, Venezuela, Mexico, Trinidad, and the Philippines. The fruit is an oblong-ovate capsule or berry, six or eight inches in length, with a thick, coriaceous, somewhat ligneous rind, enclosing a whitish pulp, in which numerous seeds are embedded. These are ovate, somewhat compressed, about as large as an almond, and consist of an exterior thin shell and a brown oily kernel. Separated from the matter in which they are enveloped, they constitute the *cacao*, or *chocolate nuts*, of commerce. The cacao tree is usually cultivated in large estates, where it is grown in the shade of the banana or other large plant, and develops its pods from the stem continually, so that the harvest goes on all the time, although the product is greater in the spring and in the autumn. The pods are cut

off, opened, and the beans contained in the glutinous sweet acid pulp are allowed to ferment, during which process the outer integument comes off easily. The beans are finally carefully dried, commonly in the sun, sometimes by means of a steam drying shed. If the sweating process is carried too far, or the beans during drying are wetted by rain, they blacken and are much lowered in value. These blackened beans are sometimes artificially whitened. Cacao beans have a slightly aromatic, bitterish, oily taste, and, when bruised or heated, an agreeable odor. (See *Am. Drug.*, 1897, 311; also *Ph. Ztg.*, 1900, 756.)

The average of a number of analyses of raw nuts gave H. Weigmann (*Konig's Nahrungs-und Genussmittel*, 3d ed., vol. i, 1019) water, 7.93 per cent.; nitrogenous matter, 14.19 per cent.; theobromine, 1.49 per cent.; fatty matter (cacao butter), 45.57 per cent., starch and other carbohydrates, 22.92 per cent.; crude fiber, 4.78 per cent.; pure ash, 3.99 per cent.; sand, 0.62 per cent. The coloring matter is probably the result of chemical change, as the fresh seeds are white. Theobromine has been found also in the shells in the proportion of about 1 per cent. (*A. J. P.*, 1862, 509.) The latter impart to boiling water a taste analogous to that of chocolate, but weaker, and are used for making a table beverage.

Theobromine was discovered by Woskresensky, who obtained it by the following method. The kernels are exhausted with water by means of the water bath; the solution is strained through linen, precipitated by lead acetate, and filtered; the filtered liquor is freed from lead by hydrogen sulphide, and evaporated; the brown residue is treated with boiling alcohol, and the liquor filtered while hot. Upon cooling, the theobromine is deposited in the form of a reddish-white powder, which is rendered colorless by repeated crystallization. Keller obtained it still purer by heating the powder between two watch glasses, by which a brilliant white sublimate was obtained. According to O. Donker and C. Treumann, theobromine is contained not only in the cotyledons but also in the shells of the cacao seeds. Four kilos of the latter yielded 13.5 Gm. of pure theobromine. Theobromine is now official.

For Emminger's method of determining theobromine in cacao, see *P. J.*, 1896, 289.

Cocoa or *Prepared Cacao* is also official in the N. F. IV under the title *Cacao Praeparata*. The description and tests are as follows:

"A powder prepared from the roasted, cured kernels of the ripe seeds of *Theobroma Cacao* Linne and of other species of *Theobroma* (Fam. *Sterculiaceae*), deprived of a portion of its fat. A brownish powder having a chocolate-like odor and taste, free from sweetness. Extracted with cold water Cocoa yields not less than 14 per cent. nor more than 22 per cent. of soluble matter. Extracted with ether, Cocoa yields not less than 18 per cent. of fat, and the fatty residue does not have a spicy odor or taste. The residue, insoluble in ether, when examined under the microscope, shows not more than 3 per cent. of Cocoa shells, and no foreign starch granules or other foreign substances. Cocoa contains not more than 6 per cent. of crude fiber and not more than 12 per cent. of starch. Cocoa yields not less than 3.5 per cent. nor more than 8 per cent. of ash, which has a distinctly reddish color." N. F.

Cacao, usually but erroneously known as cocoa, is often sold in powder which is sometimes adulterated with various other ingredients such as ground rice, barley flour, sugar, etc. Mixed with hot milk or water it is much employed as a drink. It has the advantages over tea and coffee that it is less stimulating to the nervous system and contains some nutriment. Chocolate is the solid substance expressed from the cacao bean after roasting. In Great Britain and the United States it is usually made, when pure, exclusively of the kernel of the cacao or chocolate nuts, which are first roasted, then deprived of their shells, and lastly reduced, by grinding between heated stones, to a paste, which is moulded into oblong cakes. Sometimes rice flour or other farinaceous substance, with foreign fats, is added, but these must be considered as adulterations. In the compounded form known as sweet chocolate, sugar is generally incorporated with the paste, and spices, especially cinnamon, are often added; vanilla is a favorite addition in America, France, and Spain. The well-known confection known as "*milk chocolate*" contains either whole or skim milk powder in addition to the foregoing ingredients. The U. S. Department of Agriculture standards for cocoa products are as follows:

"1. *Cocoa beans* are the seeds of the cacao tree, *Theobroma cacao*, L. 2. *Cocoa nibs, cracked cocoa*, is the roasted, broken cocoa bean freed from its shell or husk. 3. *Chocolate, plain chocolate, bitter chocolate, chocolate liquor, bitter chocolate coatings*, is the solid or plastic mass obtained by grinding cocoa nibs without the removal of fat or other constituents except the germ, and contains not more than three (3) per cent. of ash insoluble in water, three and fifty hundredths (3.50) per cent. of crude

fiber, and nine (9) per cent. of starch, and not less than forty-five (45) per cent. of cocoa fat. 4. *Sweet chocolate, sweet chocolate coatings*, is chocolate mixed with sugar (sucrose), with or without the addition of cocoa butter, spices, or other flavoring materials, and contains in the sugar- and fat-free residue no higher percentage of either ash, fiber, or starch than is found in the sugar- and fat-free residue of chocolate. 5. *Cocoa, powdered cocoa*, is cocoa nibs, with or without the germ, deprived of a portion of its fat and finely pulverized, and contains percentages of ash, crude fiber, and starch corresponding to those in chocolate after correction for fat removed. 6. *Sweet cocoa, sweetened cocoa*, is cocoa mixed with sugar (sucrose), and contains not more than sixty (60) per cent. of sugar (sucrose), and in the sugar- and fat-free residue no higher percentage of either ash, crude fiber, or starch than is found in the sugar- and fat-free residue of chocolate."

Hagenbuch examined several commercial brands of chocolate, and found that the amount of fat or cacao butter present varied from 12 to 45.8 per cent. (*A. J. P.*, 1885, p. 276.) From this it would seem that manufacturers do not uniformly extract the fat from commercial chocolate.

Oil of Theobroma. Cacao Butter.—This is the fixed oil of the chocolate nut. It is extracted either by expression, decoction, or the action of a solvent. Soubeiran recommends that the seeds, previously ground, be mixed with one-tenth of their weight of water and then pressed between hot plates of tinned iron. It is advisable that the heat should not exceed that of boiling water, and even a lower heat will answer. When the method of decoction is used, the cacao should be slightly roasted before boiling. As a solvent, carbon disulphide has been found to answer well, as recommended in the preparation of the expressed oil of nutmeg. (See *Oleum Myristicae*.) Upon the whole, the method of expression is perhaps preferable. The presence of water in the ground seeds is said greatly to facilitate the process. The expressed oil, now made largely in Philadelphia as a by-product in the manufacture of cocoa, occurs in the shape of oblong cakes, like those of chocolate, weighing about half a pound each. It is " a yellowish-white solid, having a faint, agreeable odor, and a bland, chocolate-like taste. It is usually brittle at temperatures below 25° C. (77° F.). It is slightly soluble in alcohol, soluble in boiling dehydrated alcohol, and freely soluble in ether, chloroform or benzene. Specific gravity: about 0.973 at 25° C. (77° F.). It melts between 30° and 35° C. (86° and 95° F.). Dissolve 1 Gm. of Oil of

Theobroma in 3 mils of ether in a test tube at a temperature of 17° C. (62.6° F.), and immerse the tube into water having the temperature of melting ice. The liquid does not become turbid nor deposit white flakes in less than three minutes; and if the mixture after congealing is again brought to 15° C. (59° F.), it gradually forms a perfectly clear liquid (wax, stearin, or tallow). Saponification value: not less than 188 nor more than 195. Iodine value: not less than 33 nor more than 38." *U. S.*

"A yellowish-white solid, breaking with a smooth fracture. Odor resembling that of cocoa; taste bland, agreeable. Somewhat brittle at ordinary temperatures, but softening at 25° C. (77° F.). Specific gravity 0.990 to 0.998; melting point 30° to 33° C. (86°-91.4° F.); saponification value 188 to 195; iodine value 35.5 to 37.5; acid value not more than 2.0; refractive index at 40° C. (104° F.) 1.4565 to 1.4575. In ascertaining the melting point and specific gravity, seventy-two hours should be allowed to elapse between the time of melting and the time of determining the constants. When 1 gramme is dissolved at 17° C. (62.6° F.) in 3 millilitres of ether in a test-tube, and the tube placed in water at 0° C. (32° F.), the solution neither becomes turbid nor deposits a granular or flaky mass in less than three minutes; and if, after congealing, it is exposed to a temperature of 15.5° C. (60° F.), a clear solution is gradually formed (absence of certain other fats)." *Br.*

Cacao butter consists chiefly of the glycerides of stearic, palmitic, and lauric acids, and, further, of small quantities of the glycerides of arachidic, linolic, formic, acetic, and butyric acids. The percentage of stearic acid obtainable is from 39.9 to 40.6. Kingzett believes it to contain in addition a peculiar acid which he calls *theobromic*, and to which he gives the formula $C_{64}H_{128}O_2$, but his results have not been confirmed by subsequent investigators. From its large proportion of stearin, it is one of the best fate for the preparation of stearic acid. It is said to be frequently adulterated with animal fats, which, according to E. Lamhofer, may be detected by attention to the fact that pure cacao butter dissolves entirely in ether or petroleum benzin, separating out in minute granular crystals when immersed in water of 0° C. (32° F.), the liquid portion remaining transparent for 30 or 40 minutes, when the whole solidifies. After solidification, if the oil be kept at a temperature of about 14.4° C. (58° F.), it will redissolve without turbidity. (A. J. P., 1877, p. 238.) G. Ramsperger concludes, as the result of much experimentation, that ether affords the best test of purity (see the official tests).

Uses.—Butter of cacao is used as an ingredient in cosmetic ointments, and in pharmacy for coating pills and preparing suppositories. For the last purpose it is well adapted by its blandness, and the fact that although liquefying at a temperature below that of the body, it is of firm consistence at 21.1° C. (70° F.). It is also valuable for the reason that easily decomposable substances like silver nitrate, potassium permanganate, etc., may be incorporated in it without material change and it is therefore valuable as an excipient. It was chiefly on this account that it was introduced into the U. S. Pharmacopoeia of 1860. It has the emollient properties of the fats and is used to soften and protect chapped hands or lips. F. Bringhurst prepared a lip salve by melting together 28 ounces of cacao butter, 4 ounces of yellow wax, and a drachm, each, of balsam of Peru and benzoic acid, straining, adding perfuming oils, as those of rose, bergamot, and bitter almond, in sufficient quantity, and finally, when nearly cool, an ounce of glycerin. (*A. J. P.*, July, 1867, p. 348.)

OLEUM THYMI. U. S.

OIL OF THYME **Ol. Thymi [Thyme Oil]**

"A volatile oil distilled from the flowering plant of *Thymus vulgaris* Linne (Fam. *Labiatae*), and containing not less than 20 per cent., by volume, of phenols. Preserve it in well-stoppered, amber-colored bottles, in a cool place, protected from light." *U. S.*

Huile volatile de Thym, *Fr. Cod.*; Essence de Thym, *Fr.*; Oleum Thymi, *P. G.*; Thymianol, *G.*; Esencia de tomillo, *Sp.*

In the south of France thyme grows wild in great abundance, and is largely collected for distillation. The oil is taken from France to England, and thence reaches this country under the name of *oil of origanum*, having, probably from its greater cheapness, been substituted for the latter.

Thymus vulgaris is a very common plant, indigenous to Southern Europe, and cultivated in our gardens. It possesses a subcampanulate two-lipped calyx, villous in the throat; corolla limb two-lipped, the upper erect and emarginate, the lower spreading, three-cleft. It is a low under-

shrub, procumbent at the base, with ovate-linear, revolute leaves, the flowers occurring in a whorled spike. The herbaceous portion, which should be gathered when the plant is in flower, has a peculiar, strong, aromatic, agreeable odor, not lost by drying, and a pungent, aromatic, camphoraceous taste. Its active constituent is the volatile oil, which is obtained separate by distillation with water.

The oil, as prepared in Southern France, is, after one distillation, of a reddish-brown color, and called the *red oil*, but when again distilled is colorless, and in this condition is distinguished as the *white oil*. Oil of thyme is officially described as "a colorless or red liquid, having a characteristic odor and taste. It is soluble in 2 volumes of 80 per cent. alcohol. Specific gravity: 0.894 to 0.930 at 25° C. (77° F.). It is slightly laevorotatory. Shake 1 mil of the Oil with 10 mils of hot distilled water, and, after cooling, pass the aqueous layer through a wetted filter; the filtrate does not assume a blue or violet color upon the addition of a drop of ferric chloride T.S."

According to Zeiler, one pound of the fresh herb yields 45.7 grains of the oil, of the dried herb 38 grains. The oil, as found in commerce, is of a reddish-brown color, and of an odor recalling that of thyme, but less agreeable. Its specific gravity is stated at 0.905, but probably varies, as the oil is a complex body. The more volatile portion, that coming over below 180° C. (356° F.) in distillation, is a mixture of cymene, C₁₀H₁₄, boiling at 175° C. (347° F.), and pinene, C₁₀H₁₆, boiling at 161° C. (321.8° F.). The less volatile and most valuable portion is chiefly thymol, C₁₀H₁₄O, a white crystalline solid, melting at 50° C. (122° F.), and possessing a pungent taste. *Carvacrol* is also present, at times replacing part or all of the thymol, and in addition linalool and bornyl acetate have been found in small amount. (See *Proc. A. Ph. A.*, 1897, 637.)

The true oil of thyme, according to Bennett (*P. J.*, 1908, lxxx, p. 803), differs from the various oils known commercially under this name, as well as the oils of *origanum*, in that it contains thymol, while the other oils of thyme contain the isomeric *carvacrol*. While it is probable that *carvacrol* has similar therapeutic properties to thymol, it has not been employed in medicine to any considerable extent and is far less well known.

The oil is commonly adulterated with the oil of turpentine, the *white oils*

being especially impure. The presence of oil of turpentine, according to Duyk (*J. P. A.*, 1899, 41), is due to the fact that the French peasants place in the body of the still as a foundation for the herbs a layer of pine and fir branches.

The annual production of oil of thyme at Grasse, according to Fluckiger (*A. J. P.*, 1885, 132), amounted to 40,000 kilogrammes.

Oil of thyme has been largely replaced in medicine by thymol. According to Camperdon, in doses of from three to fifteen grains (0.2-1.0 Gm.), oil of thyme causes mental excitement, and is a valuable diffusible stimulant in *collapse*. It is powerfully gennicidal. (See *Thymol*.)

Dose, three to five minims (0.2-0.3 mil).

Off. Prep.—Liquor Antisepticus, *N. F.*; Liquor Zinci et Alumini Compositus, *N. F.*; Liquor Zinci et Ferri Compositus, *N. F.*; Mistura Oleo-Balsamica, *N. F.*; Oleum Hyoscyani Compositum, *N. F.*

OLEUM TIGLII. U. S. (Br.)

CROTON OIL Ol. Tiglii

"A fixed oil expressed from the seeds of *Croton Tiglium* Linne (Fam. *Euphorbiaceae*). Preserve it in small, well-stoppered bottles, protected from light." *U. S.* "Croton Oil is the Oil expressed from the seeds of *Croton Tiglium*, Linn." *Br.*

Oleum Crotonis, *Br.*; Huile de Croton Tiglium, *Fr. Cod.*; Huile de Graines de Tilly, *Fr.*; Oleum Crotonis, *P. G.*; Krotonol, *G.*; Olio di crotontiglio. *It.*; Aceite de croton tiglio, Aceite de grano tiglio, *Sp.*

Croton Tiglium Willd. is a small tree or shrub, with a few spreading branches, bearing alternate petiolate leaves, which are ovate, acuminate, serrate, smooth, of a dark-green color on the upper surface, paler beneath, and furnished with two glands at the base. The flowers are in erect terminal racemes, scarcely as long as the leaf—the lower being female, the upper male—with straw-colored petals. The fruit is a smooth capsule, about the size of a filbert, with three cells, each containing a single seed.

The tree is a native of Hindostan, Ceylon, the Moluccas, and other parts

of India. It is pervaded by an acrid purgative principle, probably analogous to that found in other plants belonging to the family of *Euphorbiaceae*. Rumphius says that the root is employed in Amboyna, in the dose of a few grains, as a drastic purge in dropsy, and, according to the same author, the leaves are so acrid that when chewed and swallowed they excite inflammation in the lips, mouth, and throat, and along the whole course of the alimentary canal. The wood is said in small doses to be diaphoretic, in larger, purgative and emetic. But the seeds are the most active part. These have been long used in India as a powerful purgative, and were employed so early as 1630 in Europe, under the names of *grana Molucca* and *grana tiglia*. But in consequence of their violent effects they fell into neglect, and had ceased to be ranked among medicines, when, at a comparatively recent period, attention was again called to them by the writings of some English physicians in India. They are now imported for their oil, which is the only official product of the plant. It is probable that most if not all of the *Crotons* are purgatives. The oil of the Mexican *Croton morifolius* is said to be mildly purgative in doses of two or three minims (0.12-0.2 mil). In India, under the name of *Kowli seeds* (*Kuli seeds*), are used certain beans, which have been referred by authorities to the *Croton oblongifolius* Roxb., and also to the *C. persimilis* Muill.Arg. (See *Ph. Rev.*, Oct., 1896.) Kowli seeds reach a length of 2.1 cm., a breadth of 1.2 cm., a thickness of 0.8 cm., ovate, having pointed ends with a marked caruncle. The outer side shows the grayish-brown crusty seed coat with irregular rough longitudinal stripes; the cross-section shows a large endosperm, in the middle the embryo of considerable size with flat cotyledons. Besides the fatty oil and protoplasm, the cells of the endosperm show longitudinally very large aleurone grains, which contain a considerable number of small globoids and badly formed crystalloids.

The seeds of the *C. Tiglium* resemble castor beans in size and general structure. They are oblong, rounded at the extremities, with two faces, the dorsal considerably more convex than the ventral, separated from each other by longitudinal ridges, and each divided by a similar longitudinal ridge, so that the whole seed presents an irregular quadrangular figure. Sometimes their ventral surface is flat, with a longitudinal groove, owing to the presence of only two seeds in the capsule, the groove being produced by the central column or axis. The shell is covered with a soft, yellowish-brown epidermis, beneath which the surface is black and smooth, and, as the epidermis is often partially

removed by friction during their carriage, the seeds as they come to us are frequently mottled, and sometimes nearly black. The kernel or endosperm is yellowish-brown, and abounds in oil. In India the seeds are prepared for use? by submitting them to slight torref action, by which the shell is rendered more easily separable. In the dose of one or two grains (0.065 or 0.13 G-m.) the kernel purges severely.

The oil is obtained by expression from the seeds, previously deprived of the shell. It may also be separated by decoction in water, or by the action of ether, or carbon disulphide, which dissolves the oil and leaves it behind when evaporated. Guibourt recommends, after the first expression, to digest the residue with alcohol at a temperature of 48.8° to 60° C. (120°-140° F.), and then submit it to a new expression. The alcohol is to be separated by distillation from the oil, which is then to be mixed with the first product. Great care must be used, during this distillation, to prevent blistering the unprotected skin of the operator.

Extraction by Ether.—Having washed and dried the seeds, grind them in a coffee mill, and form a soft paste with ether. Introduce this into a narrow percolation tube, and gradually pour ether upon it until it is exhausted. Evaporate the ether by means of a water bath, and filter the remaining oil.

Extraction with Carbon Disulphide.—The seeds, well bruised, are introduced into a bottle with three times their weight of carbon disulphide, well rectified; the mixture is allowed to stand, with frequent agitation, for 24 hours; the whole is then poured upon a cloth and rapidly expressed. The residue is similarly treated with twice its weight of the disulphide, and expressed, after standing as before. The products of the two macerations are mixed, then filtered in a covered funnel, and finally submitted to distillation, by means of a water bath, in a glass retort, at the temperature of 71.1° or 76.6° C. (160° or 170° F.). The disulphide should be recovered by condensing its vapor in a refrigerated receiver. The oil is to be poured into a dish, to show that it contains none of the disulphide, and then introduced into a bottle and closely stoppered.

Properties.—The seeds consist of 64 per cent. of kernel and 36 of envelope. From the seeds imported into England, about 22 per cent. of oil is obtained by simple expression. Guibourt, by his process, obtained 52 per cent. from the kernels, equivalent to about 35 per cent. from the

seeds. Croton oil consists chiefly of the glycerides of stearic, palmitic, myristic, kluric, and oleic acids. There are also present, in the form of glycerin ethers, the more volatile acids, as formic, acetic, isobutyric, and isovalerianic acids. The volatile part of the acid yielded by croton oil contains, moreover, an acid of the oleic series, named by Geuther and Frolich *tiglic* or *tiglinic acid*) $C_5H_8O_2$. It is isomeric with angelic acid, but the melting points (angelic acid $45^\circ C.$ ($113^\circ F.$), *tiglic acid* $64^\circ C.$ ($147.2^\circ F.$)) and the boiling points (angelic acid $185^\circ C.$ ($365^\circ F.$), *tiglic acid* $198.5^\circ C.$ ($389.3^\circ F.$)) differ. *Crotonic acid*, $C_4H_6O_2$, was thought by Schlippe to be present, but later investigation does not confirm the statement. *Crotonol*, announced by Schlippe as the vesicating principle of the oil, has likewise been found only by the discoverer.

In 1823 John Nimmo, of Glasgow, found that about 45 per cent. of croton oil is soluble in alcohol, the insoluble 55 per cent. being inert. Recent researches have shown that the percentage of soluble portion varies greatly. (See also below.) In this soluble portion Buchheim found an acid, *crotonolic acid* or *crotonoleic acid*, which he believed to be the active principle. It is an oily substance, readily decomposable, having the character of a weak acid, and forming various salts. It is freely soluble in alcohol, and is extremely irritant to the skin and the mucous membrane. As pointed out in 1889 by Stillmark and Robert, croton seeds contain one or more toxic albuminoids, which have been especially studied under the name of *croton* by Elfstrand. Dimstan and Boole (*Proc. Roy. Soc. London*, lxiii, 1895) found that crotonoleic acid, prepared by the method of Kobert and Hirscheydt, is a mixture of inactive oily acids and a resinous substance having extraordinary power as a vesicant, for which they have proposed the name of croton resin, assigning to it the empirical formula $C_{13}H_{18}O_4$, and the molecular formula $(C_{13}H_{18}O_4)_2$, or $C_{26}H_{36}O_8$. It is described as a hard, pale yellow resin, nearly insoluble in water, and benzene, but readily dissolved by alcohol, ether, and chloroform. It is neither a glyceride, a ketone, nor an aldehyde.

Crotonoleic acid may be readily prepared by treating the portion of croton oil soluble in alcohol with a hot saturated solution of baryta in a water bath, washing the stiff white paste that forms with cold distilled water to remove excess of baryta and barium compounds with acetic, butyric, and *tiglic* acids, repeatedly treating with water, and lastly agitating with ether, which takes up only the barium oleate and

crotonoleate. The crotonoleate is separated by dissolving it out in alcohol, decomposing it carefully with sulphuric acid, and the solution containing the free acids carefully evaporated. (See also *Robert's Arbeiten*, 1890, p. 30.)

Crotin is described as a yellowish powder, yielding about 21 per cent. of ash, soluble in water, and possessed of such active poisonous properties that the subcutaneous lethal dose for the rabbit is from 0.05 to 0.08 Gm. per kilo. It attacks the blood corpuscles as well as the centric nervous system, and, indeed, probably affects all protoplasm. (*On Some Toxic Albumins*, Upsala, 1897.)

Croton oil, as found in commerce, varies greatly in color, from a pale yellow to a dark reddish-brown. That imported from India is usually pale, that expressed in Europe dark, like the deepest-colored sherry. Its consistence is rather viscid, and is increased by time. Its odor is faint, but peculiar, its taste hot and acrid, leaving in the mouth a disagreeable sensation which continues for many hours. It is officially described as "a pale yellow or brownish-yellow, somewhat viscid and slightly fluorescent liquid, having a slight, characteristic odor. *Great caution is necessary in tasting it*, and it must be handled carefully as it causes a pustular eruption, when applied to the skin. It is slightly soluble in alcohol, the solubility increasing with age; freely soluble in ether, chloroform, or in fixed or volatile oils. It is acid to litmus paper previously moistened with alcohol. Specific gravity: 0.935 to 0.950 at 25° C. (77° F.). When gently heated with twice its volume of dehydrated alcohol, it forms a 1 part each of cacao butter and white wax in a small glass flask, and then adding 2 parts; of croton oil, taking care to close the orifice of the flask at once with a cork. When the mixture begins to get thick, it is poured into cylindrical moulds, where it speedily solidifies. These crayons may be made of a thickness of about 8 or 9 millimeters ($\frac{1}{3}$ inch), and may be covered with tin foil to protect them from change. (*N. R.*, May, 1877.)

The oil is most conveniently administered in the form of pill. A safe and convenient plan is to make two drops into four pills with crumb of bread, and to give one every hour until they operate. The oil may also be given in emulsion.

Crotonoleic acid has been shown by Kobert to be a very active irritant poison, much more harsh and severe in its influence than croton oil itself. Hirscheydt has found that its salts injected into the blood are

extremely powerful depressants to the circulation. It has appeared in commerce, but after trial has been found by Hirscheidt to act badly as a practical remedy. It probably also varies greatly in purity. Ten milligrams were found by Hirscheidt to be very uncertain in their purgative effect, while large doses commonly produced excessive gastrointestinal irritation. The superiority of croton oil over the acid probably depends upon the fact that the acid exists in it chiefly in combination with glycerin, and that this crotonoleic glyceride acts with comparative kindness because of the slow decomposition and setting free of the acid which occur in the intestines. This being the case, it follows as a corollary that old, acid croton oil must be more irritant than the fresher and nearly neutral oil. Robert has confirmed this conclusion by actual trial, and asserts that the neutral oil should always be preferred in practice, and that the acid oil should be rejected.

Dose, one-half to two minims (0.03-0.12 mil).

Off. Prep.—Linimentum Crotonis, *Br.*; Col-lodium Tiglii, *N. F.*; Linimentum Tiglii, *N. F.*; Linimentum Tiglii Compositum, *N. F.*; Pilulsa Aloes, Hydrargyri et Scammonii Compositse, *N.F.*

Olibanum. Thus. *Oliban, Encens, Fr. Weihrauch, G.—Olibanum*, the frankincense of the ancients, was erroneously ascribed by Linnaeus to *Juniperus phoenicea* L. (*J. lycia* L.). There are two varieties of olibanum, one coming to Europe from the Mediterranean, and the other directly from Calcutta. These varieties were formerly considered distinct, but recent researches indicate their common origin. In 1843 Captain Kempthorne, of the East India Company's navy, saw the olibanum tree growing upon the mountains, on the African coast, between Bunder Maryah and Cape Guardafui. According to his statement, it grows on the bare marble rocks composing the hills of that region, with very brittle soil or the slightest fissure to support it, adhering by means of a substance thrown out from the base of the stem. This rises forty feet, and sends forth near the summit short branches, covered with a bright green, singular foliage. The juice, which exudes through incisions made into the inner bark, has at first the color and consistence of milk, but hardens on exposure. (*P. J.*, iv, 37.) Sir William J. Hooker says that the African olibanum is derived from *Boswellia papyrifera* Hochst., one of the *Burseraceae*; but thinks it highly probable that it is furnished by more than one species which has since proven to be the case. (*P.-J.*, 1859, 217.) Birdwood asserts (*Tr. Linn. Soc*; xxvii) that no olibanum is obtained in India, all coming from a coast district of Arabia (the same district as that described by Theophrastus), and being the product of a new species of *Boswellia*, *B. Carterii* Birdwood. It is very likely that several species of *Boswellia* furnish the olibanum of commerce— viz., *B. Carterii* Birdw. (furnishes what is known as *Luban Bedowi*, or *Luban Sheheri*), and *B. Frereana* Birdw. (furnishes *Luban Meyeti* or *Luban Matti*). It appears that the resin of *B. papyrifera* Hochst. is not gathered at all. The product of

B. serrata Roxb. (known as *Salaigugul*) is not sent into general commerce, but is employed medicinally only in India.

The Arabian or African frankincense is in the form of yellowish tears, and irregular, reddish lumps or fragments. The tears are generally small, oblong or roundish, not very brittle, with a dull and waxy fracture, softening in the mouth, and bearing much resemblance to mastic, from which, however, they differ in their want of transparency. The reddish masses soften in the hand, have a stronger taste and odor than the tears, and are often mixed with fragments of bark and small crystals of calcium carbonate which are visible under the microscope.

The Indian frankincense, or olibanum, consists chiefly of yellowish, somewhat translucent, roundish tears, larger than those of the African, and generally covered with a whitish powder produced by friction. It has a balsamic resinous odor, and an acrid, bitterish, somewhat aromatic taste. When chewed it softens in the mouth, adheres to the teeth, and partially dissolves in the saliva, which it renders milky. It burns with a brilliant flame and a fragrant odor. Triturated with water, it forms a milky, imperfect solution. Alcohol dissolves nearly three-fourths of it, and the tincture is transparent. Tschirch (*Harze und Harzbehalter*, 1900, p. 253) has made a thorough study of olibanum and determined all of its constituents with care. Alcohol extracts 72 per cent., consisting of resins 65 per cent. and volatile oil 6 per cent.; water soluble gum, 20 per cent.; bas-sorin, 6-8 per cent.; plant residue, 2-4 per cent. The resins were composed of *boswellic acid*, $C_{32}H_{52}O_4$, a resin acid of which well crystallized salts were obtained, and *olibanoresin*, $C_{14}H_{22}O$, a neutral resin.

In the essential oil Wallach identified l-pinene and dipentene, while the chemists of Schimmel & Co. found in addition phellandrene.

W. F. Daniell has described an odorous product, used as *frankincense* in Sierra Leone, and obtained from a large tree, growing in the mountainous districts of that region. The tree has been described by J. J. Bennett in *P. J.*, 1854, 251, as *Daniellathurifera* (Fam. *Leguminosae*). According to Daniell, the juice exudes through openings made by an insect, and, concreting in connection with the woody particles resulting from the boring of the insect, falls at length to the ground, where it is collected by the negroes. (See *A. J. P.*, xxvii, 338.)

Olibanum is stimulant like the other gum-resins, but is now very seldom used internally. According to Delieux, of Toulon, however, it affords a cheap, efficient substitute for the balsams of Tolu and Peru. It appears to act more favorably when combined with a little soap. Delieux has also obtained advantage from the inhalation of its fumes, when heated, in chronic *bronchitis* and *laryngitis*. (*B. G. T.*, Fev. 28, 1861.) It is chiefly employed for fumigation and in unofficial plasters. Dose, fifteen grains (1.0 Gm.), which may be increased to a drachm (3.9 Gm.) or more.

Canadian olibanum is reported by Karl Dieterich to be an American substitute for olibanum, which comes into the drug market from Hamburg. Its melting point is 77-78° C. (170.6°-172.4° P.). Thus occupies a place about midway between Canadian

olibanum or gum thus. It is a valuable American pine resin, which, however, contains no gum and therefore is not a gum resin. (*Ph. Zhalle*, 1912, 652-654.)

OLIVERI CORTEX. Br.

OLIVER'S BARK [Black Sassafras]

" Oliver's Bark is the dried bark of *Cinnamomum Oliveri*, Bailey." *Br.*

The genus *Cinnamomum* comprises some fifty-four species which are mostly tropical or subtropical evergreen shrubs or trees. They are mostly aromatic and comprise two principal groups: The one yielding camphor, and the other aromatic barks like cinnamon. Oliver's bark was official in the Ind. and Col. Add. for the Australian Colonies and is now official in the British Pharmacopoeia. The tree which furnishes this bark is *Cinnamomum Oliveri* Bailey (Fam. *Lauraceae*). It is indigenous to New South Wales and Queensland. It is much of the same habit as the trees yielding cinnamon and the bark is used as a substitute for this spice in the Australian Colonies.

"In flat pieces usually about twenty centimetres long, four centimetres wide and one centimetre thick. Cork greyish-brown, very warty. Inner surface umber-brown, satiny. Fracture short, slightly fibrous. In transverse section, umber-brown, a pale line separating the cork from the inner tissues. Aromatic odor; taste aromatic, bitter, camphoraceous." *Br.*

Off. Prep.—Tinctura Oliveri Corticis, *Br.*

Omphalea.—According to Calmody, the government chemist in Trinidad, the seeds of the *Omphalea megacarpa* (?), Fam. *Euphorbiaceae*, yield an oil which acts as a brisk cathartic in about three hours after taking, without pain or much continuance. (*P. J.*, Feb., 1898.) Cash (*J. P.*, 1911, xxxvi, p. 488) obtained from the *Omphalea triandra* seed, 56 per cent. of a pale yellow oil, with a specific gravity of 0.924, which, in doses of 0.5 Gm. exercised a cathartic and diuretic action. From the *O. diandra* (*Megacarpa*) he obtained an oil somewhat darker in color than the preceding which had a specific gravity of 0.922 and a saponification value of 190.3, and an iodine value of 119.7. This oil was also a cathartic and diuretic, although somewhat larger doses were required than in the oil from the *O. triandra*. From the allied plant, *Garcia nutans*, he also obtained a cathartic oil.

Onion. Cepa.—The bulk of *Allium Cepa* L. (Fam. *Liliaceae*.) Fourcroy and Vauquelin

obtained from the ordinary onion a white, acrid, volatile oil containing sulphur; also albumen, much uncrystallizable sugar and mucilage, phosphoric acid, both free and combined with lime, acetic acid, calcium citrate, and lignin. The expressed juice is susceptible of the vinous fermentation. The oil is essentially the same in chemical composition as the oil of *Allium sativum* L., and consists largely of allyl sulphide, $(C_3H_5)_2S$. (See *A. Pharm.*, 1892, 434.) Perkin and Hummel found *quercetin* in the outer skin of onion bulbs, and the skins have been used in dyeing.

By virtue of its volatile oil the onion taken in moderate quantities is a stimulant to the stomach and promotes digestion, but in large quantities is apt to cause gastric uneasiness. It is slightly rubefacient, said to be diuretic, and belongs among those expectorants to be employed in the advanced stages of subacute *bronchitis* or in chronic *bronchitis*. Although the onion has been asserted to exercise a marked influence on nitrogenous metabolism it can scarcely be doubted that any apparent influence which it may exert in the direction spoken of is secondary to its action upon digestion.

Onion poultices are *somewhat* effective as a counter-irritant and nerve stimulant in cases of bronchitis or *pneumonia* in young children, with nervous symptoms. According to M. V. Pog-relaky, a decoction made with the outer reddish skin of the bulb is widely used in Russia for the production of abortion. He attributes the ecbolic effect to the presence of allyl sulphide. One or two tumblerfuls of the concentrated dark brown or dark red infusion are taken at a dose.

Ononis. Rest Barrow. Ononis spinosa L.— The roots are official in several European Pharmacopoeias under the title of "*Radix Ononidis*." The plant is common throughout Europe. The root is more or less flattened, twisted and slightly branched; from 10 to 60 cm. in length and 1 to 2 cm. in thickness; externally it is grayish-brown, deeply wrinkled; the odor resembles that of licorice, the taste being sweetish, mucilaginous, afterward bitter. Reinsch obtained from this plant *ononin*, $C_{25}H_{26}O_{11}$, a glucoside. *Onocerin*, a di-secondary alcohol, $C_{26}H_{42}(OH)_2$, was isolated by Thoms, who proposed to change its name to *onocol*. (*A. Pharm.*, 1897, 28.) Cow (*A. E. P. P.*, 1912, lxi, p. 393) has found that in the dog, the aqueous extract of ononis exercises a diuretic effect approaching in power that of juniper, which conclusion has been clinically confirmed by Breitenstein. It also contains tannin.

Ophioxylon. *Radix mustelae. Rauwolfiase-pentina* Benth. (*Ophioxylonserpentinum* L.) (Fam. Apocynaceae.)—In the root of this plant, which is used in East India as a purge and anthel-mintic, Wefers-Bettink found a yellow crystalline principle, *ophioxilin*, melting at $72^{\circ} C.$ ($161.6^{\circ} F.$), and possessing the formula $C_{16}H_{12}O_6$; also a volatile oil. (*A. J. P.*, 1890.) It is widely used in India as an antidote against bites of serpents, stings of insects, etc.

Opopanax.—A concrete juice or oleo-gum-resin of *Opopanax chironium* Kch. (*Pastinaca Opopanais* li., Fam. *Umbelliferae*). This species of parsnip has a thick, yellow, fleshy, perennial root, which ends up annually a strong branching stem, rough near the base, about 2 cm. in thickness, and from 1 to 3 m. in height. The

leaves are variously pinnate, with long sheathing petioles, and large, oblong, serrate leaflets, of which the terminal one is cordate, others are deficient at their base upon the upper side and the whole are hairy on their under surface. The flowers are small, yellow, and form large flat umbels at the termination of the branches. The plant is a native of the Levant, and grows wild in the south of France, Italy and Greece. When the base of the stem is wounded, a juice exudes, which, when dried in the sun, constitutes the *opopanax* of commerce. Some authors state that it is obtained from the root. A warm climate appears necessary for the perfection of the juice, as that which has been collected from the plant in France, though similar to opopanax, is of inferior quality. The drug is brought from Turkey. It is said to come also from the East Indies; but Ainslie states that he never met with it in any Indian medicine bazaar. The method of its production is not known with any certainty.

It is sometimes in tears, but usually in irregular lumps or fragments, of a reddish-yellow color, speckled with white on the outside, paler within, and, when broken, exhibiting white pieces intermingled with the mass. Its odor is strong, peculiar, and unpleasant, its taste bitter and acrid. Its sp. gr. is 1.622. It is inflammable, burning with a bright flame. It is a gum-resin, with an admixture of other ingredients in small proportion. Pelletier found in it gum, starch, wax, malic acid, lignin, a volatile oil, and traces of caoutchouc. Subsequently, Tschirch found opopanax to consist of resin, 19 per cent., ethereal oil, 6.5 per cent.; gum and plant tissues, 70 per cent.; water and loss, 4.5 per cent. (*A. Pharm.*, 1895, 209.) Schimmel states that the oil consists of an alcohol with a sesquiterpene as the chief constituent. (*Schim. Rep.*, 1904, 67.) Water by trituration dissolves about one-half of the gum-resin, forming an opaque milky emulsion, which deposits resinous matter on standing, and becomes yellowish. Both alcohol and water distilled from it retain its flavor; but only a very minute proportion of oil can be obtained in a separate state. Opopanax was formerly employed, as an antispasmodic and deobstruent, in *hypochondriasis*, *hysteria*, *asthma*, and chronic visceral affections, and as an emmena-gogue; but it is now scarcely ever used. Dose, ten to thirty grains (0.65-2.0 Gm.).

Opuntia. *Opuntia vulgaris* (Mill.). (Fam. *Cactaceae*.) *Prickly Pear*. *Figue de Barbarie*, Fr. *Indische Feige*, G.—A common cactus composed of flattened, prickly or spinose jointed stems, and occurring in sandy soil from Nantucket to South Carolina. For analyses of fruit of this cactus, see *A. J. P.*, 1884, 3, and 1896, 170. It is of a lighter color than *minium*, and is used as a pigment.

Oreodaphne. *Umbellularia californica* (Hook et Arnott) Nutt. (Fam. *Lauraceae*.)—The *California Bay Laurel* is an evergreen tree of considerable size, rather abundant throughout the State. Its wood is much prized on account of the beauty of its grain and its immunity from the attacks of insects. The leaves yield about 4 per cent. of a neutral, straw-colored, limpid, volatile oil, which has a warm camphoraceous taste and a pungent aromatic odor, resembling somewhat that of a mixture of oils of nutmeg and cardamom. It is soluble in 1000 parts of water, and in alcohol and ether in all proportions. It is said, when inhaled, to cause dizziness and headache. Its chemical characters have been studied by John P. Heamy. (*A. J. P.*, 1875, 105.) He finds it to consist of a pure hydrocarbon, sp. gr. 0.894, boiling at 175°

C. (347° F.), and an oxygenated, pungent portion, which boils at 210° C. (410° F.). This he calls *oreodaphnol*. *Oreodaphene* was obtained by distilling oreodaphnol with glacial phosphoric acid. For the reactions, see Heamy's paper.

Organotherapeutic Extracts.—The use of the extracts of various organs as medicinal agents is one of the oldest known therapeutic measures. Thus, Pliny mentions the use of the brains of animals in the treatment of *jaundice*, and it is probable that this drug was used also by the ancient Egyptians. The modern use of organic extracts may be dated from the investigations of Brown-Sequard. (*A. de P.*, 1889, p. 51.) Since this time extracts of nearly every portion of the body have been tested therapeutically. From many of these extracts there is no reason to expect any beneficial influence in diseased conditions. On the other hand, it is impossible to deny that many of the glandular organs of the body deliver their secretions directly into the blood stream, and that these secretions are essential for the maintenance of health and it is a priori not unreasonable to expect that the artificial administration of these secretions will have a beneficial influence in certain diseased conditions. It is among the last group of drugs that *opotherapy* finds a justification for its existence. Three of these organs of internal secretion have achieved so fixed a place in medicine as to have received official recognition, namely, the hypophysis, the suprarenal capsule, and the thyroid-gland. Although the pancreas probably also delivers an internal secretion, the pancreatin of the Pharmacopoeia represents an external and not an internal secretion of the pancreatic gland. There are some which have firmly established their claims, although not yet included in the U. S. P., but the great mass of them are still in the experimental stage.

Cerebrin. Cerebrum Siccum.—The dried *brain* substance has been used by Babes and others (*K. T. W.*, 1900) in the treatment of neurasthenia, insanity and epilepsy. The treatment, however, has no scientific foundation. Wasaermann (*B. K. W.*, 1898, p. 4) has shown that an emulsion of the brain is capable of neutralizing the tetanus toxin. It has subsequently been shown also that this holds true for strychnine and morphine. On this evidence an emulsion of the dried brain substance has been used in the treatment of *tetanus* and *rabies*. (Kowalski, *K. T. W.*, 1900, No. 5.) The dose of the dried brain substance is 30 to 60 grains (2-4 Gm.).

Bronchial Gland. Glandula Bronchialis Siccum.—The dried bronchial gland has been used in the treatment of tuberculosis and chronic bronchitis, but with no very encouraging results. The dose is 1 to 3 grains (0.06-0.18 Gm.).

Ciliary Body. Corpus Ciliarae.—The extract of the ciliary body, as well as the *vitreous body* has been used in sympathetic ophthalmia by Dor and by Wecker. (*Annals d'Oculistique*, August, 1902.) *Oculin* is a name applied to a glycerin extract of the ciliary body and vitreous humor.

Kidneys. Renes Siccum.—There is considerable evidence that the kidneys supply an internal secretion, but that failure of this internal secretion is the cause of uremia, as claimed by some, has certainly not been established. Although a number of authors have claimed beneficial results from the administration of the kidney substance in nephritis and uremia, it is probable that the treatment is useless. The dose

recommended is from four to fifteen grains (0.26-1.0 Gm.) several times daily. *Nephritin* is a proprietary extract of this class.

Lungs. Pulmones Sicci.—The dried substance of the lung has been used by Brunei (*Press. Med.*, 1898, p. 22) in *tuberculosis*, *emphysema*, and *asthma*. The dose is seventy-five grains (5 Gm.) a day.

Liver. Hepar Siccum.—Gilbert and Karno (*S. M.*, 1897, p. 184) believe that there is some substance in the liver which leads to a retention of the glycogen out of the blood in the liver, and that the administration of this substance is of benefit in the treatment of diabetes. Gyr asserts that the extract of the liver is also useful in *hepatocirrhosis* (*R. M. S. R.*, June 20, 1908), and in *hemeralopia* by Roncagliolo (*Med. Klin*; 1905, p. 909). The dose of the dried liver is one-half to one ounce (15-31 Gm.) per day.

Mammary Gland. Mammæ Siccatae.—On the theory that there is some relation between the uterus and the mammary gland, the latter has been used by Shober (*Phila. M. J.*, Nov., 1899) and others, in the treatment of *menorrhagia*, *fibromata*, *dysmenorrhea*, etc. The dose of the dried gland is five to ten grains (0.32-0.65 Gm.) three times a day.

Ovaries.—That the ovaries deliver an internal secretion which if not essential to life, certainly modifies in some way metabolism, is almost universally accepted. One of the strongest proofs of this is seen in the symptoms which occur at the menopause or after double oophorectomy. The *corpus luteum*, according to Ott and Scott (*Proc. of the Soc. of Exper. Biol. and Med.*, 1910, viii, p. 49), has a marked stimulating effect upon the mammary gland, but the ovarian substance when deprived of this was without such action. There is strong clinical evidence that the administration of the ovarian substance will at least temporarily relieve the symptoms seen at the menopause, whether the latter is natural or artificial. Richter (*D. M. W.*, 1899) has found that there is a marked increase in the fatty metabolism under the feeding of the ovarian substance. These investigations have been confirmed by Thumim. (*Ther. Geg*; 1900, p. 451.)

The ovarian substance has also been used in the treatment of *neurasthenia* by Vidal (*Press. Med.*, 1900, p. 173) as well as in a host of other diseases in which there was much less likelihood of benefit following its administration. (For review of the literature, see Offergeld, *D. M. W.*, 1911, p. 1172.)

The *corpus luteum* has been used for various disturbances of *pregnancy* on the ground that these were due to the natural intermission in this function. The dried ovarian substance is marketed in various strengths. *Ovariin* represents eight times its weight in fresh bovine ovarian substance; the dose is three to six grains (0.2-0.4 Gm.). *Ovaraden* represents two parts of the gland and may be given in doses of fifteen to thirty grains (1-2 Gm.). Other proprietary preparations of the ovarian substance are *glandnovin*, *ovadin*, *ovarial*, *ovarigen*, *oophorin*, *ovaron*, and *lutein*. The dried corpora lutea is given in doses of one to five grains (0.065-0.32 Gm.) two or three times a day.

Parotid Gland. Parotis Siccum. Glandula Parotidis.—Believing that there is some connection between the parotid and the sexual organs, Bell (*Ther. Woch.*, 1896, p. 659) has employed the parotid gland in the treatment of *dysmenorrhea*, *ovarianneuralgias*, and other disorders of the pelvic organs. The dried substance is usually administered in tablet form in doses of from one to three grains (0.065-0.2 Gm.) three times a day.

Parathyroids. Glandula Parathyroidea.—These are four small bodies growing near the lateral lobes of the thyroid gland. Because of their anatomical proximity it was at one time believed that their function in the body was similar to that of the thyroid body, but it is now known that these two organs are in no way physiologically connected. The parathyroid bodies, however, are among those organs whose removal is fatal. The most prominent symptom caused by parathyroidectomy are tetanic convulsions. Ott and Scott (*Amer. Med.*, 1910) have found that the parathyroid extract has a powerful diuretic influence. The dried parathyroid gland has been used in the treatment of *tetany*. (Loewenthal, *Med.Klin.*, 1907, p. 1012.) It has also been used by Meyer (*Ther.Geg.*, 1913, 354) and Berkley (*N. Y. M. J.*, Nov. 23, 1907) in treatment of *paralysis agitans*. The dose is one-tenth of a grain (0.006 Gm.) two or three times a day.

Prostate. Glandula Prostatae Siccae.—This substance has been used, without any reasonable justification, in the treatment of prostatic enlargement, and in *prostatorrhoea*. The dose of the dried substance is two grains (0.125 Gm.).

Spleen. Lien Siccus.—It can hardly be considered definitely established that the spleen furnishes any internal secretion. According to Danilewsky and Salensky (*A. G. P.*, 1895, p. 264), however, the subcutaneous injection of the splenic extract produces an increase in the percentage of hemoglobin, and in the number of red blood cells. It is also asserted that there is an increase in the number of the white corpuscles. It is possible that these effects are not due to any substance peculiar to the spleen, but to the nucleinic acid which it contains. Accordingly, the splenic extract has been used in the treatment of *anemias*, with more or less beneficial results. Carpenter (*D. M. Ztg.*, 1907, p. 571) asserts that it has a specific action in malaria. H. C. Wood (*A. J. M. S.*, 1897, p. 511) has found it useful in *Graves's disease*. It has also been recommended in various forms of insanity. One of the difficulties in the use of this drug is to obtain a preparation which is active and yet will be borne by the stomach. The dried powder is given in doses of four to fifteen grains (0.26-1 Gm.) three times a day. It is doubtful, however, how far it entirely represents the drug. Under the name of *eurythrol*, an aqueous extract has been marketed. The dose of this is one to two teaspoonfuls, given generally in soup. *Lienaden* and *opo-lieninum* are proprietary preparations of spleen.

Testicles. Testes Sicci.—The basis of the famous elixir of Brown-Sequard, *Liquor spermaticus*, was the fluid contained in the testicles. The persistent use of the various imitations and modifications of the *Brown-Sequard Elixir* would argue that it must possess some therapeutic virtue. It is claimed by those who use it that it has a powerful tonic effect, not merely improving the strength, but also exercising a beneficial influence upon the metabolism, so as to lead to a permanent augmentation of power. It has been recommended for *neurasthenia*, *diabetes*, *locomotor ataxia*, *arteriosclerosis*, and a large number of other chronic complaints.

The dried testicular substance is given in doses of from ten to thirty grains (0.65-2 Gm.), but it is generally recommended as a liquid preparation, and that it should be given hypodermically. Among the preparations which contain testicular fluid as their important ingredient are the *Siccus e Testibus Paratus*, *orchidin*, *Hawley lymph*, *testaden*, *testidin* and *teston*.

Mesentery Gland. Coeliacin.—The dried mesentery gland has been used by Schwerdt (*M. M. W.*, 1907, p. 1230) in the treatment of scleroderma. The dose he employed was five grains (0.3 Gm.) twice a day.

Thymus Gland. Glandula Thymi Sicca.—This body, which is the ordinary sweetbread, is found only in young animals, disappearing as adult life comes on. Physiologists are not agreed as to its exact importance or function. It appears to have some connection with the growth of bone and also of the formation of the white corpuscles of the blood. It has been used in medicine chiefly for two purposes, namely, in the treatment of *exophthalmic goiter*, and for the purpose of stimulating bony growth in *rickets* and *united fracture*. It should be remarked that thymus contains a larger percentage of nuclein than any common food stuffs, and for this reason its use is generally forbidden to gouty patients. The dose of the fresh gland is from one drachm to half an ounce (2-15 Gm.) ; of the dried gland five to forty-five grains (0.32-3 Gm.).

Bone Marrow. Medulla Ossium.—This has been used by Gullan (*Lancet*, 1907, p. 520), and others, in the treatment of *pernicious anemia*. Gullan administered it by spreading the fresh red bone marrow on bread, which is taken at meal times. It is very prone to produce nausea. The dose of the fresh marrow is one to three ounces (31-93 Gm.) ; of the dried marrow two to five drachms. (7.7-20 Gm.). *Opo-osslin* and *ossagen* are proprietary preparations made from bone-marrow.

Spermin.—A salt solution of the hydrochloride of the amine spermin ($C_5H_{14}N_2$), a normal constituent of the spermatic fluid. It is used as a nerve tonic and stimulant in all diseases due to auto-intoxication, as *typhus*, *syphilis*, etc. Dose, subcutaneously, sixteen minims (1 mil) of a two per cent. solution; by mouth, ten to thirty drops (0.6-1.8 mls) of a four per cent. solution.

Origanum. *Wild Marjoram. Marjolaine sauvage*, Fr. *Wilder Majoran (Meiran)*, G.—Two species of *Origanum* (Fam. *Labiatae*) have been used in medicine. *O. majorana* L., or *sweet marjoram*, and *O. vulgare* L., or *common marjoram*. The former grows wild in Portugal and Andalusia, and is cultivated as a garden herb in other parts of Europe and in the United States. Some authors, however, consider *O. majoranoides* Willd., which is a native of Barbary, and closely allied to *O. majorana*, as the type of the sweet marjoram of our gardens. This is by others considered to be simply a form of *O. vulgare* L. *Sweet marjoram* has a pleasant odor, and a warm, aromatic, bitterish taste, which it imparts to water and alcohol. By distillation with water it yields a volatile oil. It is tonic and gently excitant, but is used more as a condiment than as a medicine. In domestic practice its infusion is employed to hasten the tardy eruption in

measles and other exanthematous diseases.

The plant is a native of Europe and America. In this country it grows along the roadsides, and in dry, stony fields and woods, from Pennsylvania to Virginia, and is in flower from June to October; but is not very abundant, and is seldom collected for use.

Sweet marjoram imported during recent years from Europe is alleged to be adulterated by mixing with it broken fragments of leaflets of the poisonous *coriaria myrtifolia*.

Two kinds of *oil of origanum* are now known commercially: the Trieste oil, of dark color and high specific gravity, and the Smyrna oil, of lighter color, lower specific gravity, and milder taste. The former contains from 60 to 85 per cent. of *carvacrol*, $C_{10}H_{14}O$, a trace of another phenol, and *cymene*, $C_{10}H_{14}$. The latter contains from 25 to 60 per cent. of *carvacrol* and, in addition, *linalool* and *cymene*. The specific gravity of the Trieste oil ranges from 0.94 to 0.98, while that of the Smyrna oil is from 0.915 to 0.945. (Gilde-meister and Hoffmann, *Aetherische Oele*, pp. 813, 814; see also *Schim. Rep.*, 1913, 76.)

The French oil of marjoram is said to be distilled from *Clinopodium Nepeta* (L.) Kze. (*Calamintha Nepeta* Link. and Hoffm.). It is colorless, but gradually turns yellow on exposure. It is neutral in reaction, sp. gr. 0.904 at 16° C. (60.8° F.), and optical rotation $[a]_p = +18^{\circ} 39'$ in chloroform solution. On fractionating, three constituents were isolated, *laevo-pinene*, *calaminthone*, and *pulegone*. *Calaminthone* is a new ketone, $C_{10}H_{16}O$. (See *P. J.*, March, 1903.)

Origanum floribundum, of Algeria, yields largely of a volatile oil containing 25 per cent. of thymol. (*P. J.*, Feb., 1903.)

Orobanche. *Epifagus virginiana* (L.) Bart. (Fam. *Orobanchaceae*.) *Beech-drops*. *Cancer Root*. *Orobanche de Virginie*, Fr. *Krebswurz*, G.—This is a parasitic, fleshy plant, found in Northeastern America, growing upon the roots of the beech tree. The plant has a bitter, nauseous, astringent taste, which is said to be diminished by drying. It has been given internally in bowel affections; but its credit depends mainly upon the idea that it is useful in obstinate *ulcers* of a cancerous character, to which it was directly applied. Other species of *orobanche*, growing in America and Europe, have been employed. They are all parasitic, fleshy plants, without verdure, and of a bitter, nauseous taste. In Europe they are called *broom rape*. C. Charaux believes that *Chlorogenic acid* which can be easily converted into caffeic acid exists in plants of the fam. *Orobanchaceae* and other families. The allied plants, *Conopholis americana* (L. f.) Wallr. (*Orobanche americana* L. f.) and *Orobanche uniflora* L., growing throughout the United States, are used for the same purposes as the species above noticed, and, like it, are called cancer root.

Oroxylon. *Oroxylon indicum* Vent. (Fam. *Bignoniaceae*.)—This East India bark is said to be not only a tonic and astringent, useful in diarrhea, but also a powerful sudorific. A yellow crystalline substance, *oroxylin*, has been separated from the bark

by Naylor and Chapman (P. J., Sept., 1890), and from the seeds by Hooper (P. J., vol. Ixi). The seeds have been used in veterinary medicine.

Orris, N. F. IV. *Iris*. *Orris Root*. *Rhizoma Iridis*, P. G. *Radix Iridis Florentines*, *Radix Ireos*.

Orthosiphon. *Orthosiphonstamineus* Benth. *Java Tea*. (Fam. *Labiatae*.)—This drug occurs in commerce in the form of small, oval, finely toothed, green leaves, rolled up like tea. Van Itallie has discovered in it a volatile oil and a crystalline gluco-side, orthosiphonin, and potassium salts. (*Ph. Ztg.*, Sept., 1886; see also *Repertoire de Pharm.*, 1887, 191.) It is said to be a powerful diuretic, and is highly recommended in nephritic colic, gravel, uric acid diathesis, and even ascites. The dose is from fifteen to thirty grains (1.0-2.0 Gm.) a day.

Osha Root.—This is the root of *Ligusticum filicinum* Wats. (Fam. *Umbelliferae*), a perennial herb indigenous in Utah and neighboring States and known as *Colorado cough root*. It is highly prized as an expectorant. H. Haupt found in it an acid, *oshaic add*, closely resembling angelic acid. (*A. J. P.*, 1867, 1868, 1873.)

Oxalis. *O. Acetosella* L. *Wood Sorrel*. *Acetosella*. *Alleluia*, *Surelle*, *Pain de Coucou*, Fr. *Sauerklee*, *Hasenklee*, G.—Wood sorrel is a small, creeping plant having radical leaves and scapes from 5 to 15 cm. high. (fam. *Oxalidaceae*). It is a native of Europe and naturalized in the Northern United States. Other indigenous species of oxalis possess similar properties to *O. Acetosella*. The whole herbaceous portion may be used.

Wood sorrel is without odor, and has an agreeable sour taste. It owes its acidity to acid *potassium oxalate* or *potassium binoxalate* (HKO_2O_4).

The fresh plant, eaten raw, is useful in scurvy.

Oxalis crassicaulis Zucc., a Peruvian species, yields edible tubers and, by expression from its leaves, a very sour and astringent juice, which is employed, in the form of syrup, in *hemorrhages*, *chronic catarrh*, and *gonorrhoea*, with asserted advantage.

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Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Paeonia. *Paeonia officinalis* L. *Peony*. *Pivoine*, Fr. *Gichtrose*, *Pfingstrose*, G. (Fam. *Ranunculaceae*.)—The root of the garden peony consists of a thick rhizome which sends off in all directions spindle-shaped roots, which gradually taper into thread-like fibers, by which they hang together. It has a strong, peculiar, disagreeable odor, and a nauseous taste, which is at first sweetish, and afterwards bitter and somewhat acrid. The odor is lost, or much diminished, by drying. Peony root was in very great repute among the ancients as a charm and as a medicine in epilepsy. In modern times it has been used as an antispasmodic. According to Rochebrune (*Toxicolog. Africaine*, i), it contains an active alkaloid, *paeonine*. The expressed juice is milky, of a strong odor and very disagreeable taste. The *seeds* are roundish-oval, about as large as a pea, externally smooth, shining, and nearly black, internally whitish, inodorous when dry, and of a mild oleaginous taste. By some authors they are said to be emetic and purgative, by others antispasmodic. The dose of the fresh root or seeds is from two drachms to an ounce (7.7-31.0 Gm.), boiled in a pint of water down to half a pint, which should be taken daily. It is said to be less active when dried. Dose, of the expressed juice of the root, one fluidounce (30 mils).

W. Will obtained from an aqueous distillate of the root of the Japanese *Paeonia Moutan* Simson, an aromatic ketone in colorless crystals. (*Ber. d. Chem. Ges.*, xix, 1777.) According to Nagae, this substance has the formula $C_9H_{10}O_3$. (*Ibid.*, xxiv.) It has been prepared by Schimmel & Co., under the name of peonol. It has a pleasant aromatic odor, and crystallizes in large needles. No essential oil was found in the root. (*Schim. Rep.*, Oct; 1890.) Dragendorff has found in the seed of *P. peregrina* Mill., a fixed oil, an alkaloid, and paeonic acid. (*Jahresb.*, 1879.)

Palicourea. *Palicourea rigida* H. B. K. (Fam. *Rubiaceae*.)—The leaves of this tree are used in Brazil as a diuretic and diaphoretic. In 1866 Peckholdt found in them an alkaloid and three organic acids. One of these acids, consisting of a yellow, oily liquid with an overpowering odor, was found to be distinctly poisonous, one drop injected into a pigeon being enough to cause death. This was called *myotonic acid*. A crystalline *palicouric acid*, an amorphous tannin, and another amorphous non-toxic bitter principle were also isolated. Santesson has confirmed the presence of an alkaloid. (*A. Pharm.*, 235.)

Panbotano Bark.—The root of the Mexican leguminous tree, *Calliandra Houstoni* Benth., has been highly recommended by Valude as an antiperiodic, although Villejean was not able to find in it either an alkaloid or a glucoside. (*Journ. de Sci. Med. de Lille*, 1890.) Pouchet (*Nouv. Rem.*, 1896), however, states that he has found in panbotano, besides saponin, an alkaloid which produces death by systolic arrest of the heart. Both Dinau (*These de Paris*, 1896) and Crespin confirm its antiperiodic value. (*B. G. T.*, Aug., 1895.) A tincture representing two ounces of the root is taken in four doses during twenty-four hours.

Pangium. *Pangium edule* Reinw. (Fam. *Bixaceae*.)—This East Indian tree, which is said to possess anthelmintic and narcotic properties, and to be capable of causing death, according to Blume, contains an alkaloid resembling *menispermine*.

Pao-Pereira Bark. *Pereiro Bark*.—Under this name a bark is employed in Brazil as a febrifuge. It is supposed to be the product of *Geissospermum laeve* (Veil.) Baill. (Fam. *Apocynaceae*). O. Hesse has found an alkaloid, *geissospermine*, $C_{19}H_{24}N_2O_2 + H_2O$, in it (see *P. J.*, viii, 648), but he seems to have been preceded in this discovery by Santos. (*A. J. P.*, 1878, 184.) Peretti has discovered in the root a second alkaloid, *pereirine*, $C_{19}H_{24}N_2O$, which, according to Guimaraes (*B. M. J.*, vol. i, 1887), in sufficient doses causes paralysis with elevation of temperature, ending in death. It has been given to man as an antiperiodic in doses of thirty grains (2.0 Gm.) a day. (See also *A. J. P.*, 1886, 278.) Later a third alkaloid, vellosine, $C_{23}H_{28}N_2O_4$, was found. This forms colorless, crystals, melting at $189^{\circ} C.$ ($372.2^{\circ} F.$), insoluble in water, easily soluble in alcohol and ether. In concentrated nitric acid it dissolves with a purplish-red color, which is very stable.

Papaya. *Melon Tree. Papaw*.—The *Carica Papaya* L. (Fam. *Caricaceae*) is a shrub, everywhere cultivated in tropical countries for the sake of its fruit. The ovoid fruit sometimes attains a length of 30 cm. and weight 4 or 5 K. According to Peckholdt (*P. J.*, Nov., 1879), the milky juice is contained in all parts of the tree, but in such small quantity, save in the unripe fruit, that it is always procured from the latter. One fruit will yield about 33 Gm., which is obtained by scratching through the skin in various places; the process does not interfere with the ripening of the fruit, but it is said that the seeds will not germinate. The milk has an acid reaction, an astringent bitterish taste, and a sp. gr. of 1.023. Upon standing for a few minutes it separates into two parts, an aqueous liquid and a white, somewhat coagulated pulpy mass. In the aqueous portion is an albuminous substance, possessed of enzymic properties, to which the names of *papain* and *papayotin* have been given. According to the researches of S. H. C. Martin, papaw juice contains besides papain, a milk-curdling ferment and globulin, albumin, and two phytalbumoses. No peptones occur in the juice, but leucine and tyrosine are present. (*J. Chem. S.*, 1886, 642; see also *P. J.*, 1885, 129.) In a representative preparation the ferment action seems to be most marked when all the proteids are associated together in the natural form. In its action upon albumin the enzyme of the papaw produces products which have a close relation to those produced by tryptic and peptic digestion. In the action of the papaw ferments on milk there is first curdling, in which the casein is separated into a soft flocculent precipitate, and afterwards a digestion of the proteids, during which process

they are converted into soluble and diffusible products. The amount of starch-converting ferment is not large, but sufficient in the fresh latex to promptly act upon starch paste, thinning it, and converting a portion at least into soluble starch and dextrin. The import of the rennet ferment and the pectase probably present require further investigation.

According to Wlurtz, fibrin is dissolved whether the solvent solution be alkaline or acid. Brunton and Wyatt and also Martin affirm, however, that one-half per cent. of hydrochloric acid will prevent digestion, but Albrecht reasserts that hydrochloric acid hastens the action of the ferment, and states that the official preparation in use in Paris hospitals is an acid one. In order entirely to convert fibrin into pure peptone so that nitric acid will produce no precipitate, the proportion of the ferment should be as great as 3 per cent., and digestion must continue for forty-eight hours at 50° C. (122° F.).

Papaya juice has a tendency to spoil by undergoing a butyric fermentation, but Wurtz found that the addition to it of glycerin preserved it without interfering with its digestive power. Imported in this form, it was a thick, milky liquid. As it now occurs in commerce, papain is a grayish, fine powder, which in appearance, odor, and taste strongly suggests pepsin.

The seeds of the papaw tree contain a glucoside, caricin, which resembles *sinigrin*. These seeds also contain the ferment, *myrosin*, and by the reaction of the two a volatile pungent body is produced, suggestive of oil of mustard in odor. An alkaloid, *carpaine*, C₁₄H₂₅O₂N, has been obtained from the leaves. Physiologically, this alkaloid has the effect of a heart stimulant, quite similar to that of *digitalis*. (*A. J. P.*, July and August, 1901, 336-48 and 383.)

Under the name of *papayotin*, *papain*, or *papoid*, the dried juice of the *Carica Papaya* is put upon the market. It is frequently adulterated with starch, which is not naturally present in the fruit. Its digestive power is far below the claims formerly made for it. It is asserted for it that, when the stomach is acid, it is much superior to pancreatin, because its action is not markedly affected by contact with the acid. In experiments made by H. C. Wood with a papoid from one of the most renowned manufacturers no digestion occurred, and it is probable that much of the article of commerce is inert. It has been used as an internal medicine in *dyspepsia* and *gastric catarrh*, and as a local application for the destruction of false membranes, *warts*, *tubercles*, walls of old sinuses, and even of *epithelioma*. (See Branch, *B. M. J.*, 1907.) It is not caustic nor astringent, but destroys the part by virtue of its power of dissolving not only muscular but connective tissue. Jacobi affirms (*T. G.*, vol. ii) that diphtheritic membranes are dissolved in a few hours by the hourly application of a mixture of one part of papain with two parts each of water and of glycerin. It is stated that from time immemorial the fresh leaves of the papaya plant have been used by the Indians to wrap meat in to make it tender, and as a dressing to *foul wounds*. Peckoldt says that, taken internally, the juice is reputed to cause intestinal inflammation. No recent observers have noted such influence. According to Brunton, the dose is from five to ten grains (0.32-0.65 Gm.). Injected into the venous circulation

it acts as a powerful poison, of which a single grain is sufficient to kill a rabbit.

Paracoto. *N. F. IV. Paracoto.*—"The dried bark of an unidentified tree indigenous to Northern Bolivia." *N. F.*

This drug was introduced into the National Formulary IV. It is not official in the U. S. or Br. Pharmacopoeia. A tincture and fluidextract are official in the N. F.. Paracoto is described as follows:

"In quills, or fragments of quills, of indefinite length, usually from 3 to 6 cm. in breadth, from 5 to 15 mm. in thickness; of a deep-brown color throughout, the outer surface nearly smooth, lightly, transversely fissured, and often very thinly scaly, the inner surface very coarsely striate; hard and heavy, but splitting and breaking readily, the fracture mealy in the outer layer, with an irregular resinous band, coarse splintery in the inner layer with large, yellowish-brown bast fibers and stone cells and darker resin tissue. Odor strong and characteristic, nutmeg-like; taste strongly aromatic and pungent. Paracoto yields not more than 3 per cent. of ash." *N. F.*

Paracotoin, $O_{12}H_8O_4$, is extracted from para-coto bark, in which it exists associated with *hydrocotoin*, $C_{15}H_{14}O_4$, *protocotoin*, $C_{16}H_{14}O_6$, *methylhydrocotoin*, $C_{16}H_{16}O_4$, and *methylprotocotoin*, $C_{17}H_{16}O_4$. Paracotoin may be distinguished from cotoin by giving no reaction with ferric chloride.

Paracotoin forms yellowish crystals soluble in alcohol and water and fusing at 149° to 151° C. (300.2° - 303.8° F.). For a special reason its manufacturers have warned against its use in intestinal hyperemia. *Piperonylic* (methylene protocatechuic) acid, $C_8H_6O_4$, is also present. Paracoto bark has been used in various types of *dysentery* and *diarrhea*, especially in *tuberculous enteritis*. Balz (of Tokio) has employed paracotoin hypodermically in the treatment of *cholera* in doses of three grains (0.2 Gm.). This principle has also been recommended for night sweats.

The dose of paracoto bark is five grains (0.3 Gm.). (For uses see *Coto Bark*, p 1344.)

Parameria. *Parameria vulneraria* Radlkofer. (Fam. *Apocynaceae*.)—This tree yields the *Balsamo de Taguloway* of the Malays. (See *A. Pharm.*, Nov., 1885.)

Pareira. *N. F. IV (U. S. P. VIII, Br. 1898). Pareira Brava, Pareira Radix, Br. Pareira Root.*—"The dried roots of *Chondrodendron tomentosum* Ruiz and Pavon (Fam. *Menispermaceae*) without the presence of more than 5 per cent. of stems or other foreign matter." *N. F.*

Chondrodendron tomentosum is a climbing, woody vine, which attains often a considerable height, and is remarkable for the size of its leaves. These are about a foot long, broadly ovate or rounded, slightly cordate, with a smooth upper surface, and on the under surface, between the veins, covered with a fine close wool of an ashy hue. The racemose fruits are of the size of large grapes, oval and black. This plant inhabits both Brazil and Peru.

Pareira was formerly official in the U. S. VIII and Br. Pharmacopoeias, but is now official in the N. F. IV, where it is described as follows: "Nearly cylindrical, more or less tortuous, of variable length and from 1 to 6 cm. in diameter. Externally brownish-black or blackish-brown with transverse ridges on knot-like projections, occasionally fissured and longitudinally wrinkled or even furrowed. Hard, heavy and tough; when freshly cut having a waxy luster; the transverse surfaces exhibiting several successive eccentric and distinctly radiate concentric zones of projecting, secondary fibro-vascular bundles, each from 2 to 4 mm. in width, and separated by distinct concentric zones of parenchyma and stone cells. Stem deeply furrowed, grayish in color, usually covered with foliaceous patches of lichens bearing their blackish apothecia; internally grayish-yellow, with a prominent development of wood with a tendency to separate fibro-vascular bundles and without a waxy luster. Odor slight, taste very bitter.

The powder is dark brown, containing numerous starch grains and a few woody fragments; starch grains mostly simple, occasionally unequally two-to four-compound, the individual grains ellipsoidal or oblong, 0.005 to 0.02 mm. in diameter and occasionally with central clefts or irregular markings; fragments with large, wide tracheae, the walls with numerous slit-like pores and associated with long, thick-walled, strongly lignified, porous wood fibers; stone cells in small groups, with thick porous walls and in form resembling those of the fruits and seeds; fragments of starch-bearing parenchyma; the cells of the root being thick-walled, strongly lignified and with large, longitudinal, elliptical pores; occasional fragments of blackish-brown cork. *Pareira* yields not more than 5 per cent. of ash." *N. F.*

For account of commercial history, see *U. S. D.*, 18th ed., 1916.

The root imparts its virtues readily in water. Feneuille found in it a soft resin, a yellow bitter principle, a brown substance, a nitrogenous substance, fecula, acid calcium malate, potassium nitrate, and various other salts. He considers the yellow bitter substance as the active principle. It is soluble in water and alcohol, and precipitated from its solution by tincture of galls. Wiggers announced in 1838 the existence in *pareira brava* of an alkaloid, for which he proposed the name of *pelosine* or *cissampeline*. Peretti of Rome, and Pelletier afterwards, separated from the root an alkaloid characterized by assuming a beautiful purple color upon contact with strong nitric acid. (*J. P. C.*, xxvi, 162.) It is stated to be uncrystallizable, insoluble in water, soluble in ether, alcohol, and the acids, and of an intensely bitter and sweetish taste. Fluckiger (*P. J.*, 1870, p. 192) found an alkaloid in *pareira*, and, having thoroughly determined its origin, investigated its properties, and fixed its composition at $C_{18}H_{21}NO_3$, showed its identity with the *bebeerine* of *nectandra* and the *buxine* of *Buxus sempervirens* obtained by Walz. Ringer and Brooke (*A. J. P.*, 1892, 255) proved that the true chondrodendron root contained a larger quantity of chemical and extractive principles than do the substitutes. (See also Dohme's paper, *D. C.*, 1896, 296.)

Pareira is supposed to have a diuretic effect and to act as an antiseptic in the bladder.

It is chiefly employed for the relief of *chronic inflammations of the urinary passages*. In Brazil it is used in the cure of the *bites of poisonous serpents*, —a vinous infusion of the root being taken internally, while the bruised leaves of the plant are applied to the wound. The dose of pareira in substance is from thirty grains to a drachm (2.0-3.9 Gm.). The infusion (1 oz. in 1 pint of boiling water) is useful. The aqueous extract may be given in the dose of from ten to thirty grains (0.65-2.0 Gm.). There is an official fluidextract made with diluted alcohol in the N. F. IV.

For preparations of pareira see U. S. D., 19th ed., p. 917.

Dose, thirty to sixty grains (2.0-3.9 Gm.).

Parietaria. *Parietaria officinalis* L. *Wall Pellitory. Parietaire, Perce-muraille, Fr. Glaskraut, G.* (Fam. *Urticaceae.*) —A perennial European herb, growing on old walls and heaps of rubbish. It is diuretic and refrigerant, and was formerly used in urinary complaints and dropsy, in the form of decoction or of the expressed juice.

Parkia. *Parkia biglandulosa* W. and A. (*P. africana* R. Br.). *African Locust. Nitta or Nutta Tree, Doura. Houlle. Neretou.*—This is an African leguminous tree, from the dried seeds of which a farinaceous food is prepared by the natives. According to De Rochebrune (*Toxicolog. Africaine*, 1898), it contains a peculiar crystalline alkaloid, *parkine*, which resembles in its physiological activity physostigmine.

Parnassia Palustris.—An infusion of the bark of this tree has been used in the treatment of *epileptics*, administered in teaspoonful doses three times daily.

Parsley Root. *N. F. IV. Petroselin Radix. Petrosel Rad.* It is described by the N. F. as "The root of *Petroselinum sativum* Hoffmann (Fam. *Um-belliferae*). The entire fusiform root, measuring up to 20 cm. in length and up to 2.5 cm. in thickness at the crown, or broken or cut into pieces; usually cut lengthwise into two or four sections; externally light yellowish, wrinkled longitudinally, somewhat annulate, root scars distinct and corky; fracture tough when damp, brittle when dry; internally, cortex whitish and characterized by numerous, reddish-brown oleoresin cells, cambium zone distinct and brownish; wood about the same thickness as the cortex, slightly radiate and light yellow. Odor aromatic; taste sweetish and pungent. The powdered drug, when examined under the microscope, shows numerous truncate or somewhat angular starch grains up to 0.03 mm. in diameter, reticulate tracheae up to 0.06 mm. in width and thin-walled, lignified fibers with simple pores. Parsley Root yields not more than 6 per cent. of ash." Dose, thirty grains (2 Gm.). (See *Petroselinum*).

Parthenium. *Chrysanthemum Parthenium* (L.) Bernh. *Feverfew. Matricaire, Fr. Mutterkraut, G.* (Fam. *Compositae.*)—A tall, perennial, branching herbaceous plant, with bipinnately divided leaves, the divisions being ovate, and compound flowers in a corymb. It is a native of Europe, but cultivated in our gardens and naturalized in some places. The whole herbaceous part is used. The plant has an odor and taste analogous to those of chamomile, which it resembles also in the appearance of its flowers and in its medicinal virtues. It yields a greenish volatile oil which boils between

165° and 220° C. (329° and 428° F.), and separates on standing, *pyrethrum camphor*, C₁₀H₁₆O. (Dessaignes and Chautard, *J. P. C.* (3), xiii, 241.)

The flowers of this and of a closely resembling species, *Matricaria Anthemis parthenoides* Desf., are said to be used in France, to a considerable extent, indiscriminately with those of the true chamomile plant, *Anthemis nobilis*, which they closely resemble, especially when double. They may, however, be distinguished, in this state, by their peculiar odor, their small receptacle, which is, moreover, rounded and flattened above, instead of being conical and somewhat pointed as in the *Anthemis*, and by the tubular five-toothed central florets, which in the chamomile are small, few, and scarcely visible, but in the two former species are large, very numerous, and very long.

Parthenium Hysterophorus L.—Jose Torar has found *parthenine* and four other alkaloids besides *parthenic acid*, in this Cuban plant which is used by the natives as a febrifuge and antiperi-odic. Of the alkaloids, *parthenine* is crystallizable and is apparently the active principle. It has been extracted and studied again by H. Vin Arny (*A. J. P.*, 1890, 121), who believes it to be a bitter glucoside and not an alkaloid. In doses of three grains (0.2 Gm.) it is said to quicken the heart, and in doses of fifteen grains (1.0 Gm.) to slow cardiac action, while fifty grains (3.2 Gm.) not only lessen the arterial pressure and respiratory frequency but reduce the bodily temperature. In doses of from seven to ten grains (0.45-0.65 Gm.) it is affirmed to be useful in neuralgia. (See *Journ. de Med. de Paris*, March, 1887; *J. P. C.*, xii, 1885; *A. J. P.*, 1897, 169.)

Parthenium integrifolium L., *American Feverfew*, *Wild Quinine* (Fam. *Compositae*), is an herbaceous perennial, growing abundantly in the prairies of the Southwestern States, which has been used as a tonic and antiperiodic; two ounces (62 Gm.) of the flowering tops may be given in infusion.

Passion Flower. *N. F. IV. Passiflora. Passion Vine.* "The dried herbage of *Passiflora incarnata* Linne (Fam. *Passifloraceae*), collected after some of the berries have matured." *N. F.*

It is described in the *N. F.* as follows: "Stems glabrous or slightly pubescent above, striate, from 6 to 8 mm. in diameter, of variable length, woody, hollow, the cavity about one-half the diameter; bark very thin, greenish or purplish; wood very porous and bordered on the inner side by a thin layer of pith; fracture of the wood uneven, of the stem smooth, of the bark coarsely fibrous. Leaves more or less broken in drying, rather thick, glabrous or often pubescent, when entire nearly orbicular in outline, base cordate, deeply three- to five-lobed, lobes ovate, acute, finely serrate, petioles from 1 to 5 cm. in length, with two glands near the summit. Tendrils numerous and closely coiled, Flowers solitary, axillary, peduncles as long as the petioles, usually three bracted; calyx cup-shaped, four to five lobes; lobes linear, imbricated, cuspidate, corona of the fresh flowers purplish; petals four to five, yellow; ovary oblong, stalked; stamens monadelphous in a tube about the stalk of the ovary, separated above, anthers narrow, versatile. Fruit from 4 to 5 cm. in length, an ovoid, many-seeded

berry; externally green or yellow, shriveled and wrinkled; seeds flat, ovate, yellowish to brown arilled. Taste and odor slight. Passion Flowers yield not more than 12 per cent. of ash." *N. F.*

This indigenous plant has been supposed to possess narcotic properties and used in *neuralgias, sleeplessness, dysmenorrhoea*, as well as in *diarrhoea* and *dysentery*. I. Ott (*Medical Bulletin*, Dec., 1898) finds that it is a depressant to the motor side of the spinal cord, but increases the rate of the respiration, and that it has very little effect upon the circulation, only temporarily reducing the arterial pressure. Dose, three to ten grains (0.2-0.65 Gm.).

Paulowilhelmia. *Paulowilhelmia speciosa* Hochst.—This acanthaceous plant is used by the Aquapine tribe on the Gold. Coast, as a fish poison, under the name of *adubiri*. (*P. J.*, xx, 1890.)

Peach Leaves. *Leaves of Prunus Persica* (L.) Sieb. et Zucc. (Fam. *Rosaceae*.) *Pechier*, Fr. *Pfirsich*, G.—The peach tree is supposed to have been originally brought from Persia, but flourishes everywhere in the warm temperate zone. Peaches are among the most grateful and wholesome of our summer fruits. They abound in saccharine matter, which renders their juices susceptible of the vinous fermentation, and a distilled liquor prepared from them has been much used, in some parts of the country, under the name of *peach brandy*. The kernels of the fruit resemble, physically and chemically, bitter almonds, for which they are frequently, and without inconvenience, substituted in commerce. The flowers, leaves, and bark also have the peculiar odor and taste of bitter almonds, and yield hydrocyanic acid. The leaves afford a volatile oil by distillation. The distilled water prepared from them was found in one instance to contain 1.407 parts of hydrocyanic acid in 1000, and in another only 0.437 parts in the same quantity. From some experiments it is inferred that the proportion of acid is greatest where there is least fruit. (*A. J. P.*, xxiv, 72.)

Peach kernel oil made by expression has found its way into Western Europe from the Levant, and is used in Italy and Southern France largely as an adulterant of almond oil. It is described as of a light yellow color, having the taste and odor of almond oil. It thickens at -9° C. or -10° C. (15.8° F. or 14° F.), and solidifies at -18° C. (-0.4° F.). The sp. gr. at 15° C. (59° F.) is 0.915. It gives with strong nitric acid a dark brown color, with sulphuric acid a dark brown becoming lighter, with solution of zinc chloride a purplish-brown; forming with the elaidin test in two hours a mass of butter-like color and consistence. Peach kernel oil has a saponification value of 189-192 and an iodine figure of 93.5. (See *Oleum Amygdalae Expressum*.)

The leaves of the peach are said to be laxative, and have also been used with asserted advantage in *whooping cough, irritability of the bladder*, etc. The dried leaves may be employed (an ounce to a pint of hot water) in infusion. The flowers of the peach are affirmed to be laxative and vermifugal, in half-fluid-ounce (15 mils) doses when fresh, given in the form of syrup. Cases of fatal poisoning in children from their use are on record. The peach kernels are distinctly active, and when rubbed up with cold water form an emulsion which may be used in place of cherry-laurel water or other

preparations of hydrocyanic acid.

Peganum. *Peganum Harmala* L. *Wild Rue*. (Fam. *Rutaceae*.)—A tall herbaceous plant growing in the Mediterranean region of Europe and Africa and extending into Thibet. In the seeds of this plant Goebel (1837) found the alkaloid *harmaline*, and Fritzsche (1847) a second alkaloid, *harmine*, which have been re-studied by Fischer and Tauber. (*A. J. P.*, 1886, 89.)

The seeds of *peganum* were used by the ancient Greeks in the treatment of eye diseases. In modern times it has been used as an emmenagogue, anthelmintic and sedative.

Harmaline or *harmine dihydride*, $C_{13}H_{14}N_2O$, is in the form of trimetric, octahedral crystals. It is soluble in alcohol and ether and slowly so in water. It melts at about $238^{\circ} C.$ ($460.4^{\circ} F.$) with decomposition. Flury (*A. E. P. P.*, 1911, lxiv, p. 105) finds that harmaline in moderate doses produced symptoms in the dog similar to those produced by cannabis and in toxic quantities it caused salivation. Its anthelmintic effect he attributes to a paralytic action upon the muscular tissues of the worm.

Pelargonium. *Pelargonium odoratissimum* Willd. *Rose Geranium*. (Fam. *Geraniaceae*.)— The *Pelargoniums*, commonly referred to as *geraniums*, are indigenous to South Africa and largely cultivated as decorative plants. Some of the species are cultivated for the distillation of the volatile oil, in France, Spain, Algiers, and the Island of Reunion. According to Guibourt, several species of *Pelargonium* yield a volatile oil by distillation, closely analogous in odor to that of the rose: the species above named, *P. capitatum* Ait., and *P. roseum* Willd., the last being regarded as a variety of *P. radula* Ait. (*Hist. Nat. des Drogues*, 4e ed., iii, 52.) The oil is obtained from the leaves. Recluz obtained from thirty-five ounces of *P. odoratissimum* W., two drachms of a volatile, crystallizable oil. (Merat and De Lens, *Dict. de Mat. Med.*, iii, 368.) According to Septimus Piesse, one cwt. yields about two ounces. (See *A. J. P.*, xxvi, 368.) The oil which occurs in commerce, purporting to be the oil of *P. odoratissimum*, is fluid at ordinary temperatures, of a pale brownish-yellow color, and the characteristic odor of the plant, merely recalling that of the rose. This oil is now much used in perfumery. Piesse states that, as this oil is used to adulterate that of roses, so is it in its turn adulterated with the cheaper oils of species of *Andropogon*. (See p. 1517.) (*A. J. P.*, xxvi, 368.) It appears, however, that the oil known as *oil of palmarosa* (see *Oil of Citronella*), distilled in India, is the one which is used most largely to adulterate oil of rose and oil of rose geranium. According to Baur, the oil is shipped in large copper flasks from Bombay to the Red Sea, and thence to Constantinople and Kizanlik. For Burtell's description of the method of distilling palmarosa oil see *Schim. Rep.*, 1909, 88. Jallard states that the true oil of rose geranium from *P. roseum* is freely soluble in 70 per cent. alcohol. The oils likely to be used to adulterate it are insoluble in this liquid. If, therefore, six drops of the suspected oil be mixed with 5 mls of 70 per cent. alcohol, there should be no separation. (*A. J. P.*, 1878, 260; from *J. P. C.*) F. W. Semmler (*Ber. d. Chem. Ges.*, xxiii, 1098) has shown that the chief ingredient in the various geranium oils is an alcohol, *geraniol*, $C_{10}H_{18}O$, which boils at from 231° to $232^{\circ} C.$ (447.8° - $449.6^{\circ} F.$), and has a sp. gr. 0.884 at 15°

C. (59° F.). When oxidized by chromium trioxide mixtures, it is changed into *citral*, C₁₀H₁₆O, an aldehyde found in many of the essential oils, and this when oxidized by silver oxide yields *geranic acid*, C₁₀H₁₆O₂. The geraniol is both free and combined as *tiglic acid ester*. The oil also contains citronellol. (*Schim. Rep.*, April, 1897.) Geranium oil is sometimes adulterated with dimethyl sulphide, (CH₃)₂ S. (*Schim. Rep.*, 1909, 55; see also *Am. Perf.*, Jan., 1913.)

Pengawar Djambi. *Paku Eidang. Golden Moss.*—This is composed of silky, long, yellow or brownish hairs, very soft, which are obtained in Sumatra from the base of the shrub of various ferns, especially *Cibotium* Link. (Fam. *Cyatheaceae*), a peculiar fern related to *Dicksonia*. (See also *S. W. P.*, 1910, No. 43, 661.) It has the power of causing rapid coagulation of blood, and, when properly used, of mechanically arresting hemorrhages from capillaries. It has been much used in the physiological laboratories of Europe and this country, and was employed in human medicine during the Middle Ages under the name of *AgnusScythicus*. The medieval drug was composed of pieces of the rhizome with the attached scales and petioles so cut as to resemble animals. Interest in the *pengawar djambi* was revived on account of the assertions of Junker of its usefulness during the Franco-German war. (*L. M. R.*, Dec., 1887.) It is undoubtedly a very efficient styptic.

Penthaclethra. *Penthacelthra macrophylla* Benth. (Fam. *Leguminosae*.) *Owala Grains.*—The seeds of this plant, which grows in the Congo States, are said to contain an alkaloid, *paucine*, crystallizing in yellow foliaceous crystals, melting at 126° C. (258.8° F.), insoluble in ether and chloroform, having the formula C₂₇H₃₈O₅N₅. (*P. J.*, lix.) *Paucinehydrochloride*, C₂₇H₃₉O₅N₅ 2HCl + 6H₂O, is marketed by Merck and Co., and is stated to be physiologically inactive.

PEPO. U. S. (Br.)

PEPO [Pumpkin Seed]

"The dried ripe seeds of cultivated varieties of *Cucurbita Pepo* Linne (Fam. *Cucurbitaceae*), without the presence or admixture of more than 5 per cent. of other substances." *U. S.* "Melon Pumpkin Seeds, are the prepared fresh ripe seeds of cultivated plants of *Cucurbita maxima*, Duch. Melon Pumpkin Seeds must not be more than one month old, and when required for use about 100 grammes are bruised with a little water or milk to a creamy consistence and administered as a single dose." *Br.*

Cucurbitae Semina Praeparata. *Br.*; Melon Pumpkin Seeds; Semen Peponis, Semina Cucurbitae; Semences de Potirons ou de Courge, *Fr.*; Kurbiasamen, Kurbiskorner, Graumontaamen, *G.*; Calabaza (Semilla), *Sp.*

The *Cucurbita Pepo*, or *common pumpkin*, is a plant almost too well known to need description. The seeds are the part used. These are officially described as follows: "Broadly elliptical or ovate, from 15 to 23 mm. in length and from 2 to 3 mm. in thickness; externally yellowish-white, very smooth, occasionally with thin, transparent fragments of adhering pulp and with a shallow groove parallel to and within 1 mm. of the margin; fracture short, seed-coat consisting of a white coriaceous outer layer and a membranous inner layer occasionally of a dark green color; embryo whitish, straight, with a small conical hypocotyl and two plano-convex cotyledons; slightly odorous when contused; taste bland and oily. Under the microscope, sections of Pepo show an outer epidermal layer consisting of palisade-like cells, the radial walls attaining a length of 1 mm., the outer walls being usually torn off so that it appears as though the seeds were covered with very long hairs; a sub-epidermal layer consisting- of from 5 to 12 rows of cells with slightly thickened, lignified and porous walls; a layer of strongly lignified stone cells, elliptical in outline and about 0.075 mm. in length; a single layer of small cells resembling those of the sub-epidermal layer; several rows of parenchyma cells with characteristic reticulate markings and separated from each other by large intercellular spaces; several layers of parenchyma cells, the inner layer being more or less collapsed and bounded on the inside by a single epidermal layer, the cells having rather thick walls; the perisperm cells are usually more or less collapsed and the endosperm consists of a single layer of cells filled with small aleurone grains; the cotyledons consist of thin-walled, isodiametric, elongated or palisade-like cells containing a fixed oil and numerous small aleurone grains." *U. S.*

The British Pharmacopoeia recognizes the melon pumpkin seeds, under the title of *Cucurbitae Semina Praeparata*. These are derived from a closely related species, *Cucurbita maxima* Duch., which closely resembles *C. Pepo* and differs in that the margins of the leaves possess rounded teeth, whereas in *C. Pepo* they are acute. The British definition and description are as follows: "Flat, ovate, white, and exalbuminous, consisting of two fleshy, easily separable cotyledons, freshly deprived of the yellowish outer, and brownish inner integument. Faint odor; taste very slight. Before preparation, the seeds measure from eight to twenty millimetres in length, and from nine to twelve millimetres in breadth." *Br.*

They contain a fixed oil, consisting of the glycerides of palmitic, myristic,

and oleic acids, with some free fatty acid, an aromatic principle, chlorophyll, sugar, starch, and, according to Dorner and Wolkowich, an alkaloid, cucurbitine. Deprived of their coating, and exhausted by ether, they yield 30 per cent. of fixed oil. (*Ann. Ther.*, 1862, p. 176.) The researches of Dorner and Wolkowich have not received confirmation, and their alkaloid probably has no existence. Pumpkin seed oil has a sp. gr. at 15° C. (59° F.) of 0.923, and solidifies at -15° C. (5° F.). The cold drawn oil is used for culinary purposes and the lower qualities for burning. The oil dries very slowly. (Lewkowitsch, *Chem. Analysis of Oils*, etc., 2d ed., 1898, 372.) Sicker obtained 30 per cent. of the oil from the seeds; it was reddish-yellow in color, soluble in ether, benzene, and carbon disulphide, but insoluble in alcohol. (*Proc. A. Ph., A.*, 1897, 545.) Willard Graham endeavored to prepare *Oil of Pumpkin Seed* by expression, but failed to obtain appreciable quantities even under a pressure of 3000 pounds. By extraction with acetone the ground seed yielded 25 per cent. of oil, clear reddish, limpid, and of agreeable odor and taste. Its sp. gr. at 15° C. (59° F.) was 0.9208; saponification number, 192.5; acid number, 18.9; ether number, 173.6; soluble in all proportions of carbon disulphide, ether, chloroform, and in twenty parts of absolute alcohol, and drying on standing to a tough, yellowish, transparent mass. These properties and constants agree well with a commercial specimen, evidently also obtained by extraction. The latter, however, had a lower acid number, 3.5, while the ether number was somewhat higher, 191.7. (*A. J. P.*, 1901, 352.) J. C. Lyons used an ounce of the oil with success in a case of tapeworm (*A. J. P.*, 1865, 253), but Wolff has found it inert when pure and free from resin, which he prepares by extracting the oil from the powdered seeds by means of petroleum benzin, then treating the remaining powder with ether, chloroform, and alcohol, which yields on evaporation a soft greenish-brown resinous liquid resembling the oleoresin of male fern. Heekel was the first to assert that the active principle is a resin, and in this he has been corroborated by L. Wolff (pamphlet, Phila., 1882), who found the resin to be efficient in doses of fifteen grains (1 Gm.), given in pill followed in two or three hours by castor oil, and who recommends an alcoholic fluidextract as the best preparation of the drug after the resin.

Power and Salway (*J. Am. C. S.*, 1910, p. 346) found the resin as well as the oil which they separated from the seed, destitute of anthelmintic powers.

W. E. Miller (*A. J. P.*, 1891, 585) analyzed both the shells and the

kernels of pumpkin seed. He also found a resin soluble in alcohol, and a dark reddish fixed oil.

Uses.—It is said that in Italy the seeds of the *Cucurbita maxima*, and in the West Indies those of *C. occidentalis*, have been long used in doses of an ounce and a half as tenifuges. In the *Dictionary of Materia Medica* by Merat and De Lens (ii, 493) it is stated that Hoarau had reported that in the Isle of France the seeds of a small variety of pumpkin were used against the *tapeworm*, and with never-failing success. In the year 1820, Mongeney, a physician of Cuba, published the results of his experience with the flesh of the pumpkin in the same disease. He had discovered the remedy by accident, and found it uniformly successful. He gave to the patient, in the morning, fasting, about three ounces of the fresh pumpkin in the form of a paste, and followed it at the end of an hour by about two ounces of honey, which latter was twice repeated at intervals of an hour. So far as we know, attention was first directed to it in this country by Richard Soule. (*B. M. S. J.*, Oct., 1851.) Since this time the drug has steadily grown in favor, and, properly used, is one of our most efficient and harmless tenifuges. The patient should be allowed only a light supper of bread and milk, in the morning early should take an ounce and a half of the seeds, a cup of tea or coffee an hour later, but no food, at 10 A.M. a brisk cathartic, and two hours later a substantial meal. We have obtained excellent results from the exhibition of the beaten seeds in the form of an electuary strongly flavored with oil of cinnamon or of gaultheria.

Dose, one to two ounces (31-62 Gm.).

Perezia Root.—This root is obtained from several Mexican plants, *Perezia Wrightii* A. Gray, *P. Nana* A. Gray, and *P. Dugesii* A. Gray. (Fam. *Compositae*.) It contains *pipitzahoic acid*, a substance which crystallizes in beautiful golden-yellow needles. R. Anschutz and J. W. Leather obtained from the dried roots of *P. adnata* A. Gray (*Trixis Pipitzahoac* Schaffner), an average of 3.6 per cent. of this acid, which melts at from 103° to 104° C. (217.4°-219.2° F.), sublimes readily, and is easily soluble in alcohol, ether, chloroform, benzene, and glacial acetic acid. The authors confirm the formula given to the acid in 1855—viz., $C_{15}H_{20}O_3$. It is a quinone, and bears great resemblance, when recrystallized from diluted alcohol, to *oxythymoquinone*, which, recrystallized from the same liquid, is scarcely distinguishable from it. (*A. J. P.*, 1884, 185, and *Ph. Rund.*, 1883, 245; *A. Pharm.*, 1887, 183.)

Under the name of *perezol* the 0.5 per cent. alcoholic solution of *pipitzahoic acid* has been recommended by Duyk as an alkalimetric indicator. By acids it is at once decolorized; with alkalies it becomes reddish. Boric, and perhaps other acids, and

acetates, borates, bicarbonates, and carbonates act with respect to the solution like alkalies. For a paper on pipitzahoic acid by Altamirans, see *Analen del Institute Mex.*, Nat. 7, p. 21, or *P. J.*, 1905, 553.

Periploca. *Periploca graeca* L.—From the bark of this asclepiadaceous shrub, growing in the neighborhood of the Black Sea, has been separated by Lehmann (*A. Pharm.*, 1897, p. 157) a colorless glucoside, *periplocin*, $C_{30}H_{48}O_{12}$, soluble in 125 parts of water, freely soluble in alcohol. According to the experiments of Burschinski (*St. P. M. W.*, 1897), it is an active cardiac poison belonging to the digitalis group. It has been used as a cardiac tonic by Cholewa (*Th. M.*, 1904, p. 292), Silberberg (*In. Dis., Odessa*, 1909), and others, as a practical remedy in the treatment of heart disease. Silberberg asserts that it is better suited for intravenous injection than strophanthin. The dose is from one one-hundred-and-twentieth to one-sixtieth of a grain (0.0005-0.0011 Gm.).

PETROSELINUM. U. S.

PARSLEY FRUIT Petrosel. [Parsley Seed]

"The dried ripe fruit of *Petroselinum sativum* Hoffman (Fam. *Umbelliferae*), without the presence or admixture of more than 5 per cent. of foreign seeds or other matter. Preserve Parsley Fruit carefully in tightly-closed containers, protected from light." *U. S.*

Ache, Persil, *Fr.*; Petersilie, *G.*; Prezzemolo, *It.*

Petroselinum sativum Hoffman (*Apium petroselinum* L.).—The *common parsley*, which is used extensively as a culinary herb, is a hardy biennial bearing pinnately-compound leaves, which in the cultivated varieties are greatly divided. During its early stages the leaves are arranged in rosettes and the plant is six inches or less above the ground; the flowering and fruiting plant, however, is from 2 to 3 feet in height. It is a native of Sardinia and was introduced into England in 1548, and is naturalized in salt marshes on the coast of California. It has been cultivated as a sweet herb since earliest times and was used by the ancient Greeks and Romans as a part of their festive garlands on account of retaining its color so long.

Parsley-root is recognized by the N. F.; it is spindle-shaped, about 1 cm. in thickness, externally white and marked with close annular wrinkles, internally fleshy and white with a yellowish central portion. It has a pleasant odor and sweetish slightly aromatic taste, but loses this property by long boiling and by time. It was formerly used as a diuretic

in dropsical affections, but has been shown by Cow (A. E. P. P., 1912, Ixx, p. 393) to possess very feeble powers.

The fruit, which has been admitted into the U. S. P. IX consists of two dry, seed-like, mericarps, which are in the fresh state joined along the central commissure. It is officially described as follows: " Mericarps usually separated, ovoid-crescent shaped, from 2 to 3 mm. in length and about 1 mm. in diameter; externally grayish-brown, becoming grayish or brownish on aging, having 5 yellowish, filiform, prominent ribs, alternating with the coarsely roughened furrows; in transverse section nearly hemispherical, the commissural surface with 2 vittae or oil-tubes, the dorsal surface usually with a single vitta, occasionally 2 vittae in the groves between the primary ribs; endosperm large, oily, enclosing a small embryo; odor and taste characteristic and aromatic, especially when bruised. Under the microscope, sections of Parsley Fruit show an epidermal layer with thick cuticularized walls having numerous small centrifugal projections; several layers of small, thin-walled parenchyma cells, being usually considerably collapsed and occasionally containing a rosette aggregate of calcium oxalate; a single, large, brown, elliptical vitta or oil-tube between each of the primary ribs and surrounded by a layer of comparatively large yellowish-brown, tangentially elongated cells; a single fibro-vascular bundle more or less surrounded by a few or occasionally numerous sclerenchymatous fibers; inner epidermis of narrow, thin-walled elongated cells closely cohering with the brownish tabular cells of the seed-coat; commissural surface usually with 2 large vittae, a very few stone cells and showing a slight separation of pericarp and seed-coat; endosperm of polygonal, thick-walled parenchyma cells containing fixed oil and numerous, small aleurone grains usually containing a small rosette aggregate of calcium oxalate. The vittae usually contain yellowish oil globules or a resin-like mass adhering to the walls, and occasionally are divided by a radial wall. The powder is grayish-brown; mostly of large, irregular fragments; cells of endosperm with aleurone grains, each usually containing a rosette aggregate of calcium oxalate, from 0.003 to 0.007 mm. in diameter; fragments with light yellow vittae and the yellowish-brown cells of the pericarp; fragments with narrow tracheae and more or less lignified sclerenchymatous fibers." *U. S.*

All parts of the plant contain a volatile oil, to which it owes its odor and mainly its taste, as well as its use in seasoning. This oil consists of a hydrocarbon, C₁₀H₁₆, probably pinene, and apiol. Braconnot obtained

from the herb a peculiar substance, resembling pectic acid in appearance, which he named apiin. It is procured by boiling the herb in water, straining the liquor, and allowing it to cool. The apiin then forms a gelatinous mass, which requires only to be washed with cold water. (*Ber. d. Chem. Ges.*, 1876, 1121) found that by repeated dissolving of this gelatinous mass in alcohol and precipitation by water it could be purified and then obtained from concentrated alcoholic solution in silky needles of the formula $C_{27}H_{32}O_{16}$. Joret and Homolle found the seeds to contain a volatile oil, a crystallizable fatty matter, pectin, what they believe to be the apiin of Braconnot, chlorophyll, tannin, a coloring matter, extractive, lignin, various salts, and, in addition to these, a peculiar substance to which they gave the name of *apiol*. This, however, is a mixture only partly consisting of true apiol which is the dimethoxymethylene ether of allyl-tetra-oxybenzene, $C_{12}H_{14}O_4$: (See *Oleoresina Petroselini*.)

Off. Prep.—*Oleoresina Petroselini*, U. S.

Peucedanum. *Chucklusa. Hog Fennel. Sulphurwort.*—This is the root of *Peucedanum officinale* (Fam. *Umbelliferae*), originally an European plant but now growing in North America. The active constituent of the root is *peucedanin*, $C_{16}H_{16}O_4$, stated to be diuretic and emmenagogue.

Peucedanum palustre Munch. *Marsh Parsley. Marsh Smallage. Persil de Marais*, Fr. *Radix Olsnitii. Sumpfsilge, Elsenich*, G.—The root of this European umbellifer is, when dried, of a brown color externally, having a strong aromatic odor, and an acrid, pungent, aromatic taste. Peschier found it to contain a volatile oil, a fixed oil, and a peculiar acid which he calls *selinic*. It has been used for *epilepsy* in Russia. Dose, from twenty to thirty grains (1.3-2.0 Gm.) thrice daily, rapidly increased to four times the amount. (J. P. C., 1859.)

Pharbitis.—A genus constituted by Choisy, 1833, its species referable to *Ipomoea* or *Convolvulus*. *Ipomoea hederacea* (L.) Jacq. (*Pharbitis Nil Choisy*).—The seeds of this Japanese plant have been chemically examined by K. Hirano and also by Y. Inoko, who find that they contain a large proportion of a resinous substance, seemingly identical with *convolvulin*, and acting as a cathartic in doses of from seven to ten grains (0.45-0.65 Gm.). (*Sei-i-kwai*, 1891.)

Phaselin.—This substance is represented as the active constituent of the bean of *Dilka Mexicano*, a South American plant. It is used similarly to papain as a digestive in doses of eight to fifteen grains (0.5-1.0 Gm.).

Phaseolus. *Phaseolus vulgaris* L. *Common Kidney or String Bean*. (Fam. *Leguminosae*.)—Of this species there are some 70 cultivated varieties. Soltsien found

an alkaloid, *phaseoline*, in the legumes of the common bean. He, during a toxicological analysis, traced the source of the alkaloid which might, under other circumstances, have been mistaken for a ptomaine, to the beans found in the stomach under examination. The new substance is not crystallizable in the free state, but it crystallizes as a hydrochloride. (*A. Pharm.*, 1884.)

Phyllanthus. *Phyllanthus Niruri* L.—Ottow isolated from this widely distributed euphorbia-ceous plant *phyllanthin*, $C_{30}H_{37}O_8$, which crystallizes in colorless needles, is intensely bitter, insoluble in water, but soluble in alcohol, petroleum benzin, chloroform, and ether.

Physalis. *Physalis Alkekengi* L. *Alkekengi*. *Common Winter Cherry*. *Alkekenge*, *Coqueret*, Fr. *Judenkirsche*, *Schlutte*, G.—A perennial herbaceous plant, belonging to the *Solanaceae*, growing wild in the south of Europe, cultivated in our gardens and said to be escaping locally. The fruit is a round red berry, about as large as a cherry, enclosed in the inflated calyx, and containing numerous flat kidney-shaped seeds. All parts of the plant are bitter, especially the leaves and the capsules enveloping the fruit. The berries are very juicy, and have an acidulous, bitterish taste. By drying they shrink, and become a brownish-red color. A bitter principle, *physalin*, has been isolated by Dessaignes and Chautard by extracting an infusion of the plant with chloroform. It is a yellowish, bitter powder, very slightly soluble in cold water and freely soluble in alcohol and chloroform, especially with the aid of heat. Its composition is $C_{14}H_{16}O_5$. (*J. P. C.*, 3e ser., xxi, 24.) The berries are said to be aperient and diuretic, and have been recommended in *suppression of urine*, *gravel*, and other diseases of the urinary passages. Gendron recommends them very highly as a febrifuge. (*A. G. M.*, xxiii, 536.) They also have been highly commended in *gout*. An extract of alkekengi berries to which lithium salt has been added is sold under the name of *lithal*. From six to twelve berries, or half an ounce of the expressed juice, may be taken for a dose; and much larger quantities are not injurious. They are consumed to a considerable extent in some parts of Europe as food.

The berries of *Physalis viscosa* L., of this country, are said by Clayton to be diuretic.

PHYSOSTIGMA. U. S.

PHYSOSTIGMA *Physostig.* [Calabar Bean, Ordeal Bean]

"The dried ripe seeds of *Physostigma venenosum* Balfour (Fam. *Leguminosae*), yielding not less than 0.15 per cent. of the alkaloids of *Physostigma*." *U. S.*

Physostigmatis Semina, *Br.* 1898; Chopnut; Ordeal Bean of Calabar; Faba Calabarica; Fève du Calabar, *Fr. Cod.*; Kalabarbohne, *G.*; Haba del calabar, *Eseve, Sp.*

Physostigma venenosum is a climbing plant, with a ligneous stem, and frequenting especially the banks of streams, into which it often drops its fruit when ripe, and it is said that the people of Calabar derive their supply principally from the borders of the streams down which the fruits are carried. The rhizome is spreading, with numerous rootlets, often having attached to them small succulent tubers. The flowers are in axillary, multiflorous, pendulous racemes. The corolla is papilionaceous, of a pale pink color, with a purplish tinge. The legume when ripe is about seven inches long, and contains two or three seeds. It ripens at all seasons, but is most abundant during the rainy season from June to September. The seeds are the part used. The plant, which is indigenous to Western Africa, has been introduced into India and Brazil, and is said to flourish in the latter country. The market supplies are obtained from the regions surrounding the mouth of the Niger and the lower portion of the Calabar River, the chief port of export being Lagos (*Ap. Ztg.*, xxvi, p. 568; xxvii, p. 137). Only one other species (*P. mesoponticum* Taub.), also of tropical Africa, is known. For a paper on the botanical description, history, etc., of *Physostigma venenosum* by J. U. Lloyd, see *West. Drug.*, 1897, 249.

This bean was brought to the notice of the scientific public by Daniell, in 1846. Considerable attention was attached to the subject, and specimens of the bean were obtained by Christison from the Gold Coast. These were planted in the Botanical Garden at Edinburgh, and produced a perennial creeper. In the year 1859, specimens of the plant were sent from Calabar, which came under the observation of Balfour, of Edinburgh, who was thus enabled to ascertain its botanical character.

Properties.—The seeds are officially described as follows: " Oblong or ellipsoidal, somewhat compressed reniform, from 15 to 30 mm. in length and from 10 to 15 mm. in thickness; externally reddish or chocolate brown, smooth, somewhat wrinkled near the brownish-black groove, the latter being about 2 mm. in width and extending almost the entire length of the convex edge and in which are found frequently the remains of the white membranous funiculus, the margins of the seed-coat on both sides of the groove somewhat elevated, of a yellowish-red or brownish-red color and somewhat thickened; embryos large, white, with short hypocotyl and two concavo-convex cotyledons; taste at first starchy, afterwards acrid. The powder is grayish-white, starch grains numerous, from 0.005 to 0.15 mm. in diameter, ellipsoidal or somewhat reniform, and usually with a distinct cleft and frequently with radiating

or irregular fissures; fragments of seed-coat with very thick, reddish-brown cells, being either palisade-like or very irregular and resembling stone cells, but the walls are not lignified; an occasional fragment with tracheae showing reticulate thickenings. *Physostigma* yields not more than 3 per cent. of ash." *U. S.*

Physostigmine was official in the Br. Pharm., 1885, and was thus described: " In colorless or pinkish crystals, slightly soluble in water, but readily soluble in alcohol and in diluted acids. The aqueous solution has an alkaline reaction, when warmed with or when shaken with dilute solution of potash becomes red, and when evaporated to dryness over a water bath leaves a bluish residue, the acidified solution of which is beautifully dichroic, being blue and red." *Br.*, 1885.

Calabar beans are occasionally substituted by a number of more or less similar seeds of African plants. Hartwich (*S. W. P.*, 1905, p. 441) calls attention to a false *physostigma* found in the Hamburg drug market which is derived from *PentacletJzra macropliylla* Benth., a leguminous tree indigenous to tropical Africa. The seeds are dark reddish-brown, from 5 to 7 cm. long, about 5 cm. broad and about 1 cm. thick. They are flattened-oval or roundish-triangular.

Physostigma yields its virtues to alcohol, and imperfectly to water. The shell constitutes, according to Edwards, 30 per cent., the kernel 70 per cent., of the bean. Jobst and Hesse (*J. P. C.*, March, 1864, p. 277) first isolated an active principle, which they found exclusively in the cotyledons. They obtained it by exhausting an alcoholic extract of the seeds with water, adding magnesia to neutralization, which is indicated by the liquid becoming brown, then concentrating, and treating with ether. The ethereal solution was shaken with a little weak sulphuric acid. The liquid separated into two layers—the upper, ethereal, containing no alkaloid, and the lower, a solution of the sulphate in water. The latter was separated, treated with magnesia, and afterwards with ether, which yielded the alkaloid on evaporation. The substance thus obtained they proposed to name *physostigmine*. In 1865 Vee and Leven (*C. R. A. S.*, 60, 1194) obtained, by treating the seeds in nearly the same manner, an alkaloid to which they gave the name *eserine*, which formed colorless tabular crystals of a bitter taste, readily soluble in ether, alcohol, or chloroform, but sparingly in water. The crystals contain 1 molecule of water, which they lose at 100° C. (212° F.), and the anhydrous alkaloid then fuses at from 102° to 103° C. (215.6 °-

217.4° F.). Eserine is now generally accepted as identical with physostigmine. In 1867, Hesse (*Ann. Ch. Ph.*, 141, 82) obtained the same alkaloid in a still purer state, perfectly colorless and tasteless, fusing at 45° C. (113° F.), and decomposing at 100° C. (212° F.) with red coloration. He gives it the formula $C_{15}H_{21}O_2N_3$.

A peculiarity of the alkaloid is that an aqueous solution of it, or of one of its salts, exposed to the air in the presence of potassium or sodium hydroxides, or lime, becomes red, owing to the absorption of oxygen. The coloring matter is taken up by chloroform. The color is not permanent, but gradually changes to yellow, green, or blue. This test will detect less than the hundred-thousandth part of the alkaloid. The same property is possessed by the alcoholic extract of the bean. This is the cause of the color changes taking place in solutions dispensed in ordinary glass bottles. The change may be retarded by previously rinsing out the bottle with diluted hydrochloric acid, and subsequently with distilled water, or it may be entirely prevented by coating the inner surface of the dispensing vial with paraffin.

Harnack and Witkowski (*A. E. P. P.*, v; also x) in 1876 obtained still another alkaloid, which they named *calabarine*. It is soluble in alcohol and water, nearly insoluble in ether, melts at 132° C. (269.6° F.), and differs in physiological character from physostigmine. It is now generally known under the name of *eseridine*. The formula $C_{15}H_{23}O_3N_3$ has been given to it by Eber (*Ph. Ztg.*, 1888, p. 611), which differs from that of physostigmine, it will be seen, by H_2O only, and it is stated that the one can be changed into the other by the action of dilute acids. It has properties like eserine but in a milder degree. *Eseramine*, $C_{16}H_{25}O_3N_4$, is another alkaloid of feeble activity which is present. It was announced by Ehrenberg in 1893 (*Verhand. d. Gesellsch. Deutsche Natur. u. Aertzte.*, 1893, ii, p. 102). There is much reason for believing that calabarine is a decomposition product derived from physostigmine. (Husemann, *A. E. P. P.*, 1878, 14; Harnack, *A. E. P. P.*, x.)

Still another alkaloid announced by Salway is *physorenine*, $C_{14}H_{18}O_3N_2$. It is a powerful myotic like eserine. It is believed to be an intermediate product in the decomposition of eserine by alkalies, which results in the formation of a new base called *eseroline*, $C_{13}H_{18}ON_2$. Another decomposition product of eserine is produced by an excess of

ammonia and is called *eserine blue*, $C_{17}H_{23}O_2N_3$.

Hesse obtained also a neutral fatty body, *plhysterin*, by exhausting the cotyledons with petroleum benzin. It is closely allied to cholesterin, but its chloroform solution is devoid of rotatory power. Its formula is $C_{26}H_{44}O + H_2O$, and its melting point is $133^\circ C$. ($271.4^\circ F$).

Uses.—The action of physostigma is practically that of its dominant alkaloid physostigmine, but the effects are more or less modified by the other alkaloids; thus calabarine is a stimulant to the spinal cord and in this regard antagonistic to physostigmine, while isophyso-stigmine possesses the physiological properties of the dominant alkaloid upon the unstriated muscle, but apparently not upon the other structures of the body. For this reason whenever the systemic action is desired the alkaloid should be given the preference over preparations of the whole drug. On the other hand, as a stimulant to the unstriated muscle of the intestines, as in *constipation*, the whole drug may properly be used.

Poisoning.—Calabar bean has been used from time immemorial by the natives of Africa as an ordeal, and, when given by their head men, usually proves fatal to the accused, unless free vomiting occurs. A draught containing 19 seeds pounded and infused in water is said to have killed a man in an hour. In the experiments of Fraser, it was found that the integuments of the seeds, as well as the shell, are distinctly purgative. It is probable that in the fresh bean they are also emetic, and that the priests or chiefs who administer the ordeal take advantage of this in regulating the effects of the poison to suit their own purposes; sometimes, however, even the pure alkaloid causes vomiting. (Gubler.) Of seventy children poisoned in Liverpool by eating Calabar beans which had been thrown upon a waste heap, vomiting occurred, or was produced by emetics, in all except one, in whom four kernels caused death. The nausea and vomiting came on in about half an hour, the nervous symptoms in less than an hour.

There are generally diminution of reflexes, coarse muscular tremors which may be sufficiently violent to suggest convulsions, contraction of the pupil, and progressive diminution of motor power. In the fatal cases death is generally due to paralytic asphyxia.

In the treatment of physostigma poisoning the stomach should be thoroughly washed out either with an emetic or the stomach pump. and

tannic acid or compound solution of iodine given as a chemical antidote. Atropine, which is a partial physiological antagonist, should be given in doses of about one-fiftieth of a grain (0.0013 Gin.), and strychnine and other stimulants employed as indicated.

Dose, one to three grains (0.065-0.2 Gm.).

Off. Prep.—Extractum Physostigmatis, *U. S.*; Tinctura Physostigmatis, *U. S.*

Phytelephas.—*Phytelephas macrocarpa* Ruiz. and Pav., or *negrito-palm*, of Ecuador, yields the *Tagud nut*, from which is derived the hard white substance, *vegetable ivory* or *corajo*. The nuts contain a fixed oil which is said to enter commerce. (*J. P. C.*, xvi.) The ground nuts have been recently used as an adulterant in cattle powders.

Phytolacca. *N. F. IV (U. S. P. VIII). Poke Root. Phytolaccae Radix. Phytolacca Root. Racine de Phytolaque, Fr. Kermesbeerenwurzel, G.*— "The dried root of *Phytolacca decandra* Linne (Fam. *Phytolaccaceae*), collected in the autumn." *N. F.*

The *U. S. P.* has in the past recognized both the root and the berries of the *Phytolacca decandra* L. This is an indigenous plant, with a large, branching, perennial root, often 20 to 25 cm. in diameter, which is fleshy, fibrous, whitish within, and covered with a thin brownish cork. The stems, which are annual, frequently grow to the height of 6 to 15 dm., and divide into numerous spreading branches, which are green when young, but becoming purple especially in the upper portions after the berries have ripened. The leaves are alternate, ovate-oblong, entire, pointed, smooth ribbed beneath, and on short foot-stalks. The flowers are small and in long racemes. The raceme of flowers becomes a cluster of dark purple, almost black, shining berries flattened above and below, and divided into ten loculi, each containing one seed.

Poke is abundant in all parts of the United States, flourishing along fences, by the borders of woods, in newly cleared fields, and especially in the muck thrown up from the ditches or swamps. It also grows spontaneously in Northern Africa and Southern Europe, where, however, it is supposed to have been introduced from America. Its flowers begin to appear in July, and the fruit ripens in autumn. The magnitude of the poke weed, its large rich leaves, and its beautiful clusters of purple berries, often mingled upon the same branch with the green unripe fruit and the flowers still in bloom, render it one of the most striking of our native plants. The young shoots are much used as food early in the spring, boiled in the manner of asparagus. The ashes of the stems and leaves yield, according to Braconnot, not less than 4.2 per cent. of potassium hydroxide. In the plant the potassium is combined with an acid resembling malic acid. The leaves, berries, and root are used in medicine, but the latter is the most active. It should be dug up late in November, cut into thin transverse slices, and dried with a moderate heat. As its virtues are diminished by keeping, a new supply should be procured every year. The berries should be collected when perfectly ripe, and the leaves about the middle of the summer, when the foot-stalks begin to redden.

The berries (*Phytolaccae Fructus*, U. S., 1890, *Phytolaccae Baccae*, U. S., 1880, *Poke Berry*) contain a succulent pulp, and yield upon pressure a large quantity of fine purplish, red juice. They have a sweet, nauseous, slightly acrid taste, with little odor.

The dried root is "cylindrical, somewhat tapering, sparingly branched, from 3 to 7 cm. in thickness, mostly in transverse or longitudinal slices; externally yellowish-brown, finely longitudinally or spirally wrinkled and thickly annulate with lighter colored, low ridges; fracture fibrous, characterized by alternating layers of fibro-vascular tissue and parenchyma, the layers of the latter being much retracted. Odor slight; taste sweetish, afterwards highly acrid. Phyt'olacca yields not more than 14 per cent. of ash." *N. F.*

From the analysis of Edward Donnelly, the root appears to contain tannic acid, starch, gum, sugar, resin, fixed oil and lignin, besides various inorganic substances. (*A. J. P.*, xv, 169.) Claussen (*Pharm.*, 1879, p. 466) prepared from the seeds of *Phytolacca decandra*, by extraction with alcohol, evaporation to dryness, and taking up with chloroform or ether, after washing the residue with petroleum benzin, a neutral principle in silky lustrous crystals, insoluble in water, soluble in alcohol, ether, and chloroform, which he named *phytolaccin*. A. Tereil (*C. R. A. S.*, 91, 856) obtained from the berries an acid (*phytolaccic acid*) as an uncrystallizable yellowish-brown mass of gummy consistency. It was soluble in water and alcohol, slightly soluble in ether, of acid reaction, and gelatinizing with hydrochloric and sulphuric acids. W. F. Wagner (*A. J. P.*, 1887, p. 69) found tannin in the berries, but not in the root. W. A. Partee (*A. J. P.*, 1888, p. 123) made a proximate examination of poke root and found crystals deposited from a solution of an alcoholic extract in absolute alcohol; he also discovered traces of tannin, glucose, and indications which pointed to the presence of a glucosidal principle. Frankforter and Ramaley (*A. J. P.*, 1897, 281) have again analyzed the root with care. They find nearly 10 per cent. of a non-reducing sugar, free acid, identified as formic acid, but no certain proof of either alkaloid or glucoside. The very bitter resin amounted to 1 per cent.; *phytolaccine*, an alkaloid, has been said to exist in minute quantities in the root.

Uses.—*Phytolacca* is emetic, purgative and somewhat narcotic. As an emetic it is very slow in its operation, frequently not beginning to cause vomiting in less than one or two hours after it has been taken, and then continuing to act for a long time upon both the stomach and the bowels. The vomiting produced by it is said not to be attended with much pain or spasm, but narcotic effects have been observed by some physicians, such as drowsiness, vertigo, and dimness of vision. In overdoses it produces excessive vomiting and purging, attended with great prostration of strength, and sometimes with convulsions, and has, in several instances, proven fatal. According to Robert Bartholow, *phytolacca* causes in the lower animals convulsions and death from paralysis of respiration. It is not fit for use as an emetic, but has been employed as an alterative in *chronicrheumatism*, *granularconjunctivitis*, and even in *cancer*. Locally it has been used in the form of ointment (a drachm to the ounce) in the treatment of *psora*, *tinea capitis*, *sycosis*, and *favus*. It occasions at first a sense of smarting and heat in the parts to which it is applied. Alcohol, diluted alcohol, and water, extract the virtues of the poke root. A fluidextract is included in the National

Formulary.

Dose, emetic, ten to thirty grains (0.65-2.0 Gm.), alterative, one to five grains (0.065-0.32 Gm.).

Phytolacca Acinosa Roxh. (Fam. *Phytolaccaceae*).—This plant has long been used in Japan as a diuretic, and is said to be violently poisonous. C. Nagai has separated from it an amorphous resin, *phytolaccotoxin*, which appears to be a spinal convulsant, and at the same time stimulant to the circulation, probably through the vasomotor centers. (*Sei-i-kwai. Med. Journ.*, April, 1891.)

Pichurim Beans. *Semen Pichurim. Sassafras Nuts. Feves Pichurim, Noix de Sassafras, Fr. Pichurimbohnen, Sassafrasnusse, G.*—The seeds of *Nectandra Puchury-major* Nees v. E., and *N. Puchury - minor* Nees (*Ocotea Puchury-minor* Mart.) (Fam. *Lauraceae*), yielding respectively "*Fabae Pichurim majores*," or larger pichurim seeds, and "*Fabae Pichurim minores*," smaller pichurim seeds. The two species are closely allied and both have been known to botanists as *Ocotea Pichurim* H. B. K. (*Laurus Pichurim* Willd.). The trees grow in Brazil, Guiana, Venezuela, and other parts of South America, and are sometimes spoken of as *Brazilian* or *South American Sassafras*. Carson, of the University of Pennsylvania, had specimens of the fruit and other parts of the trees sent him, sufficient to verify the ascription of the *pichurim beans* to this source. (*A. J. P.*, xxvii, 385.) The seeds of commerce usually consist of the separated cotyledons. They are plano-convex, from 3 to 5 cm. in length and nearly 2 cm. in width. Externally they are smooth and blackish-brown, being internally light brown. They have an aromatic odor combining that of nutmegs and sassafras, and a spicy pungent taste.

Pichurim beans contain a concrete volatile oil, a fatty matter of the consistency of butter, besides resin, fecula, gum, sugar, and lignin. The fatty matter, which is known as *pichurim fat*, amounts to about 30 per cent. and contains *laurostearin*, $C_3H_5C_{12}H_{23}O_2)_3$, and *pichurim camphor* which appears to be identical with *laurel camphor*. A liquid product brought from South America and known as the *native oil of laurel* or *sassafras*, or *aceite de sassafras*, is obtained by incising the trunk of the *Nectandra puchury*. This, as described by Procter (*A. J. P.*, 1851, p. 1) is a reddish oleoresin with a specific gravity of 0.898, a characteristic odor, and an aromatic somewhat camphoraceous taste. It is believed to be the same as that with which the copaiba from Mara-caibo is adulterated. It may be distinguished from copaiba by its ready solubility in alcohol of 0.838 and by the fact that its volatile oil is acted on by potassium.

Muller, by distilling the oil in contact with sulphuric acid, obtained a greenish-yellow oil possessing the peculiar odor of the beans. By fractional distillation he separated—1, a colorless oil, boiling at 150° C. (302° F.) ; 2, a colorless oil, boiling between 165° C. (329° F.) and 170° C. (338° F.); both of these oils consisting principally of hydrocarbons, *OioHig*; 3, a greenish-yellow viscid oil, boiling between 235° C. (455° F.) and 240° C. (464° F.), and having the composition $C_{38}H_{58}O_2$; 4, a deep blue oil, having a faint odor, boiling between 260° C. (500° F.) and 265° C. (509° F.).

In medicinal properties the pichurim beans resemble the common aromatics, and may be employed for the same purposes. In South America they are said to be used as a substitute for nutmeg, and have even been called by that name. They are rare in this country. The oil obtained from the tree is said to impart its odor to the perspiration and urine, and to be useful in *rheumatism, gout*, etc. The bark is sometimes employed as a tonic and febrifuge.

Picrasma. *Picrasma quassioides* (Ham.) Benn. (Fam. *Simarubaceae*).—The wood of this tree, which grows in the subtropical Himalayas, and resembles closely the *Ailanthus* in its appearance, has an intensely bitter taste, and has been proposed as a substitute for quassia. W. Dymock and C. J. H. Warden have found in it a crystalline principle which they believe to be quassin, and to exist in the probable proportion of from 0.02 to 0.03 per cent. The same investigators believe that the drug has in it a peculiar alkaloid. (*P. J.*, xx, 1889.) A principle analogous to quassin was isolated by Shimoyama from the bark of *P. eilantoides*. (*Ap. Ztg.*, 1892, 439.)

PICRORHIZA. Br.

PICRORHIZA

"Picrorhiza is the dried rhizome of *Picrorhiza Kurroa*, Royle." 'Br.

Kutki, Katki, Kuru, Kuruwa, Kaur, Karru, Kutaki, Kali-kutki, or Black Kutki, Katukurogani.

Picrorhiza Kurroa Royle (*P. Kurroa* Benth.), more properly known as *P. Lindleyana* (Wall. Wettst.), is a low, hairy perennial herb (Fam. *Scrophulariaceae*), indigenous to the Alpine Himalayas. The rootstalk or the rhizome has long been used in India and has been frequently spoken of by European and Mahometan writers as *black hellebore*, but is essentially different.

Properties.—*Picrorhiza* occurs "in cylindrical pieces two to five centimetres long, and four to eight millimetres thick, sometimes terminating in a stem or scaly leaf-bud; brittle. Cork greyish-brown, wrinkled, with transverse leaf scars and small buds. Fracture short. In transverse section internally dark and porous, with a thin, greyish cork and narrow ring of tangentially elongated wood-bundles. No odor; taste very bitter." Br.

Picrorhiza resembles externally the rhizome of *Gentiana Kurroo* Royle (Fam. *Gentianaceae*), the latter, however, is uniformly brown internally,

whereas the rhizome of *Picrorhiza* is darker or black, whence its name *kali* or black kutki. It is the dried rhizome of an Alpine-Himalayan plant, *Kurroa*. From this rhizome H. Warden has separated a glucoside, *picrorhizin*, which is freely soluble in water and alcohol and appears to be the bitter principle of the drug; also a red-brown, resinous, tasteless body, *picrorhizetin*, and, perhaps, cathartic acid (*Pharmacog. Indica*, vol. 3).

Uses.—The natives of India attribute active antiperiodic power to *picrorhiza*, which appears to be a powerful bitter tonic with slight laxative action. It is given in doses of from one to twenty grains (0.065-1.3 Gm.) as a tonic and from forty to fifty grains (2.6-3.2 Gm.) as an antiperiodic, usually in combination with aromatic'.

Off. Prep.—*Extractum Picrorhizae Liquidum*, Br.; *Tinctura Picrorhizae*, Br.

PILOCARPUS. U. S.

PILOCARPUS *Pilocarp*. [Jaborandi]

"The dried leaflets of *Pilocarpus Jaborandi* Holmes, known in commerce as Pernambuco Jaborandi, or of *Pilocarpus microphyllus* Stapf, known in commerce as Maranham Jaborandi (Fam. *Rutaceae*), without the presence or admixture of more than 5 per cent. of the stalks bearing the leaflets and stems of the same plant, or other matter, and yielding not less than 0.6 per cent. of the alkaloids of *Pilocarpus*." U. S.

Jaborandi Folia, Br. 1898; Jaborandi leaves, *Pilocarpi Foliola*; Jaborandi, Fr. Cod.; Folia Jaborandi, P. G.; Jaborandiblatter, G.; Jaborandi, It.; Jaborandi (Hoja de), Sp.

It is unfortunate in our opinion that this drug was omitted from the Br. Pharm., 1914; it was official in the Br. Pharm., 1898, under the title "Jaborandi Folia."

Pilocarpus was first introduced to the notice of the European profession by Coutinho (J. P. C., 4e ser., xx, 51) under the name of Jaborandi, a name which has adhered to the drug, although the terms Jaborandi, laborandi and Jamborandi are used in South America to designate various pungent, sudorific plants, most of which belong to the genus *Piper*, but some of which have no botanical relation at all with the

peppers. Although the leaves of the Piper Jaborandi have been sent into commerce as Jaborandi, none of the true jaborandis of South America have any physiological relations with the official drug, which, in South America is known as *Arruda do Mato* or as *Arruda brava* or, rarely, as *Jamguarandi* or *Jaurandi*.

The genus *Pilocarpus* consists of woody shrubs belonging to the Rutaceae and inhabits tropical and subtropical America, including Cuba, Guadeloupe, Martinique, and probably other islands. For elaborate botanical and histological studies of the commercial species of *Pilocarpus*, see the articles by A. Duvall, *B. Sc. Pharm.*, iii, pp. 41 and 98; Geiger, *Ber. d. D. Phar. Ges.*, 1897, p. 356; Hartwich, *Apoth. Zeit.*, 1900; Holmes *P. J.*, 1903, p. 713; and 1904, p. 54; Schneider, *Jour. of Pharmacology* (N. Y. C. P.), 1897, No. 6; Tunman, *S. W. P.*, xlvii, p. 177. The following species of the genus have been used in medicine:

P. Jaborandi Holmes (*P. officinalis* Poehl). —This plant inhabits the northern and northeastern part of Brazil whence its leaves find their way through Sergipe, Allogoa, Sobral and Ceara, etc., to Liverpool and Hamburg, the chief centers of European commerce in the drug. Like those of *P. selloanus* its leaves are two or three jugate and are especially separated from those of the *P. pennatifolius* by the fact that all of the leaflets except the terminal one have their bases cordate, while the bases of all the leaflets of *P. pennatifolius* are attenuate. This species is practically no longer obtainable in commerce, only occasional lots being imported.

P. pennatifolius Lemaire (*P. simplex* Baillon) inhabits the southern portion of Brazil and Paraguay, whence its leaves were formerly largely exported through Buenos Ayres and Rio Janeiro; at present they seem to have almost disappeared from commerce. The leaves are grayish-green in color, oval, elliptical, obtuse, attenuate at the summit, which is feebly emarginate, and also attenuate at their base but not petiolated. The species is recognized in the Belgian Pharmacopoeia.

In the original specimens of Jaborandi seen by Coutinho, and also in other specimens received from the doctor's family by F. V. G-reene, U. S. N., some of the leaves are hairy, although most of them are smooth, and it seems probable that the species does contribute somewhat to the Jaborandi of commerce.

P. selloanus Engler, formerly official in the U. S. P., appears to be a variety of *P. pennatifolius* Lemaire, from which it differs almost solely in the length of its flower stalk, which is six times as long as the flower bud, while that of *P. pennatifolius*, is but three to four times as long as the bud. *P. selloanus* seems to be the more southern plant of the two, and is especially abundant in Paraguay.

P. trachylophus Holmes.—The leaves of this species are smaller than those of the *P. Jaborandi*, and are oblong, elliptical, obtuse, and emarginate at the summit with cordate bases, symmetrically and shortly petiolate. The plant grows in Northeastern Brazil, especially in the provinces of Ceara and Maranhao, and the leaves, although they contain so little of the alkaloid (about 0.2 per cent.) as to be of small value, have been sent into commerce in considerable quantities. Their color upon the surface is vivid green, below yellowish-green. The under surface is covered with short hairs.

P. microphyllus Stapf grows in the northeastern part of Brazil, whence the leaves, much mixed with the debris of the petioles, of the twigs and of the fruit, are sent to Liverpool and Hamburg. These leaves are alternate, im-paripinnate having from one to five pairs of leaflets, or are often apparently simple owing to the failure of the lateral leaflets to develop. The leaflets are opposite, slightly pubescent, their petioles being marked by a deep longitudinal furrow. They vary very much in form, the base usually being attenuate and feebly cordate or unequal.

P. spicatus A. Saint-Hilaire (*P. parviflorus* Martins et Nees), inhabits the southern and northern portions of Brazil and can be recognized at once by its having simple leaves which are from 3 to 11 cm. long and from 1 to 4 cm. broad, and are tender or coriaceous and more or less pubescent and dotted. They are brownish-green above, paler beneath, and attached by a short twisted petiole. They appeared in commerce in 1895 under the name of *Arocati jaborandi*. *P. subcoriaceus* Engler is probably a variety of this species. *P. racemosus* Vain, a native of Martinique, Cuba, Guadeloupe and probably other of the West Indian Islands, appeared first in commerce in 1903 as a new variety of *jaborandi* under the name of *Guadeloupe jaborandi*. The leaves are proportionately broader than those of *Pernambuco jaborandi*, more obovate in outline, of a purer green color, and are trifoliate or apparently simple. Considerable diversity of result has been obtained by chemists in the examination of the Guadeloupe *jaborandi*. Rocher (A. J.

P., 1900) obtained 1 per cent. of total alkaloids of which 0.6 per cent. was believed to be pilocarpine, the remainder jaborine. In the laboratory of Wright, Layman and Umney, only 0.34 per cent. of total alkaloids were reported as existing, while in an assay by A. J. Cownley (*P. J.*, 1903, Ixxii) 0.6 per cent. of total alkaloids was obtained, about 50 per cent. of which was believed to be isopilocarpine. The commercial cultivation of jaborandi (may some day be successful, as the *P. pennatifolius* has been found to grow freely in Sicily and produce a leaf containing a fair proportion of alkaloid. Pilocarpus is usually bought by assay. The variation in the percentage of alkaloid, according to the observations of A. Duval, depends not merely on the original contents of the drug but upon the fact that the alkaloid disappears when the pilocarpus is kept for some length of time in a moist atmosphere. Pilocarpus was at one time adulterated with spurious jaborandis, other foreign leaves, stems, dirt and mouldy leaves. At the present time the commercial article is of good quality. There are, however, reports of the leaves of other plants being substituted. Weigel states that under the name of "*Feuilles de Bois d'inde*," the leaves of the logwood plant were substituted for Paraguay jaborandi. The most common adulterant appears to be in lots of *P. microphyllus*, which often contain leaves of the leguminous plant, *Tunatea decipiens* (Holmes), O. Kze. (*Swartzia decipiens* Holmes). In general appearance the two leaves resemble one another, both being imparipinnate and having the leaflets about the same size and shape, but in *P. microphyllus* the leaflets are opposite and the petioles are only slightly pubescent, while in the *Tunatea* the leaflets are alternate, and the petioles very pubescent. Then again, the absence of secreting hairs, the deep green of the upper and lighter green of the lower surface of the leguminous leaf serve easily to distinguish it from the true drug.

The following description of the drug is adapted from that of F. V. Greene, U. S. N., who had unquestionable specimens of the original jaborandi of Coutinho. The package contained several stems branched at an angle of about 20°, these branches being furnished with alternate leaves, which are imparipinnate, with from two to five opposite leaflets (Planchon has met with leaves having as many as seven or nine, and, more rarely, eleven leaflets) articulated to the rachis by short petiolules, thickened at the base. The leaflets, which are coriaceous in texture, vary considerably in size and outline. As a rule, they may be considered as oblong-lanceolate, and are entire, emarginate, with an unequal base. The midrib rises very little above the upper surface of the leaflet, but is

very prominent and sharp on the lower. The veins, which are rather more prominent on the lower surface, leave the midrib at an angle of about 60°, pursue a parallel course across the leaflet, and finally turn up and anastomose within about a quarter of an inch of the margin. The leaflets are pellucidly punctate; the dots are the receptacles of secretion, are numerous and irregularly distributed over the whole surface, and are plainly visible when the leaflet is held up to the light. According to Conroy, the leaflets yield 0.76 per cent., the leafstalks only 0.37 per cent. of alkaloid. The fruit consists of five carpels, of which not more than two or three are usually developed to maturity; when ripe, the carpels dehisce into two valves, and then remind one strongly of miniature cockle shells with the valves open exposing the animals. The black, shining, reniform seeds (one for each carpel) have a lancet-shaped hilum, a sharp ridge on the back near the apex, and a smooth, pale yellow endocarp surrounding it.

Paraguay jaborandi from *P. pennatifolius* and *P. selloamis* is an inferior variety of the drug, which reaches European commerce from Buenos Ayres and from Rio Janeiro, and is believed to be collected in Paraguay. The leaves are thinner than those of the Pernambuco jaborandi, and have only two or three, never four, pairs of leaflets. It is also noticeable in the Paraguay variety that the lateral veins are not prominent, that the base is so tapered that the widest portion is above the middle, and that the upper surface is grayish-green.

Properties.—The Pernambuco and Maranham jaborandis are official, being described as follows :

"Pernambuco Jaborandi.—Leaflets when entire, oval, oblong, or elliptical, from 4 to 10.5 cm. in length and from 2 to 4 cm. in breadth and with short, stout petiolules; summits more or less rounded or acute and emarginate; bases rounded or acute and mostly unequal; margins entire and narrowly revolute; very smooth, shiny, coriaceous and glandular-punctate; upper surfaces grayish to brownish-green, midribs mostly depressed, under surfaces yellowish- or greenish-brown and slightly pubescent .on the prominent midvein; peculiarly aromatic when crushed; taste bitterish, becoming somewhat pungent and having a sialogogue effect.

"Maranhm Jaborandi.—Leaflets rhomboid-ally oval to obovate or elliptical from 1.5 to 5 crn-in length and from 1 to 3 cm. in breadth, the

lateral ones nearly sessile, the terminal ones on margined petiolules, from 0.5 to 1.5 cm. in length; of a nearly uniform grayish or yellowish-green color, rather thin but otherwise resembling Pernambuco Jaborandi.

"Under the microscope, transverse sections of *Pilocarpus* show the upper epidermal cells with a yellowish layer of cutin from 0.005 to 0.01 mm. in thickness; palisade cells, 1 to 3 rows deep, being filled with chloroplastids; among the palisade cells occur large, nearly circular, oil-secretion reservoirs from 0.08 to 0.15 mm. in diameter; the dorsal pneumatic layer, from 10 to 20 rows in depth, the cells occasionally containing rosette aggregates of calcium oxalate from 0.01 to 0.025 mm. in diameter; distributed in the center of the leaf are the collateral fibro-vascular bundles each surrounded by a more or less interrupted circle of several rows of thick-walled, slightly lignified bast-fibers, tracheae associated with strongly lignified wood-fibers; among the cells of the lower epidermis occur numerous stomata. On surface view the stomata are broadly elliptical, from 0.025 to 0.04 mm. in length, being uniformly smaller in Maranhão Jaborandi. Upon both surfaces of Pernambuco Jaborandi occur a number of non-glandular, one-celled hairs, more or less bent or curved, from 0.08 to 0.5 mm. in length, thick-walled and with numerous, slight, centrifugal projections.

The powder is dark green or greenish-brown; epidermal cells on surface view 5-or 6-sided; stomata broadly elliptical, from 0.02 to 0.04 mm. in length, usually with four neighboring cells; fragments of fibro-vascular bundles showing tracheae with simple or bordered pores or spiral thickenings, associated with thick-walled and strongly lignified wood-fibers; bast-fibers few, walls thick and only slightly lignified; calcium oxalate in rosette aggregates, from 0.01 to 0.025 mm. in diameter; fragments of laminae showing large, oil-secretion reservoirs and usually containing one or more globules of oil; non-glandular hairs having thick walls, usually more or less broken, are occasionally found. *Pilocarpus* yields not more than 7 per cent. of ash." U. S.

An alkaloid was isolated in 1875 from Jaborandi almost simultaneously by A. W. Gerrard and M. Hardy. To this the name of *pilocarpine* was given. Gerrard at the same time stated that there were at least two alkaloids in the leaves, and this view seemed to be confirmed when *jaborine* was discovered. He also obtained a volatile oil, tannic acid, a peculiar volatile acid, and potassium chloride. *Pilocarpine* may be

prepared as follows. The leaves are exhausted with 80 per cent. alcohol containing 8 grammes of hydrochloric acid in a liter, the tincture is distilled and evaporated to the consistence of a liquid extract, and this is mixed with a small quantity of water, and filtered. The filtrate is treated with a slight excess of ammonia, and then with a large quantity of chloroform. The chloroform solution is agitated with water, to which hydrochloric acid is added, drop by drop, in sufficient quantity to neutralize the alkaloid, the hydrochloride of which is obtained in long needles on evaporating the aqueous solution, while foreign principles remain dissolved in the chloroform. By dissolving the crystals in water, treating the solution with ammonia and chloroform, and evaporating the latter solution, pilocarpine is obtained as a soft viscous mass, which is only slightly soluble in water, but is freely soluble in alcohol, ether, and chloroform.

Kingzett originally assigned pilocarpine the formula $C_{23}H_{24}O_4N_4 + 4H_2O$. Hamack and Meyer, on the other hand, give it as $C_{11}H_{16}O_2N_2$. The latter has been accepted, and is recognized by the U. S. Pharmacopoeia. It was later definitely established as correct by the synthesis of pilocarpine afterwards effected by Hardy and Calmels. (*C. R. A. S.*, cv, pp. 68 to 71; also *A. J. P.*, 1887, p. 632.) By the action of hydrochloric acid or of barium hydroxide, pilocarpine, $C_{11}H_{16}O_2N_2$, is changed into *pilocarpidine*, $C_{10}H_{14}O_2N_2$, by the loss of a methyl group. Now Hardy and Calmels have converted β -pyridine- α -lactic acid, into *pilocarpidine*, the methyl iodide of which by oxidation is converted into pilocarpine. The synthetical pilocarpidine and pilocarpine yield gummy derivatives similar to those obtained by Harnack and Meyer from the natural products. The physiological action of synthetical pilocarpine is identical with that of the natural alkaloid. Knudsen, E. Merck, and Petit and Polonovski all dispute the conclusions of Hardy and Calmels, and state that they failed to get pilocarpine by the synthetic method of these investigators. (*Proc. A. Ph. A.*, 1897, 716.) Petit and Polonovski (*J. P. C.* (6), v, 481) obtained *pilocarpic* and *pilocarpidic acids* from pilocarpine and pilocarpidine. Harnack and Meyer first stated that *jaborine* is easily formed from pilocarpine, and may be produced by simply heating the latter alkaloid. They also showed that *pilocarpine* has physiological effects analogous to those of *nicotine*, while *jaborine* resembles *atropine* in its effects.

Uses.—The therapeutic virtues of jaborandi appear to be due entirely to

the alkaloid pilocarpine and the crude drug is very rarely employed.

When an overdose of jaborandi, or its principle alkaloid, has been taken, the symptoms begin with flushing of the face and neck, soon followed by free sweating and salivation, both of which may be extremely profuse. Frequently there is nausea and sometimes vomiting, the pulse is usually somewhat more rapid than normal, the pupils contracted, and often there is *diarrhea*. In patients with circulatory disturbances, pulmonary edema may occur, and prove rapidly fatal. The antagonism between pilocarpine and atropine is about as complete as between any two drugs, and the most certain treatment for cases of poisoning by jaborandi, after evacuating the stomach, is the prompt administration of a full dose of atropine, or some substance containing it.

Dose, of jaborandi, from twenty to forty grains (1.3-2.6 Gm.).

Off. Prep.—Fluidextractum Pilocarpi, *U. S.*

PILULÆ.

PILLS

Pilules, *Fr.*; Pillen, *G.*; Pillole, *It.*; Pildoras, *Sp.*

These are globular masses of a size convenient for swallowing. They are well adapted for the administration of medicines which are unpleasant to the taste or smell, or insoluble in water, and which do not require to be given in large doses. Deliquescent substances should not be made into pills, and those which are efflorescent should be previously deprived of their water by crystallization. Care should be taken not to combine materials the mutual reaction of which may result in a change of physical conditions.

Some substances have a consistence which enables them to be made immediately into pills. Such are the softer extracts and certain gum-resins, and the addition of a little water to the former, and of a few drops of alcohol to the latter, will give them the requisite softness and plasticity, if previously wanting. Substances which are very soft, or in the liquid state, are formed into the pilular mass by incorporation with dry and inert powders, such as wheat flour, starch, and powdered gum arabic, or with crumb of bread. Powders must be mixed with soft, solid

bodies, as extracts, confections, soap, etc., or with tenacious liquids, as syrup, molasses, honey, mucilage or glycerin and the last-mentioned substance has been especially recommended in connection with a little alcohol. Heavy metallic powders are most conveniently made into pills with the former; light vegetable powders with the latter. Mucilage is very often used, but pills made with it are apt when kept to become hard and of difficult solubility in the liquids of the stomach, and if metallic substances are mixed with it the mass does not work well. A mixture of syrup and powdered gum arabic is not subject to the same inconveniences, and is an excellent material for the formation of pills. Honey evaporated to about half its bulk has been highly recommended. Confection of rose and glucose are among the best excipients, when the pills are to be kept long. For the same purpose of keeping the pills soft, the addition of a small portion of some fixed oil or deliquescent salt has been recommended, but glycerin is still better. Glycerin incorporated with one-twenty-fifth of its weight of powdered tragacanth is said to cause pills to remain soluble for almost any length of time. The official mucilage of tragacanth is an excellent excipient. Martindale prepares a mass by heating together with constant stirring to 115.5° C. (240° F.) five parts by weight of glycerin and one of flour, or, when a very firm mass is required, equal parts of flour and glycerin. It has been objected that pills made with glycerin could not be handsomely gilded or silvered, the luster of the metal disappearing. This is true, however, only of very recent pills, or of those in which an excess of glycerin has been used. Many powders require only water. Such are all those which contain ingredients capable of forming an adhesive or viscid solution with the liquid. Care should always be taken that the substance added is not incompatible with the main constituents of the pill.

The materials should be accurately mixed together, and beaten in a mortar until formed into a perfectly uniform and plastic mass. This should be of such a consistence that the pills may preserve their form, without being so hard as to resist the solvent power of the gastric fluids. As pills frequently become very hard by time, it is often convenient to keep the mass in a state fit to be divided when wanted for use. This may be done by wrapping it in waxed paper, putting it in covered pots, and occasionally moistening it as it becomes dry, or, more effectually, by keeping it in glass or well glazed jars, accurately closed with rubber cloth. The mass is made into pills by rolling it with a spatula, or with a flat, smooth piece of hard wood, into a cylinder of precisely the same thickness throughout, and of a length corresponding to the number of

pills required. It is then divided as equally as possible by the hand, or, more accurately, by a machine. (See *Remington's Practice of Pharmacy*, 5th edition, p. 1217.) The pills receive a spherical form by being rolled between the fingers or by the use of one of the pill rolling machines. Mialhe describes a little instrument for rolling pills, composed of two circular plates, one about 12 inches, the other 6, in diameter, the former having a ledge at the border one-third of an inch high, the latter with a similar ledge, varying, according to the size of the pills, from less than a line to nearly two lines, and with a strap on the back by which it can be fitted to the hand. This is to be moved in a rotary manner upon the larger plate, holding the divided portions of the pill mass. Similar pill rollers made of wood are now in use. In order to prevent the adhesion of pills to one another, or to the sides of the vessel in which they may be placed, it is customary to agitate them with some dry powder, which gives them an external coating, that serves also to conceal their taste. For this purpose magnesium carbonate, rice flour, or starch may be used. Magnesium carbonate is sometimes incompatible with one of the ingredients of the pills, and licorice root is then preferable, though it occasionally becomes mouldy with very damp pills. The powder of lycopodium, which has been long in use in Europe, is now considerably employed in this country, and is perhaps one of the best substances for the purpose. It is the custom in some sections of the United States, particularly on the Pacific coast, to give the pill a coating of gold or silver leaf. This is done by agitating the pills, prepared without dusting powder, and with their surface still damp, or coated with a very small quantity of mucilage, with gold or silver leaf, in a hollow spherical wooden box made by turning two hemispheres out of hard wood, fitting each other, and provided with a short handle.

It was proposed by Garot to cover pills with gelatin, which answers the purpose of concealing their taste and odor and counteracting deliquescence or chemical change from exposure to the air, but it sometimes interferes with their solubility in the stomach. This method of coating is largely used at the present time. One of the best machines that have been devised for gelatin coating pills extemporaneously on the small scale is that of H. Maynard, of Chicago. This consists of a circular plate in which are affixed twenty fine needles; the pills are rolled into depressions, and are easily impaled on the points of the needles; they are then dipped into a solution of gelatin, gently rotated, and allowed to cool. Another plan, less effectual, but more convenient, is to introduce the pills into a spherical box, to drop on them enough syrup

simply to moisten their surface, then to give a rotary movement to the box until the pills are uniformly covered, and finally to add by degrees either powdered French chalk, elm bark, or some similar substance, shaking the box with each addition, and continuing the process until nothing more will adhere to the pills. The investing material may be rendered agreeable to the taste and smell by aromatic additions, if deemed advisable. Calloud found that a good powder for coating pills, because little disposed to attract moisture, is made by boiling one part of flaxseed and three parts of white sugar with sufficient Water until a thick mucilage is formed, evaporating this carefully to dryness, and then pulverizing. The same writer has since suggested, as still more effective, a powder made by forming a mucilage with one part of tragacanth and two parts of water, pressing this through linen, mixing it with twenty parts of sugar of milk, spreading the paste thus made in thin layers to dry, and then powdering. The pills may be simply moistened with water and then shaken in the powder. L'Hermite proposed first to agitate the pills in a mortar with a little concentrated solution of gum, and afterwards to put them into a box containing dry and very finely powdered sugar, to which a rotary motion is given. If the coating be not sufficiently thick, the process may be repeated. (*J. P. C.*, xxv, 460.) For a list of excipients for pills by J. Cohn, see *Proc. A. Ph. A.*, 1900, 469 from *Ph. Ztg.*, 1900, 221; also G. Gugge, *A. Ph. A. Year Book*, 1914, p. 81.

Gelatin coating on the larger scale is accomplished by the use of the vacuum apparatus of J. B. Russell (see Remington's *Practice of Pharmacy*), or by simply rotating the pills in contact with a solution of gelatin in large spherical vessels, such as are used for sugar coating.

The sugar coating of pills is now conducted upon a large scale by manufacturers, who send immense quantities both of popular and of official pills into the market thus protected. The process employed is similar to that of the confectioners in coating almonds. After having been thoroughly dried, the pills are put into a hemispherical tinned copper basin, which is suspended from the ceiling and moved quickly backward and forward with an eccentric motion, so as to cause a constant attrition among the pills. First a little very thick syrup, or syrup of gum, is introduced in order to give a thin coating to their surface, and afterwards very finely powdered and very dry white sugar is sifted or thrown over them, the motion being constantly maintained. The sugar is fixed by the moist surface of the pills, and the coating

made compact and smooth by the attrition. The process is aided by a gentle heat, but the heat must be guarded, lest the pills be much softened, and thus lose their shape and even discolor the coating. Dexterous manipulation is necessary in order that the process may succeed thoroughly. For practical remarks on the sugar coating of pills, see an essay by H. C. Archibald in *A. J. P.*, 1867, p. 199, and by Wm. R. Warner, dr., and T. S. Wiegand in *A. J. P.*, 1902, 32. On a larger scale a pill coater of copper of peculiar construction, heated by steam pipes, is now used.

Still another method of coating pills, proposed by E. K. Durden is to cover the pills with collodion, which completely conceals the taste. The solution employed by Durden had the sp. gr. 0.810, and two dippings gave a sufficient coating. (*A. J. P.*, xxi, 183.) It is, however, yet to be determined whether a coating of collodion would yield readily to the solvent powers of the gastric juice. Blanchard covers pills with a solution of Tolu balsam in ether, but H. C. Baidon objects to this, that it takes too long to dry, and suggests as a substitute a solution of a drachm of the balsam in three drachms of chloroform, which dries sufficiently in twenty minutes. If old and solid Tolu balsam be selected, it will be less liable to the objection of drying slowly. This balsam is officially employed in coating the U. S. pills of ferrous iodide. A solution of mastic in ether has also been used for coating pills, and the white of egg has been recommended for the same purpose.

Pills are sometimes coated with substances which do not dissolve in the stomach, with the object of permitting the passage of the undissolved pill into the intestines; for this purpose keratin coating has been largely used. (See *Keratin*, Part II, and Remington's *Practice of Pharmacy*, sixth edition.) *Salol* has also been employed, by melting it in an enamelled pan at a temperature of about 50° C. (122° F.) and dropping in the pills, rotating until covered, and then transferring to a dry pan, still rotating (to prevent adhesion) until cold.

An improved (method of salol coating for pills intended for enteric use has been contributed by J. C. and B. L. DeG. Peacock (*Proc. P. Ph. A.*, 1915, p. 258). The particular points to be observed are the amount of salol to be used and the shape and size of the vessel used in melting the salol.

W. Q. Toplis (*Proc. P. Ph. A.*, 1915, p. 262) proposes stearic acid as an

enteric coating for pills and gives details of the method to be followed in producing a satisfactory article.

Pills which are to be kept long should be well dried, and put into bottles with loosely fitting stoppers to prevent mouldiness. Though the U. S. Pharmacopoeia, in almost every instance, orders the mass to 'be divided into pills, yet it should be understood rather as indicating the number of pills to be made from a certain quantity of the mass, -when particular directions are not given by the physician, than as requiring the division to be made immediately after the materials have been mixed. It will be found convenient by the apothecary to retain a portion of the mass undivided, especially when it is desirable to keep the pills soft. The British Pharmacopoeia furnishes formulas for pill masses, using the title of " Pilula " instead of " Massa," the title of the class adopted by the U. S. Pharmacopoeia; there is, in our opinion, a decided advantage in selecting a name for the class which is not likely to be confused with that used for the divided pills.

Pills containing silver nitrate, potassium permanganate or other easily oxidizable substances, should be made by diluting with kaolin or talc and massing with petrolatum or mixtures of petrolatum and paraffin. All organic matter should be excluded.

Compressed pills are made directly from the medicinal substance without the aid of an excipient. The drug, if not already in granular powder, is made so, and then forced into pill shape by means of a powerful press. For certain substances which are crystalline in structure, such as quinine bisulphate, potassium bromide, and potassium iodide, and which have some cohesiveness and yet are of easy solubility, the process is a good one. An apparatus was contrived by J. P. Remington for compressing pills (see 16th ed., *U. S. D.*, and *Practice of Pharmacy*, 5th ed., page 1233). It is made of cast steel; the base has two counter-sunk depressions with a short post in the center of each, and a lenticular depression is made in the upper surface of each post. A steel cylinder having a central aperture of the diameter of the post is placed in the depression, the proper quantity of powder is introduced, and the plunger, which has a corresponding lenticular depression on its lower surface, is placed on the powder and is struck a quick blow with a mallet; the powder is compressed, and the pill adheres to the cylinder; by removing the cylinder and holding it over a box and tapping the plunger again lightly, the pill is forced out and falls into a box.

Compressed tablets, are now used to an enormous extent, being made by various manufacturers with machinery of ingenious construction; the fact of their requiring no excipient, the ease with which they can be tested, and their permanent character (in most cases being just as valuable years after they were made as when fresh) have caused their extensive employment. Care should be taken, however, not to use them in those few cases where very prompt action is required, as the powerful compression to which they are subjected renders them less quickly effective than the same drug administered in the form of a loose powder.

For a description of some of the more important forms of pill compressing machines with illustrations, see Remington's *Practice of Pharmacy*, sixth edition.

PILULÆ ALOES. U. S. (Br.)

PILLS OF ALOES Pil. Aloes

Pilula Aloes, *Br.*; Aloes Pill; Pill of Barbados Aloes, Pill of Socotrine Aloes; Pilules d'Aloes et de Savon, *Fr. Cod.*; Pilules Aloétiques Savonneuses, *Fr.*; Alcepillen, *G.*

"Aloes, in fine powder, thirteen grammes [or 201 grains]; Soap, in fine powder, thirteen grammes [or 201 grains]; Water, a sufficient quantity, to make one hundred pills. Mix the powders intimately, then incorporate sufficient water to form a mass, and divide it into one hundred pills." *U. S.*

"Aloes, in powder, 58 grammes; Hard Soap, in powder, 29 grammes; Oil of Caraway, 3 millilitres; Syrup of Glucose, 10 grammes or a sufficient quantity. Mix to form a mass." *Br.*

In the *Br. Pharm.*, 1898, confection of rose was used as the excipient. It is now replaced by syrup of glucose.

The former British process for *Pill of Socotrine Aloes* was the same except that Socotrine was substituted for Barbados Aloes, and the volatile Oil of Nutmeg for Oil of Caraway.

The soap, in this formula, not only serves to impart a proper consistence to the aloes, but is thought to qualify its operation and diminish its

liability to irritate the rectum. Five of the U. S. pills, containing ten grains (0.65 Gm.) of aloes, may be given with a view to their purgative effect, but the preparation is usually employed as a laxative in *habitual costiveness*.

Dose, one, two or three pills at bedtime. The British pill mass is of very nearly the same strength as that of the U. S. Pharmacopoeia.

PILULA ALOES ET ASAFETIDÆ. Br.

PILL OF ALOES AND ASAFETIDA

Pilulae Aloes et Asafoetidae, *N. F.*; Pilules d'Aloes et d'Asefetide, *Fr.*; Aloe und Asfoetida-Pillen, *G.*

A process for these pills was not retained in the U. S. P. IX, but are recognized by the N. F. IV (see Part III); the British process is as follows:

Aloes, in powder, 30 grammes; Asafetida, 30 grammes; Hard Soap, in powder, 30 grammes; Syrup of Glucose, 10 grammes, or a sufficient quantity. Mix to form a mass." *Br.*

In the Br. Pharm., 1898, confection of rose was used as the excipient. It is now replaced by syrup of glucose.

Pills made from this mass are peculiarly adapted, by the stimulant and carminative properties of the asafetida, to eases of costiveness attended with flatulence and debility of the digestive organs.

Dose, about four grains (0.26 Gm.) of the mass.

PILULA ALOES ET FERRI. Br.

PILL OF ALOES AND IRON

Pilulae Aloes et Ferri, *N. F.*; Pilulae Italicae Nigrae; Pilules d'Aloes et de Fer, *Fr.*; Pilulae Aloeticae ferratae, *P. G.*; Eisenhaltige Aloepillen, Aloe und Eisenpillen, Italienische Pillen, *G.*,

"Exsiccated Ferrous Sulphate, 10 grammes; Aloes, in powder, 20 grammes; Compound Powder of Cinnamon, 35 grammes; Syrup of Glucose, 35 grammes, or a sufficient quantity. Mix to form a mass." *Br.*

These pills were deleted from the U. S. P. IX, but were introduced without change into the N. F. IV.

This pill differs from the preparation of the same name in the British Pharmacopoeia in the substitution of aromatic powder for the compound powder of cinnamon. It is essentially an old preparation of the Edinburgh Pharmacopoeia, was omitted in the original British, and reintroduced and continued in the present edition. The Br. Pharm., 1898, improved this mass by substituting exsiccated ferrous sulphate for the crystallized salt formerly employed, and by the use of syrup of glucose instead of confection of rose. It is said that the laxative power of aloes is increased, and its tendency to irritate the rectum diminished, by combination with ferrous sulphate. This pill is especially adapted to amenorrhœa with debility of the stomach and constipation.

Dose, of the Br. mass, from three to eight grains (0.2-0.5 Gm.); of the N. F. pills, from one to three pills.

PILULA ALOES ET MYRRHÆ. Br.

PILL OF ALOES AND MYRRH

Pilulæ Aloes et Myrrhæ, *N. F.*, Rufus's Pills; Pilule d'Aloes et de Myrrhe, Pilules de Rufus, *Fr.*; Rufussche Pillen, *G.*

"Aloes, in powder, 44 grammes; Myrrh, in powder, 22 grammes; Syrup of -lucose, 34 grammes, or a sufficient quantity. Mix to form a mass." *Br.*

These pills were deleted from the U. S. P. IX, but were introduced without change into the N. F. IV.

This composition has been long in use, under the name of *Rufus's Pills*. It is employed, as a warm stimulant cathartic, in general debility attended with *constipation*, and in *retention* or *suppression of the menses*.

Dose, of the Br. mass, from four to eight grains (0.26-0.5 Gm.); of the N. F. pills, three to six pills.

PILULE ASAFŒTIDÆ. U. S.

PILLS OF ASAFETIDA Pil. Asafoet.

Pilules d'Asefetide, *Fr.*; Asafoetida-Pillen, *G.*

"Asafetida, twenty grammes [or 309 grains]; Soap, in fine powder, six grammes [or 93 grains]; Water, a sufficient quantity, to make one hundred pills. Beat the solids together with water, so as to form a mass, and divide it into one hundred pills." *U. S.*

Each of these pills contains three grains (0.20 Gm.) of asafetida. They are a convenient form for administering asafetida, the unpleasant odor and taste of which render it very offensive in the liquid state.

Dose, one to three pills.

PILULÆ CATHARTICÆ COMPOSITÆ. U. S.

COMPOUND CATHARTIC PILLS Pil. Cathart. Co.

Antibilious Pills; Pilules cathartiques composees, *Fr.*; Abfuhrpillen, *G.*

"Compound Extract of Colocynth, eighty grammes [or 2 ounces av., 360 grains]; Mild Mercurous Chloride, sixty grammes [or 2 ounces av., 51 grains]; Resin of Jalap, in fine powder, twenty grammes [or 309 grains]; Gamboge, in fine powder, fifteen grammes [or 231 grains]; Diluted Alcohol, a sufficient quantity, to make one thousand pills. Mix the powders intimately, then incorporate a sufficient quantity "of diluted alcohol to form a mass, and divide it into one thousand pills." *U. S.*

This cathartic compound was first made official in the second edition of the U. S. Pharmacopoeia. It was intended to combine smallness of bulk with efficiency and comparative mildness of purgative action and a peculiar tendency to the biliary organs. Such an official preparation was much wanted in this country, in which bilious fevers, and other complaints attended with congestion of the liver and portal circle generally, so much abound. The object of smallness of bulk is accomplished by employing extracts and the more energetic cathartics; that of a peculiar tendency to the liver, by the use of calomel, and that of efficiency with mildness of operation, by the union of several

powerful purgatives'. It is a fact, abundantly proved by experience, that drastic cathartics become milder by combination, without losing any of their purgative power. It is highly important that these pills be prepared in exact compliance with the directions, and that the *compound extract of colocynth* and the *resin of Jalap* used be of good quality. When they fail, the result is generally ascribable to the substitution of jalap for the resin, or to the use of a compound extract of colocynth made with nearly inert scammony, inferior aloes, and insufficient colocynth, and altogether badly prepared.

Each pill weighs about 3 grains (0.194 Gm.), and contains 2.70 grains (0.175 Gm.) of active ingredients. A single pill will generally be found to operate as a mild laxative. In a full dose, the preparation acts vigorously on the bowels, producing bilious stools, generally without much pain or disorder of the stomach. It may be employed in most instances where a brisk cathartic is required, but is particularly applicable to the early stages of *bilious fevers*, to *hepatitis*, *jaundice*, and all those derangements which depend on congestion of the portal circle. It should not be used in habitual constipation.

Dose, one to three pills.

PILULA COLOCYNTHIDIS COMPOSITA. Br.

COMPOUND PILL OF COLOCYNTH

Pilulae Colocynthidis Compositae, *N. F.*; Cochia Pills; Pilules de Coloquinte composees, *Fr. Cod.*; Pilules cochees mineures, *Fr.*; Zusammengesetzte Koloquinten-Pillen, *G.*

"Colocynth Pulp, in powder, 20 grammes; Aloes, in powder, 35 grammes; Scammony Resin, in powder, 35 grammes; Potassium Sulphate, in powder, 5 grammes; Oil of Cloves, 5 millilitres; Distilled Water, a sufficient quantity. Triturate the Oil of Cloves with the Potassium Sulphate; add the Colocynth Pulp; mix; add the Aloes and Scammony Resin; mix; add Distilled Water, and mix to form a mass." *Br.*

This is not, like the old London pills of the same name, merely another form of the compound extract of colocynth, though containing essentially the same materials—one great difference being that colocynth and aloes are used in substance in the pill, instead of in the state of extract. Potassium sulphate is used to promote the more

complete division of the aloes and scammony. The preparation is actively cathartic. This pill is also official in the N. F. IV.

Dose, from five to ten grains (0.32-0.65 Gm.).

Off. Prep.—*Pilula Colocynthis et Hyoscyami, Br.*

PILULA COLOCYNTHIDIS ET HYOSCYAMI. Br.

PILL OF COLOCYNTH AND HYOSCYAMUS

Pilulae Colocynthis et Hyoscyami, N. F.: Pilules de Coloquinte et d'Extrait de Jusquiame, Fr.; Koloquinten-Bilsenkrautpillenmasse, G.

"Compound Pill of Colocynth, 50 grammes; Extract of Hyoscyamus, 25 grammes; Distilled Water, a sufficient quantity. Mix to form a mass." *Br.*

This was an official pill of the Edinburgh College. It is asserted that the compound pill and compound extract of colocynth are almost entirely deprived of their griping tendency by combination, as above, with extract of hyoscyamus, without losing any of their purgative power.

Dose, from five to twenty grains (0.32-1.3 Gm.).

This pill is also official in the N. F. IV).

PILULA IPECACUANHA CUM SCILLA. Br.

PILL OF IPECACUANHA WITH SQUILL

Pilules d'Ipecacuanha et de Scille, *Fr.*; Brechwurzel-Meerzwiebelpillen, *G.*

"Compound Powder of Ipecacuanha, 30 grammes; Squill, in powder, 10 grammes; Am-moniac'nm, in powder, 10 grammes; Syrup of Glucose, a sufficient quantity. Mix to form a mass. This Pill contains about 5 per cent. of Opium." *Br.*

This is an old-fashioned combination of expectorants, intended for *chronic bronchitis*, but scarcely in keeping with modern practice.

Dose, from five to ten grains (0.32-0.65 Gm.).

PILULA IPECACUANHÆ CUM URGINEA. Br.

PILL OF IPECACUANHA WITH URGINEA

"Compound Powder of Ipecacuanha, 30 grammes; Urginea, in powder, 10 grammes; Ammoniacum, in powder, 10 grammes; Syrup of Glucose, a sufficient quantity. Mix to form a mass. This Pill contains about 5 per cent. of Opium." *Br.*

This is the same as Pill of Ipecacuanhae with Squill, except that Indian Squill or Urginea is used in place of the Mediterranean variety.

PILULÆ RHEI COMPOSITES. U. S. (Br.)

COMPOUND PILLS OF RHUBARB Pil. Rhei Co.

Pilula Rhei Composita, *Br.*; Pilules de Rhubarbe composees, *Fr.*; Rhabarber und Aloepillen, *G.*

"Rhubarb, in No. 80 powder, thirteen grammes [or 201 grains]; Aloes, in fine powder, ten grammes [or 154 grains]; Myrrh, in fine powder, six grammes [or 93 grains]; Oil of Peppermint, five-tenths of a mil [or 8 minims]; Water, a sufficient quantity, to make one hundred pills. Mix the oil of peppermint intimately with the powders, then incorporate sufficient water to form a mass; divide it into one hundred pills." U. S.

"Rhubarb, in powder, 25 grammes; Aloes, in powder, 20 grammes; Myrrh, in powder, 14 grammes; Hard Soap, in powder, 14 grammes; Oil of Peppermint, 2 millilitres; Syrup of Glucose, 25 grammes, or a sufficient quantity. Mix to form a mass." *Br.*

This is a tonic laxative, useful in *costiveness*. If made in quantity the pills should be kept in loosely stoppered bottles. The use of glycerin favors the formation of mouldiness through the attraction of moisture, and it was replaced in the formula of the *Br. Ph.*, 1898, by syrup of glucose.

Dose, of the compound rhubarb pills, two to four pills, or from five to fifteen grains (0.32-1.0 Gm.) of the mass, twice a day.

PILULA SCILLÆ COMPOSITA. Br.

COMPOUND SQUILL PILL

Pilules de Scille composees, Fr.; Meerzwiebelpillenmasae, G.

"Squill, in powder, 25 grammes; Ginger, in powder, 20 grammes; Ammoniacum in powder, 20 grammes; Hard Soap, in powder, 15 grammes; Syrup of Glucose, 20 grammes, or a sufficient quantity. Mix to form a mass." Br.

This preparation was dropped at the 1880 revision of the U. S. Pharmacopoeia.

This is a stimulating expectorant compound, depending for its virtues chiefly on the squill, and applicable to the treatment of *chronic bronchitis*. The mass should be freshly made when wanted, as the squill which it contains is liable to 'be injured by keeping.

Dose, from five to ten grains (0.32-0.65 Gm.).

PILULA URGINEÆ COMPOSITA. Br.

COMPOUND URGINEA PILL

"Urginea, in powder, 25 grammes; Ginger, in powder, 20 grammes; Ammoniacum, in powder, 20 grammes; Hard Soap, in powder, 15 grammes; Syrup of Glucose, 20 grammes, or a sufficient quantity. Mix to form a mass." Br.

This pill is the same as the Compound Squill pill, except that the Indian Squill, Urginea, replaces the ordinary variety.

Dose, from five to ten grains (0.32-0.65 Gm.).

Pimenta. *N. F. IV (U. S. VIII). Allspice. Pimento. Semen Amomi. Piper Jamaicense. Pimento. Allspice. Jamaica Pepper. Piment de la Jamazque, Touteepice, Poivre de la Jamazque, Fr. Englisches Gewurs, Neugewurz, Nelkenpfeffer, G. Pimenti, It. Pimienta de la Jamaica, Sp.*— "The dried, nearly ripe fruit of *Pimenta officinalis* Lindley (Fam. *Myrtaceae*), without the presence of more than 5 per cent. of stems or other foreign matter." *N. F.*

Pimenta was dropped from the U. S. and Br. Pharmacopoeias but admitted to the National Formulary IV.

The tree yielding pimenta is a native of the West Indies, Mexico, and South America, and is abundant in Jamaica, whence its fruit received the name of *Jamaica pepper*. The allspice plant is cultivated in Central America and the surrounding countries, but more than half the supply to the United States comes from Jamaica, where the tree is so abundant as to form in the mountainous districts whole forests, and to require no further cultivation than the clearing out of the under-brush. The berries are gathered after having attained their full size, but while yet green, and are carefully dried in the sun. When sufficiently dry, they are put into bags and casks for exportation. The fruits of four other species of the genus *Pimenta*, found in Venezuela, Guiana, and the West Indies, are employed in their native countries as spices.

It is described by the *N. F.* as: "Sub-globular, from 4 to 7 mm. in diameter, summits with four calyx teeth forming a minute ring; externally dark brown, somewhat rough and glandular-punctate; pericarp brittle, about 1 mm. in thickness; two-celled and two-seeded; dissepiments thin; seeds plano-convex, slightly reniform, externally reddish-brown, smooth, somewhat wrinkled and shiny. Odor and taste, particularly of the pericarp, aromatic and distinctive. The powder is reddish-brown or dark brown and, when examined under the microscope, shows irregular fragments and numerous starch grains, the latter being either simple or compound, the individual grains spherical, from 0.003 to 0.015 mm. in diameter, plano-convex or polygonal, and frequently with a central circular marking or cleft; stone cells numerous, of tabular, pyriform or variable shape and with thick, porous, and strongly lignified walls, the lumina frequently filled with a yellowish-or reddish-brown amorphous substance, fragments with oil secretion reservoirs containing globules of a yellowish-brown oil; parenchyma cells with reddish-brown tannin masses. Stem fragments very few, and characterized by more or less curved, thick-walled, non-glandular hairs, rosette aggregates of calcium oxalate, from 0.006 to 0.017 mm. in diameter, tracheid-like tissues of the wood and long narrow bast fibers. The yield of crude fiber does not exceed 25 per cent. when estimated as directed in the U. S. Pharmacopoeia. *Pimenta* yields not more than 6 per cent. of ash." *N. F.*

The odor of *Pimenta* berries is thought to resemble that of a mixture of cinnamon, cloves, and nutmeg. Hence the name of *allspice*, by which they are best known in this country. They impart their flavor to water, and all their virtues to alcohol. The infusion is of a brown color, and reddens litmus paper.

Pimenta yields a volatile oil by distillation having the sp. gr. of from 1.04 to 1.05 at 15° C. (59° F.). (See *Oleum Pimentae*.) Bonastre obtained from them a volatile oil, a green fixed oil, a fatty substance in yellowish flakes, tannin, gum, resin, uncrystallizable sugar, coloring matter, malic and gallic acids, saline matters, moisture, and lignin. The green oil has the burning aromatic taste of pimenta, and is supposed to be the acrid principle. Upon this, therefore, together with the volatile oil, the medicinal properties of the berries depend, and, as these two principles exist most largely in the shell or cortical portion, this part is most efficient. According to

Bonastre, the shell contains 10 per cent. of the volatile and 8 of the fixed oil, the seeds only 5 per cent. of the former and 2.5 of the latter. Berzelius considered the green» fixed oil of Bonastre as a mixture of volatile oil, resin, fixed oil, and perhaps a little chlorophyll. Dragendorff, in 1871, announced the existence of an alkaloid in allspice. It is present in exceedingly small quantity, and has somewhat the odor of coniine. W. W. Abell obtained from 448 Gm. of pimenta leaves one-half of one per cent. of volatile oil resembling oil of bay; he also found tannic acid. (*A. J. P.*, 1886, 163.) A convention of hygienists at Vienna decided that ground allspice should not yield more than 6 per cent. of ash, of which not more than 0.5 per cent. should be soluble in hydrochloric acid.

Pimenta is sometimes adulterated by the larger and less aromatic berries of the Mexican *Myrtus Tobasco* Mocino.

Uses.—Pimenta is an aromatic spice, used in medicine chiefly as an adjuvant to tonics and purgatives. It is particularly useful in cases attended with much *flatulence*. It is, however, much more largely employed as a condiment than as a medicine.

It is one of the ingredients in compound tincture of guaiac of the National Formulary IV. *Aqua Pimentae* Br., 1898, was formerly official—it was a distilled water.

Dose, ten to forty grains (0.65-2.6 Gm.).

Pimento Water (*Aqua Pimentae*). *Eau de piment de la Jamaïque*, Fr.; *Nelkenpfefferwasser*, G.—It was prepared by the Br. 1898 as follows; "Pimento, bruised, 8 ounces (Imperial) or 250 grammes; water, 2 gallons (Imp. meas.) or 10 litres. Distil one-half." *Br.*, 1898. Pimento water is an agreeable aromatic water, used as a vehicle.

Pimpinella. N. F. IV. *Pimpernel Root*. *Pimpinella Saxifraga* L. *Small Burnet Saxifrage*. *Saxifraga*. *Radix Pimpinelle*, P. G. *Grand Boucage*, Fr. *Pimpinell*, *Bibernell*, G.—"The dried rhizome and roots of *Pimpinella Saxifraga* Linne, or *Pimpinella magna* Linne (Fam. *Umbelliferae*)." N. F.

This is a perennial umbelliferous European plant growing on sunny hills, and in dry meadows and pastures. It is also naturalized, growing along roadsides and in waste places in the northern United States and Canada. The root has a strong, aromatic, yet unpleasant odor, and a sweetish, pungent, biting, aromatic, bitterish taste. Pimpinella is described by the N. F. as "cylindrical or slightly tapering, from 10 to 20 cm. in length and from 1 to 1.5 cm. in diameter at the crown, frequently branching, sometimes split longitudinally or broken into pieces; the upper or rhizome portion annulate, with undeveloped stem buds and a few attached stem remains which should not be over 5 cm. in length; roots longitudinally wrinkled, slightly annulate, cortex thin, easily detached; fracture short when dry, tough and flexuous when damp; externally light yellowish-brown; internally porous; cortex broad and whitish with numerous groups of projecting radial bast fibers and reddish-brown oleoresin cells; wood yellowish, usually with a few indistinct fibers, medullary rays interrupted,

cambium zone distinct. Odor aromatic; taste sweetish, pungent and acrid.

"The powdered drug, when examined under the microscope, shows numerous simple or two- to four-compound starch grains, the individual grains being from 0.004 to 0.01 mm. in diameter; secretion canals from 0.05 to 0.06 mm. in diameter; tracheae reticulate or scalariform, from 0.035 to 0.07 mm. in breadth; fibers, thin-walled numerous, thick-walled with simple pores few (*P. magna*].

" *Pimpinella* yields not more than 5 per cent. of ash." *N. F.*

Its active constituents are volatile oil and an acrid resin. The yellow volatile oil has an odor recalling parsley, and a biting taste. Buchheim obtained from the alcoholic extract a crystalline principle, which he called *pimpinellin*, $C_{13}H_{10}O_5$. It is insoluble in water and petroleum ether, but soluble in alcohol. It is considered diaphoretic, diuretic, and stomachic, and has been used in *chronic catarrh*, *asthma*, *dropsy*, *amenorrhea*, etc. The dose in substance is about half a drachm (2.0 Gm.), and in infusion two drachms (7.7 Gm.). The root is used also as a local stimulant in toothache, etc.

Pinckneya. *Pinckneya pubens* Rich. *Fever Tree*. (Fam. *Rubiaceae*.)—A large shrub or small tree, growing in South Carolina, Georgia, and Florida, in low and moist places along the sea-coast. It is botanically allied to the *Cinchonas*. The bark is bitter and has been used with alleged advantage in *intermittent fever*. E. H. Naudain (*A. J. P.*, April, 1885) found in it a glucoside, *pinckneyin*, but no alkaloid.

Pineapple. *Ananas sativa* Schult. f. (Fam. *Bromeliaceae*.)—Some years ago V. Marcano discovered that the juice of the ordinary *pineapple* has the power of digesting proteid vegetable and animal substances. R. II. Chittenden (*Trans. Connecticut Academy*, vol. viii, 1891) found that the fresh pineapple juice is a very constant and powerful digestant of albuminous matters; that the ferment is decidedly active in the presence of either acids or alkaline carbonates, but is most energetic in neutral solution; that the ferment is most active between 50° and 60° C. (122° and 140° F.); still digests at 30° C. (86° F.), but is destroyed at a temperature of 70° C. (158° F.); that the digestion takes place with rapidity; that the ferment, to which the name bromelin has been given, is more nearly related to trypsin than to pepsin, forming during its action not only proteoses and peptone, but also leucine and tyrosine.

E. V. Flack subjected pineapples grown in Cape Colony to analysis. He found in the fresh fruit: Crude fat 1.11 per cent., proteins 0.49 per cent., crude fiber 0.33 per cent., nitrogen-free extract 13.51 per cent., ash 0.70 per cent., silica, 0.069 per cent., lime 0.047 per cent., potash 0.358 per cent., phosphoric oxide 0.024 per cent., and moisture 83.86 per cent. (*Chem. News*, 1912, 99.)

Pinguicula Vulgaris and **Pinguicula Alpina** L. (Fam. *Lentibulariaceae*.)—These perennials of the northern United States and Canada are used as a folk medicine in the treatment of wounds and as a purgative. It has been asserted that *P. vulgaris* contains a proteolytic ferment; this has been used in combination with the extract of thyme in the treatment of whooping-cough under the name of "*diatussin*." The dose of

diatussin for a child of five years is one to three drops twice a day.

Pini-Pini. *Arra Diabo*.—This is the bark of *Jatropha urens* (Fam. *Euphorbiaceae*).—This Brazilian plant has been long used by the natives of Southern America as a blistering agent. Very little is known of its constituents and it is but lately that it has come into notice as a caustic and blistering medium.

PIPER. U. S.

PEPPER [Black Pepper]

“The dried, unripe fruit of *Piper nigrum* Linne (Fam. *Piperaceae*), without the presence or admixture of more than 2 per cent. of stems or other foreign matter.” *U. S.*

Piper Nigrum, *Br.* 1898; Common Pepper; Poivre noir, *Fr. Cod.*; Poivre, *Fr.*; Schwarzer Pfeffer, *G.*; Pepenero, *It.*; Pimienti negra, *Sp.*; Fifil uswud, *Arab.*; Lada, *Malay*; Maricha, *Jav.*; Sahan, *Palembang*.

The pepper vine (*Piper nigrum*) is a perennial plant, with a round, smooth, woody, articulated stem, swelling near the joints, branched, and from eight to twelve feet or more in length. The leaves are entire, broad-ovate, acuminate, seven-nerved, coriaceous, very smooth, of a dark green color, and attached by strong sheath-like footstalks to the joints of the branches. The flowers are small, whitish, sessile, covering thickly a cylindrical spadix, and succeeded by globular berries, which are red when ripe.

The plant grows wild in Cochin-China and various parts of India. It is cultivated on the coast of Malabar, in the peninsula of Malacca, in Siam, Sumatra, Java, Borneo, the Philippines, Japan, and many other places in the East; also to some extent in the West Indies. The best pepper is affirmed to be produced in Malabar, but Europe and America derive their chief supplies from Sumatra and Java. The plant is propagated by cuttings, and is supported by props, or trees planted for the purpose, upon which it is trained. In three or four years from the period of planting, it begins to bear fruit. The plant sometimes begins to bear as early as the first year after planting, increases in its yield to the fifth or sixth year, when it produces eight or ten pounds, and begins to lose its productiveness about the fifteenth year. The berries are gathered as soon as one is seen to turn red—i.e., before they are all perfectly ripe—and upon being dried, become black and wrinkled. The greatest

production is in Sumatra, and the ports of export. are principally Singapore and Penang, the Malabar pepper coming from Tellicherry. In England, at least, it is customary to mix peppers of different origin in grinding, taking Malabar for weight, Penang for strength, and Sumatra for color. (*Bulletin U. S. Dept. of Agric.*, No. 13, 1887.) The importations from the Strait Settlements to the United States of unground black and white pepper is on an average about 20,000,000 pounds annually. Owing to the widespread cultivation of pepper a large number of varieties exist; these receive their names from the place of their production or their ports of shipment, as Singapore, Acheen, Penang, Siam, Tellicherry, Trang, Lampong-, etc. For a description of the most important of these varieties with the percentage of active constituents contained in each, see J. W. Gladhill, *A. J. P.*, Feb., 1904; Kraemer and Sindall, *A. J. P.*, 1908, p. 1; also Blyth, *Foods: Their Composition and Analysis*.

White pepper is the ripe berry, deprived of a part of its pericarp by maceration in water and subsequent friction, and afterwards dried in the sun. It occurs as yellowish more or less broken grains with a smooth shiny surface from which the epicarp or outer layer of the fruit has been removed. It is sold in the market either as a whole white pepper or as broken white pepper; the whole peppers are very likely to have some of the epicarp or hull remaining. The removed hull is sold separately under the name of "pepper hulls;" it forms a light to dark brown powder, with a very pungent odor and taste and contains large amounts of the oleoresin of pepper, but according to Gladhill, no piperine. The hulls are sometimes sold mixed with broken white pepper. This mixture contains more oleoresin and less piperine than does the pure pepper; the percentage of the two active constituents varying according to the percentage of drugs in the mixture. White pepper is much less pungent but more aromatic than black pepper.

Long Pepper is obtained from *Piper officinarum* DC., and *P. longum* L., the former species yielding the principal commercial supplies and being grown in Java, India, and the Philippines. The plants are distinguished in having their flowers in dense, short, terminal, and nearly cylindrical spikes and their fruits, consisting of very small one-seeded berries or drupes, embedded in a pulpy matter. The fruit is green when immature, and becomes red as it ripens. It is gathered in the former state, as it is then hotter than when perfectly ripe. The whole spike is taken from the plant, and dried in the sun. The fruit of the *P. officinarum* is cylindrical,

2 .to 6 cm. long and 4 to 7 mm. in diameter, indented on its surface, of a dark-gray color, a weak aromatic odor, and a pungent fiery taste. The fruits of *P. longum* are shorter and thicker. Dulong found its chemical composition to be closely analogous to that of black pepper. Like that, it contains pipeline, a concrete oil or soft resin upon which its burning acidity depends, and a volatile oil to which it probably owes its odor. Its medicinal virtues are essentially the same as those of black pepper, but it is inferior to that spice, and is seldom used except as an adulterant. *West African* or *Ashantee Pepper* is the fruit of *P. Clussii*, C. DC., which grows abundantly in tropical Africa. It does not come into Western commerce, although much used in Africa. The berry is described as resembling cubeb, but less rugose, and with a more slender pedicel, and having the odor and taste of black pepper. Stenhouse found piperine in this variety of pepper.

Kissi Pepper is a fruit yielded by the *Piper Famechoni*, Heckel, of Upper Guinea. The berries, which grow in cylindrical clusters, are small, blackish-brown, ovoidal, with a cubeb-like pedicel at their base. Their powder is very aromatic, with an especially pleasant taste. They have been found by A. Barille to contain 4.5 per cent. of volatile oil and 3.7 per cent. of piperine. (*J. P. C.*, 1903, 106.)

Properties.—The dried berries are "nearly globular, from 3.5 to 6 mm. in diameter, epicarp very thin, easily separable from the sarcocarp; externally blackish-brown or grayish-black, coarsely reticulate; unilocular, 1-seeded; seed nearly white, hollow, adhering to the pericarp; odor aromatic, slightly empyreumatic; taste aromatic and very pungent. The powder is a mixture of blackish-brown fragments of the pericarp and nearly white fragments of the endosperm and embryo; starch grains spherical or somewhat angular, from 0.001 to 0.003 mm. in diameter, mostly in the polygonal cells of the endosperm; stone cells of the epicarp varying from nearly isodiametric or palisade-like to long tapering or somewhat irregular in shape, with thick porous walls and large lumina frequently containing a reddish-brown pigment; stone cells of the endocarp unevenly thickened, the outer walls being usually rather thin. and the lumina usually filled with a reddish-brown substance; oil cells with suberized walls and containing a yellowish oil, from which monoclinic prisms of piperine occasionally separate. Pepper yields not less than 6 per cent. of non-volatile extract, soluble in ether . It contains not less than 25 per cent. of starch. Pepper yields not more than 7 per cent. of ash. The amount of ash in Pepper, insoluble in

diluted hydrochloric acid, does' not exceed 2 per cent. of the weight of Pepper taken." *U. S.*

For information on the pharmacognosy of pepper, see Winton and Moeller in the " *Microscopy of Vegetable Foods*; " Winton and Bailey, *Ztchr. f. Unters. d. Nahr. u. Genussm.*, 1905, ix, p. 227; Spaeth, *Ibid.*, 1908, xv, p. 472; Kraemer and Sindall, *A. J. P.*, 1908, lxxx, p. 1; Collin in *Ann. des. Falsifications*, 1910, iii, p. 272.

They yield their virtues partially to water, entirely to alcohol and ether. Pelletier found them to contain a peculiar principle called piperine (see Part II), an acrid concrete oil or soft resin of a green color, a balsamic volatile oil, isomeric with oil of turpentine, a colored gummy substance, an extractive matter, like that found in leguminous plants capable of being precipitated by infusion of galls, starch, a portion of bassorin, tartaric and malic acids, lignin, and various salts. William Johnston (*Konig's Nahrungs- und Genussmittel*, 3d ed., Bd. i, 1046) finds that *piperidine*, $C_5H_{11}N$, is an invariable constituent of pepper in amounts varying from 0.21 to 0.77 per cent.

Piperidine is of great chemical interest as being a simple derivative of pyridine, which seems to underly the molecular structure of so many alkaloids. Piperidine is a hexahydropyridine and can easily be obtained from pyridine by the action of tin and hydrochloric acid. Conversely piperidine can be changed into pyridine when sulphuric acid at 300° C. (572° F.) or gentle oxidizing agents act upon it. Coniine, it will be remembered, is a normal propylpyridine. Moore and Row (*J. P.*, 1898) have shown that piperidine resembles coniine in its physiological effects.

The taste and medicinal activity of pepper depend mainly on the concrete oil or resin, and on the volatile oil. The concrete oil is of a deep green color, very acrid, and soluble in alcohol and ether. The volatile oil is limpid, colorless, becoming yellow by age, of a strong odor, and of a taste less acrid than that of pepper itself. It consists of terpenes including' dipentene, phellandrene, etc., and it forms a liquid but not a solid compound with hydrochloric acid. According to Weigle (*Ap. Ztg.*, 1893, 626), pepper contains; besides cellulose, starch, and coloring matter, (1) Volatile oil, smelling strongly of pepper, but without pungency; (2) a thick oil, tasteless and nearly odorless; (3) odorless piperine whose solutions possess the pungency of pepper. Weigle believes that in the fresh fruit the volatile oil acts as a solvent for the

piperine and he thus accounts for their pungency.

For a paper on commercial peppers, by J. W. Gladhill, see *A. J. P.*, 1904, 71.

Adulterations.—On account, of its extensive use as a condiment, pepper has been largely adulterated, especially when sold in the form of a powder. Chief of the adulterants are pepper-hulls, ground olive pits, wheat middlings, and roasted cereals. Among the other substances sometimes used have been ground beans or peas, corn starch, flaxseed, mustard hulls, and coffee hulls. The adulterated articles are usually fortified with the addition of Cayenne pepper. At the present time, by virtue of the National and state Food Laws, black pepper is seldom adulterated. Adulterations can be detected by the microscope with more or less ease (see *P. J.*, lxxi, 269; *P. J.*, June, 1890; *Bull. U. S. Dept. of Agriculture*, No. 13, Part II, pp. 183, 1887; *A. J. P.*, 1887, 146); but when pepper has been adulterated to the amount of 10 per cent. the discovery of the fraud is best made by determining the proportion of ash, of ether extract and of piperine present. The ash should never be above 6.5 per cent. for black and 3 per cent. for white pepper; the ether extract should be between 7.5 and 10 per cent. for black and 6 to 9 per cent. for white pepper, the U. S. standard being not less than 6 per cent. in which not less than 3.25 per cent. nitrogen shall be present. Piperine should be present in from 5.5 to 9 per cent. in good black pepper. The amount of oleoresin in any pepper can readily be determined by subtracting the weight of piperine from that of the mixture. Penang pepper is sometimes made to resemble the higher priced white peppers by coating the grains with an earthy matter (lime or clay). According to A. Mennechet, the fruits of *Myrsine africana* and of *Embelia Ribes* may sometimes be detected in the powder of pepper by extracting with ether and adding a little water, followed by a few drops of ammonia, when after shaking, a deep lilac-red color will appear in the aqueous layer. (*J. P. C.*, xiv, 587.)

Uses.—Black pepper is a warm carminative stimulant, capable of producing general arterial excitement, but acting with greater proportional energy on the part to which it is applied. From the time of Hippocrates it has been used as a condiment and in medicine. Its chief medicinal application is to excite the languid stomach and correct *flatulence*. It was for years occasionally administered for the cure of *intermittents*, but its employment for this purpose had passed from the

profession to the laity, till a few years since revived by an Italian physician, to be again consigned to forgetfulness. Piperine has also been employed in the same disease, and has even been thought superior to quinine sulphate, but experience has not confirmed this favorable opinion. That, in its impure state, when mixed with a portion of the acrid principle, it will occasionally cure intermittents, there can be no doubt, but it is not comparable to the preparations of cinchona, and is certain fly less active than the official oleoresin of pepper. In intermittent fever, pepper may be found a useful adjuvant to the more powerful febrifuge. It may be given whole or in powder, but is more energetic in the latter state.

Dose, of pepper, five to twenty grains (0.32-1.3 Gm.).

Off. Prep.—*Confectio Piperis, Br.*; *Oleo-resina Piperis, U. S.*; *Pulvis Opii Compositus, Br.*; *Tinctura Antiperiodica, N. F.*; *Tincture Antiperiodica sine Aloe, N. F.*

Piper Novae-Hollandiae Miq. (Fam. *Piperaceae*).—The berries of this Australian pepper contain a volatile oil, and are said to be useful in gonorrhoea and allied diseases.

Piper Ovatum Vahl.—From the leaves of this plant, found growing in Trinidad, Dunstan and Carr (*Chem. News*, 1895, 278) extracted a crystalline principle, *piperovatine*, $C_{16}H_{21}NO_2$. It is insoluble in water, but soluble in alcohol. It is said to act as a depressant of both motor and sensory nerves, and as a stimulant to the spinal cord.

Pipi Root.—The root of the *Petiveria alliacea* L. (Fam. *Phytolaccaceae*), which more than sixty years ago attracted notice in Europe, is said to have re-entered commerce. It is described as consisting of irregularly bent pieces, 3 to 6 mm. thick, externally grayish-brown, upon transverse section showing a brownish bark with white dots, and a lighter colored radiating ligneous wood. The cork layer consists of 3 or 4 rows of cells, the thick primary bark encloses crystals of calcium oxalate; the woody cord contains tracheids with narrow dotted tracheae, two-rowed medullary rays and in the center a thin pith. The genus *Petiveria* grows in tropical America, extending into Mexico and Texas. The shrubby plants are mostly acrid and have an alliaceous odor. It is reported to be a stimulant, expectorant and diaphoretic. (*A. J. P.*, Aug., 1887.)

Piscidia. *Piscidia Erythrina* L, *Jamaica Dogwood*. *Dogwood Bark*. *Ecorce du Bois de chien*. *Ecarce de Piscidie*. *Mulungu*. *Murungu*.—This is a leguminous tree growing throughout the West Indies and the neighboring countries, being found in Florida, Texas, Mexico, and the northern portion of South America, and yielding to commerce a very valuable wood. From time immemorial the bark has been used for catching fish. The leaves, twigs, and root bark are collected, macerated with the residue from

the distillation of rum or with lime water, then transferred into baskets, and the latter dragged up and down the water until the fish are stupefied.

In 1844 William Hamilton called the attention of the profession to the plant (*P. J.*, Aug., 1844) as a powerful narcotic and analgesic. The bark of commerce is in pieces of 5 to 10 cm. in length and about 8 cm. in width, having a thickness of 1.5 cm. The outer surface of some of the pieces is of a dark gray-brown, while others are of a yellow-brown, with no shade of gray present. The bark is frequently studded with flattened protuberances of a lighter color than the surrounding cork. The central part of the bark is much lighter colored, and, when wet or freshly broken, is of a peculiar blue-green color. The inner part of the bark is of a dark brown color and very fibrous. It has a strong odor resembling opium when broken into pieces. It is acrimonious, and produces a burning sensation in the mouth and pharynx.

E. Hart obtained a neutral principle, $C_{29}H_{24}O_8$, to which he gave the name *piscidin*. (*A. J. P.*, 1883, 369; see also *Ibid.*, Sept., 1898.) Paul C. Freer and A. M. Clover have examined Hart's piscidin and found it to consist of two distinct chemical compounds. The first of these forms colorless, highly refracting rectangular prisms, melting at $201^{\circ} C.$ ($393.8^{\circ} F.$); composition $C_{25}H_{20}O_7$. The second separates from alcohol in fine yellow needles, melting at $216^{\circ} G.$ ($420.8^{\circ} F.$); composition $C_{20}H_{18}O_6$. The authors found also in the aqueous extract of the bark *piscidic acid*, soluble in water; insoluble in chloroform, benzene or ligroin. It forms acicular crystals, which melt at 182° to $185^{\circ} C.$ (359.6° - $3650 F.$); composition $H_2.C_{11}H_{10}O_7$. (*A. Pharm.*, Feb., 1901.)

The action of the drug upon the lower animals has been studied by J. Ott and A. C. Nagle with similar results. (*Jamaica Dogwood*, Parke, Davis & Co., 1881.) The conclusions reached are, 1. It is narcotic to frogs, rabbits, and men. 2. It does not affect the irritability of the motor nerves. 3. It does not attack the peripheral ends of the sensory nerves. 4. It reduces reflex action by a stimulant action on the centers of Setschenow. 5. It produces a tetanoid state by a stimulant action on the spinal cord, and not by a paralysis of Setschenow's centers. 6. It dilates the pupil, which dilatation passes into a state of contraction upon the supervention of asphyxia. 7. It is a salivator. 8. It increases the secretion of the skin. 9. It reduces the frequency of the pulse. 10. It increases arterial tension by stimulation of the vasomotor center. 11. This increase of pressure is soon succeeded by a fall, due to a weakening of the heart itself.

The exact practical value of the drug has not been determined, nor are the results produced in man, by doses approaching toxic, known. Hamilton took a drachm, when suffering with severe toothache, on going to bed. He first felt a violent sensation of heat internally, which gradually extended to the surface, and was followed by profuse perspiration, with profound sleep for twelve hours. On awaking, he was quite free from pain, and without the unpleasant sensations which follow a dose of opium. Various practitioners have reported good results from its use as an anodyne in *neuralgia*, *nervous insomnia*, *whoopingcough*, etc., but in other hands it has failed to do good. H. C. Wood found it in one case of neuralgia to produce great nausea and gastric distress without evincing the slightest narcotic effect. (For formula for fluidextract by

Lemberger, see *U. S. D.*, 19th ed., p. 1616; also *D. C.*, 1881, 179.) The dose of the fluidextract is a fluidrachm (3.75 mls), to be carefully increased.

Pithecolobium.—*Pithecolobium Saman* Benth. (Fam. *Leguminosae*.) —A shade-tree, growing from Mexico to Brazil, and planted for shade in Japanese coffee plantations, which yields a poisonous alkaloid, *pithecolobine-saponin*, whose physiological action is analogous to that of sapotoxin.

Plantain. *Plantago major* L. *Rib Grass.* *Ribwort.* *Ripple Grass.* *Plantain*, Fr. *Wegerich*, G. (Fam. *Plantaginaceae*.)—The leaves are saline, bitterish, and acrid to the taste; the root is saline and sweetish. The common plantain weed was formerly considered refrigerant, diuretic, de-obstruent, and somewhat astringent. The ancients esteemed it highly, but it is at present never used, except externally in domestic practice as a stimulant application to sores. The leaves are applied whole or bruised in the form of a poultice. *Plantago media* L., or *hoary plantain*, and *P. lanceolata* L., or *rib grass*, which are also naturalized in America, possess properties similar to those of *P. major*, and may be used for the same purposes.

For results of examination of the leaves of *P. major*, see Kosenbaum (*A. J. P.*, 1886, 418.) J. F. Strawinski found in the rhizome a substance which he believes to be either phlobaphene or proto-catechuic acid. (*A. J. P.*, 1898, 189.)

Bourdier (*A. Pharm.*, ccxvi) has found in a number of species of *plantago*, including the *P. major*, a glucoside *aucubin*, which was isolated from the *Aucuba japonica*.

Semen psyllii is the name given to the seeds of several species of European *Plantago*. The best are those of *Plantago Psyllium* L., or *fleawort*, which grows in the south of Europe and in Northern Africa. They are ovoid, about 3 mm. in length, and 1 to 1.5 mm. in width, convex on one side, concave on the other, dark-brown and on flat side reddish-brown, shining, inodorous, and nearly tasteless, but mucilaginous when chewed. They are demulcent and emollient, and may be used internally and externally in the same manner as flaxseed, which they closely resemble in medicinal properties. *Spogel seed*, used in India as a demulcent in intestinal irritation, is derived from *P. Isphagula* Roxb., probably a variety of *P. ovata* Forsk. (See *Journ. Med. de Paris*, Sept., 1887.)

Plumbago Europea L. *Leadwort.* *Dentellaria.* (Fam. *Plumbaginaceae*.) —A perennial, herbaceous plant, growing in the south of Europe. It has an acrid taste, and, when chewed, excites a flow of saliva. This is particularly the case with the root, which has been long used to relieve toothache; hence its French name *dentelaire*. A decoction of the root in olive oil has been highly recommended for *itch*. A crystallizable, acrid principle, called *plumbagin*, has been extracted from the root by Dulong. (*J. P. C.* (2), xiv, 441.) *Plumbago zeylanica* is said to be a very powerful diaphoretic.

Plumiera. *Pagoda Tree.*—The bark of *Plumiera sucuuba* Spruce (Fam. *Apocynaceae*), a plant growing in South America which the natives of Brazil have long used in the

treatment of fevers. It is asserted also to be an anthelmintic and emmenagogue. Plumier, the French botanist, first brought this plant to the attention of the medical profession. The important constituents of the plant are *Plumierin* (*agoniadin*), $C_{21}H_{24}O_{12} + H_2O$, and *plumieric acid*, $C_{20}H_{24}O_{12}$. The *P. acutifolia*, said to contain an alkaloid, $C_{57}H_{72}N_{33}$, has been used in the treatment of *gonorrhoea*.

PODOPHYLLI INDICI RESINA. Br.

INDIAN PODOPHYLLUM RESIN [Podophyllum Emodi Resin]

"Indian Podophyllum Resin is a powdered resin prepared by the same process as that described under 'Podophylli Resina,' employing Indian Podophyllum Rhizome in place of Podophyllum Rhizome. It possesses the characters and responds to the tests described under 'Podophylli Resina.'" *Br.*

(See *Podophylli Indici Rhizoma*.)

The rhizome of the Indian Podophyllum has become a commercial article and appears to have been largely used in the making of podophyllin. The question as to the relative yield of the Indian and American plants is a matter of great importance to the manufacturer, it usually being stated that the Indian rhizome is twice as active. Some years since Dymock and Hooper obtained 12 per cent. of resin from *P. Emodi*; Umney, working with large quantities (*P. J.*, Sept., 1902), got out 11.4 per cent.; since then John Barclay (*P. J.*, 1903, lxx) was not able to obtain a greater yield than 6.69 per cent. Umney, commenting on this, believes that of late years the Indian plant gives a much smaller product than formerly, probably on account of the time of year in which it is now dug. In regard to the therapeutic interchangeability of the two resins it has been demonstrated by the researches of Dunstan and Henry and J. C. Umney that the active substances in true Podophyllin are all present in the Indian resin, but it is not assured that the proportion of these active principles is the same in the two resins. At one time it was claimed that the resin from the Indian species was more active than that obtained from the American plant, but this appears not to be correct. In the present state of our knowledge, the manufacturer is certainly not justified in putting upon the market a resin made from the Indian plant unless it is plainly marked as the Indian Podophyllin. Distinguishing between the two resins has become a question of importance. The presence of a yellowish-green color does not, as has been affirmed, prove that a podophyllin is impure or of Indian origin.

The test of solubility is also uncertain. The Indian Podophyllin, properly prepared, is freely soluble in alcohol. It is commonly stated that the true Podophyllin will dissolve in ammonia (1 to 100). The Indian species is seemingly much less soluble in ammonia than this, but a properly prepared official resin does not always come up to this standard. E. J. Millard (P. J., Ix) states that the Indian resin strikes with strong sulphuric acid an orange to red color, the official resin yellow coloration, tending to brown, but especially commends the following test:

To six grains (0.4 Gm.) of the resin in a test tube add one fluidrachm (3.75 mils) of diluted alcohol sp. gr. 0.920, and eight or ten drops (0.4-0.5 mil) of solution potash, B. P.; shake gently by rotating the test tube. In case of the Indian resin, the mixture becomes in a few seconds a semi-solid gelatinous mass, so that the test tube can be safely inverted. If this does not occur quickly, the mixture should be heated until it just begins to boil, and when cold it will be found to have gelatinized. The official resin similarly treated gives a dark fluid that shows no signs of gelatinizing even after standing for days. The Indian Podophyllum Resin is used for the same purposes as the American. (See Resina Podophylli.)

Dose, one-fourth to one grain (0.016 to 0.065 mil); of the tincture (Tinctura Podophylli Indici), five to fifteen minims (0.3-0.9 mil).

PODOPHYLLI INDICI RHIZOMA. Br.

INDIAN PODOPHYLLUM RHIZOME [Podophyllum Emodi Rhizome]

“Indian Podophyllum Rhizome is the dried rhizome and roots of *Podophyllum Emodi*, Wall; *.

Podophyllum Emodi (Fam. *Berberidaceae*) is a perennial herb which is indigenous to Thibet and Afghanistan. It somewhat resembles our American Podophyllum. The stem rises to a height of six or twelve inches before the leaves, which attain a diameter of six to ten inches when fully expanded. The latter are curiously reflexed, droop umbrella-like and are often spotted. The plant produces in May a large sub-sessile pinkish-white flower which arises from the axil of one of the leaves, maturing before the latter are fully expanded. The fruit is about the size of a small lemon, of a bright orange color, being fully ripe in about

August or September.

The contorted rhizome of *Podophyllum Emodi* is from six to eight mm. in thickness, crowded above with numerous buds or short branches, marked by depressed oval or circular scars, and giving off numerous simple rootlets from the whole of the under surface. The terminal bud is enclosed in whitish papery sheaths. The color is earthy-brown. The fracture is white, short, and mealy, or yellow and horny, exhibiting a circular arrangement of yellow vascular bundles, and bounded on the outside by a thin brown cortical layer.

"Rhizome cylindrical or flattened, contorted, earthy-brown; usually about ten millimetres thick; below with numerous root-scars, or with stout roots, and crowned with the short remains of aerial stems, bearing cup-shaped scars. In transverse section, pale-brown and starchy or homy, with a ring of radially elongated wood-bundles. Slight odor; taste bitter and acrid." *Br.*

It is used for the same purposes as podophyllum.

Off. Prep.—Podophylli Indici Resina, *Br.*; Tinctura Podophylli Indici (from Resin), *Br.*

PODOPHYLLUM. U. S. (Br.)

PODOPHYLLUM Podoph. [Mandrake, May Apple Rhizome]

"The dried rhizome and roots of *Podophyllum peltatum* Linne (Fam. *Berberidaceae*), yielding not less than 3 per cent. of resin." *U. S.*
"Podophyllum Rhizome is the dried rhizome and roots of *Podophyllum peltatum*, Linn." *Br.*

Podophylli Rhizoma, *Br.*; Podophyllum Root, Wild Mandrake, Devil's Apple, Umbrella Plant, Vegetable Calomel, Mandrake, American Mandrake, Wild Lemon, Ground Lemon, Hog Apple, Indian Apple, Raccoon Berry, Duck's Foot, Rhizome de Podophyllum, *Fr. Cod.*; Fuss-blattwurz, *G.*; Podofillo, *It.*; Podofilo (Rizoma de), *Sp.*

Podophyllum peltatum (May-apple) is an indigenous herbaceous plant. The rhizome is perennial, creeping, usually several feet in length, about one-quarter of an inch thick, brown externally, smooth, jointed, and furnished with roots at the joints. The stem is about a foot high, erect,

round, smooth. The basal leaves are centrally peltate, with six or seven wedge-shaped lobes, irregularly incised at their summits, yellowish-green on their upper surface, paler and slightly pubescent beneath. The flower-bearing stems bear from one to three similar leaves. The flower is nodding, and appears between two leaves at the apex of the stem or at the base of the upper leaf when three leaves are present. The calyx is composed of three oval, obtuse, concave, deciduous sepals. The corolla has from six to nine white, fragrant petals, which are obovate, obtuse, concave, with delicate transparent veins. The stamens are from thirteen to twenty, shorter than the petals, with oblong, yellow anthers, of twice the length of the filaments. The stigma is sessile, and rendered irregular on its surface by numerous folds or convolutions. The fruit is a large oval berry, crowned with the persistent stigma, and containing a sweetish fleshy pulp, in which about twelve ovate seeds are embedded. It is, when ripe, of a lemon-yellow color, diversified by round brownish spots. Two species of the genus *Podophyllum* are known as growing in China while *Podophyllum Emodi*, which inhabits the interior ranges of the Himalayas and is very abundant in Cashmere, is recognized in the Br.

The plant has been found on Mount Togakushi, in Japan, and is extensively diffused through the Eastern United States, growing luxuriantly in moist shady woods and in low marshy grounds from Canada, to Minnesota and southward to Florida and Texas. It is propagated by its creeping rhizome, and is often found in large patches. The flowers appear about the end of May and the beginning of June, and the fruit ripens in the latter part of September. The leaves are said to be poisonous. The fruit has a subacid, sweetish, peculiar taste, agreeable to some palates, and may be eaten freely with impunity. From its color and shape, it is sometimes called *wild lemon*. The rhizome is the official portion, and is said to be most efficient when collected after the falling of the leaves. It shrinks considerably in drying.

Properties.—The dried rhizome is much wrinkled lengthwise, is yellowish or reddish-brown externally, and furnished with roots of a similar but somewhat paler color. It was determined, by an experiment of Wm. Saunders, that these roots contain as much active matter as the rhizome itself. It is officially described as follows: "Rhizome horizontal, nearly cylindrical, jointed, compressed on the upper and lower surfaces, sometimes branched; in pieces from 3 to 20 cm. in length, the internodes from 2 to 9 mm. in diameter; externally dark brown, longitudinally

wrinkled or nearly smooth with irregular, somewhat V-shaped scars of scale leaves, nodes annulate, upper portion marked with large, circular, depressed stem-scars and sometimes with buds or stem-bases; at or near the nodes on the lower portion occur numerous root-scars or roots from 2 to 7 cm. in length and about 2 mm. in thickness; fracture short; internally, bark light brown, wood with small yellowish, vascular bundles, pith large and white; odor slight; taste sweetish, disagreeably bitter and acrid. Under the microscope, a transverse section of the rhizome of *Podophyllum* show's an outer layer of one or two rows of reddish-brown cells; parenchyma of cortex and pith with numerous single, spherical, polygonal, or 2- to 6-compound starch grains, or rosette aggregates of calcium oxalate; vascular bundles from 24 to 34, arranged in a circle between cortex and pith. The powder is light brown, with a pronounced and characteristic odor; starch grains numerous, spherical, polygonal or 2- to 6-compound, the individual grains from 0.003 to 0.015 mm. in diameter; calcium oxalate crystals few, in rosette aggregates from 0.05 to 0.08 mm. in diameter and occasionally in raphide's from 0.03 to 0.09 mm. in length; tracheae with simple pores or reticulate thick-enings; fragments of starch-bearing parenchyma and reddish-brown cork cells. *Podophyllum* yields not more than 3 per cent. of ash.

"Rhizome nearly cylindrical, of very variable length, usually about five millimetres thick; dark reddish-brown, smooth or only slightly wrinkled; enlarged at intervals of about five centimetre's, the upper surface of each enlargement being marked by a depressed circular scar, below which, on the under surface, are rather stout, brittle, brown roots, or the scars corresponding to them. In transverse section, either nearly white and starchy, or pale yellowish-brown and horny. Characteristic odor; taste slightly bitter and acrid." *Br.*

The root in its aggregate state is nearly inodorous, but in powder has a sweetish not unpleasant odor. The taste is at first sweetish, afterwards bitter, nauseous, and slightly acrid. Both the decoction and the tincture are bitter, but alcohol is said to be the best solvent of the active matter. V. Podwysstzki (*Ph. Z. R.*, Bd. xx, 777) announced the active principle to be solely a neutral crystalline principle, *picropodophyllin*. This principle is associated with an inactive resin-acid, *picropodophyllic acid*, and the combination of the two he named *podophyllotoxin*. Picropodophyllin is in colorless, silky, extremely delicate needles, very soluble in chloroform, readily soluble in 95 per cent. alcohol, but very

slightly in 75 per cent. alcohol. It is soluble in ether, and crystallizes from a warm saturated solution on cooling. It is insoluble in water, turpentine, or benzin. Podophyllotoxin is a bitter, white, resinous powder, soluble in weak alcohol and hot water. It may be precipitated from its alcoholic solution by water in large quantity. (*P. J.*, 1882, 1011.) Podwysstozki also obtained *podophylloquercetin*, the coloring principle, which is closely allied to quercetin and is the cause of the varying color of resin of Podophyllum. His results have since been corrected and supplemented by R. Kiirsten (*A. J. P.*, 1891, 485), who has obtained the several principles in a purer state. The results of Kursten's investigation are as follows: The podopliyllotoxin prepared by Podwysstozki's method was not constant in composition, and its melting point varied from 100° to 125° C. (212°-257° F.); further, the podophyllic acid of that author is composed mainly of a crystallizable, active, but very impure substance.

Podophyllotoxin, $C_{23}H_{24}O_9$, is obtained by extracting the coarsely powdered rhizome with cold, light petroleum, until freed from fat; after drying in the air, the extraction is continued with chloroform, until the liquid comes away almost free from yellow color. As it is not possible to work with alcohol-free chloroform, too prolonged extraction with chloroform would yield a more impure extract. The chloroform extract is distilled and the residue is dried over a not too warm water bath, partially dissolved in benzene, filtered, and the filtrate allowed to remain from three to eight days, when a brownish-yellow mass of well-formed, thick, strongly refractive prisms is produced. This is purified by washing with a 50 per cent. alcohol, then with ether, recrystal-izing first from boiling benzene, and finally from solution in hot 45 per cent. alcohol; the compound is thus obtained in long, well-formed prisms which melt at 94° C. (201.2° F.).

Podophyllotoxin, when oxidized in an alkaline solution in the cold by means of potassium permanganate, yielded, besides a little carbonic anhydride and a brown amorphous substance, principally two compounds, the more considerable of which was *podophyllic acid*, obtained as well-formed, colorless crystals from solution in a mixture of benzene and alcohol. The compound is without action on animals. It melts at from 158° to 160° C. (316.4°-320° F.). Its aqueous solution, neutralized with aqueous potassium hydroxide, gives no precipitate with gold, calcium, or barium chlorides; silver nitrate gives a white precipitate, soluble in much water; copper acetate gives a blue precipitate. The copper salt was prepared as beautiful light green prisms

and analyzed.

Picropodophyllin results from the action of alkalis on podophyllotoxin; thus, on heating the latter with aqueous ammonia, a well-crystallized product is obtained, which at first was recrystallized from strong alcohol; but this was found to be unnecessary, as the melting point, 227° C. (440.6° F.), was not affected by it. Picropodophyllin has the same composition as podophyllotoxin, but they differ in melting point and in their action on polarized light,—the former inactive, the latter laevorotatory; the former is less soluble in all liquids than the latter; the latter gives Millon's reaction, the former does not. By oxidation and reduction the two compounds yield the same products.

Dunstan and Henry (*Proc. Chem. Soc.*, March, 1898) find that the constituents of the Indian Podophyllum (*Podophyllum Emodi*) and of the American Podophyllum (*Podophyllum peltatum*) are identical. The chief constituent is the *podophyllotoxin* of Podwyssotzki and Kiirsten. It is strongly laevorotatory, and acts as a powerful purgative and intestinal irritant. They found that when heated with alkalis, it is converted by hydration into the salt of an unstable gelatinous acid, *podophyllic acid*, C₁₅H₁₆O₇, of which several salts were obtained and analyzed. This acid very readily loses water, and furnishes the crystalline *picropodophyllin* of Podwyssotzki and Kiirsten, which is isomeric with podophyllotoxin. It passes again into podophyllic acid when warmed with aqueous alkalis. Podophyllotoxin and pieropodophyllin furnish identical decomposition products; when oxidized with nitric acid, oxalic acid is the principal product; when fused with alkalis, *orcinol* and acetic acid are produced. Both substances contain three methyl groups and no hydroxyl. It is likely that picropodophyllin is the lactone of podophyllic acid. Picropodophyllin is therapeutically inactive. The yellow coloring matter of Podophyllum, called by Podwyssotzki *podophylloquercetin*, was proved by the authors to be identical with quercetin, the yellow coloring matter of quercitron bark. An uncrystallizable resin, *podophylloresin*, was also isolated and found to exert a purgative action. A fatty oil has been separated from the rhizome of Podophyllum by Dohme and Engelhardt. (See *Proc. A. Ph. A.*, 1904, 340.) Gordin and Merrell (*Proc. A. Ph. A.*, 1902, 343) proposes to judge of the quality of resin of Podophyllum by an assay based on the percentage of crude picropodophyllin and the following requirements: Pure podophyllin must be completely soluble in about twice its weight of cold alcohol. 2. It should contain about 64 per cent. ether-soluble and

about 74 per cent. chloroform-soluble matter. 3. It should yield about 22 per cent. crude picropodophyllin when assayed by the method described by them.

Manlius Smith recommended that the resin should be prepared by forming an alcoholic tincture of the root, evaporating the tincture until most of the alcohol is driven off, and throwing the residue into water, by which the resin is precipitated. The concentration should not be carried too far, as otherwise the resin separates in clots, which cannot be easily washed. According to Smith, the resin, when pure, is white, and purges actively. It has been called *Podophyllin* for many years. (*A. J. P.*, xxiv. 306. See *Resina Podophylli*.) The proportion of resin contained in the root of the *P. peltatum* appears to vary very much, the variation possibly depending upon the season of the year at which the drug has been gathered. John Barclay (*P. J.*, 1903, Feb., 164) obtained a percentage of 1.6 to 3.86 per cent., stating that these figures were confirmed by the results of the manufacturers of Podophyllin on a large scale, but J. C. Umney states that in five years' experience working with batches of 1000 pounds, the rhizome averaged a yield of 6.6 per cent. Both observers noticed that the Indian rhizome (*P. Emodi*) contains a much larger proportion of resin, the average according to Umney being 11.4 per cent. How far the proportion of podophyllotoxin varies in the different rhizomes does not seem to have been determined. (See B. B. Dott, *P. J.*, 1903, Mar. 460.) (*P. J.*, 1911, Ixxxvii, p. 156.)

From the *leaves* of *P. peltatum* Thos. J. Husband, Jr., obtained berberine and a resin which was free from purgative properties, 8 grains producing no other effect than slight headache. (*A. J. P.*, 1869.)

B. F. Carter (*A. J. P.*, 1886, p. 449) also examined the leaves. He found tannin, uncrys-tallized sugar, coloring matter, and 6 per cent. of resin. This latter seems to be of twofold character, ether dissolving the soft resin, while the hard resin remains behind. The resin has a bitter taste and a much milder action than that of the rhizome. Fused with potassium hydroxide a small amount of protocathechuic acid seems to be formed.

A method of assay for Podophyllum has been proposed by W. M. Jenkins (*J. I. and, E. C.*, 1914, p. 671) which is based upon a shaking out method using a mixture of chloroform and alcohol.

Uses.—Podophyllum is a slow but active and certain cathartic producing copious liquid discharges often with much griping. It has been attributed with cholagogic properties and is used in various forms of *hepatic torpor* but its virtues in this direction are probably no greater than that of other active purgatives. In small doses it is frequently used in *chronic constipation*, especially in conjunction with aloes or cascara.

In overdoses Podophyllum acts as an irritant poison; an amount estimated at five grains of the resin caused death in a woman sixty years old (*N. Y. M. E.*, April, 1890); the symptoms were vomiting and purging, followed some hours after their cessation by coma, full soft pulse, slight elevation of temperature, and haemo-globinuria.

Dose, five to ten grains (0.32-0.65 Gm.), but it is rarely exhibited in the crude form.

Off. Prep.—Fluidextractum Podophylli, *U. S.*; Resina Podophylli, *U. S. (Br.)*; Tinctura Podophylli (from Resin), *Br.*; Extractum Podophylli, *N. F.*; Pilulae Aloes et Podophylli Compositae (from Resin), *N. F.*; Pilulae Aloes, Hydrargyri et Podophylli (from Resin), *N. F.*; Pilulae Aloini Compositae (from Resin), *N. F.*; Pilulae Catharticae Vegetabiles (from Resin), *N. F.*; Pilulae Colocynthis et Podophylli (from Resin), *N. F.*; Pilulae Laxativae Post Partum (from Resin), *N. F.*

Polygala. *Polygala polygama* Walt. (*P. rubella* Muhl.) (Fam. *Polygalaceae.*) *Bitter Milkwort. American Bitter Polygala. Polygale, Lai-tier, Fr. Kreuzblume, Milchwurz, G.*—Bitter *polygala* is an indigenous, perennial plant, which was formerly official. It has a strong and permanent bitter taste, which it yields to water and alcohol. In small doses bitter *polygala* is tonic, in larger, laxative and diaphoretic. It appears to be closely analogous in medicinal virtues to *Polygala amara* L., of Europe, which is used for a similar purpose. From the seeds of the *P. butyracea* Heck. and Schlag., an African plant, the natives prepare an edible fat. (See *P. J.*, xx, Aug., 1889.)

Polymnia. *Polymnia uvedalia* L. Bear's Foot. (Fam. *Compositae.*)—A tall, branching plant, growing in rich soil from New York to Missouri and southward. Great virtues as a remedy in *malarial splenic enlargements* have been attributed to this plant.

Polypodium. *Polypody. Fern Root.*—Various species of this genus of ferns are asserted to have medicinal properties. *Polypodium vulgare* L., very common both in Europe and America, was believed by the ancients to be an active cholagogue purgative, and has been used in modern times as an expectorant in *chronic catarrh* and *asthma*. Dose, from one to eight drachms (3.9-31 Gm.), usually given with a cathartic. The rhizome, as it usually occurs in commerce, is from 2 to 12 cm. in length and 3 to 8 mm. in thickness, somewhat contorted, covered with brown, easily separable scales, which should be removed before being used. Its color is reddish-brown, with a tinge of yellow, its odor disagreeably oleaginous, its taste peculiar,

sweetish, somewhat bitter, and nauseous. *P. adiantiforme*, of Porto Rico, is believed by the natives to be a powerful antisyphilitic. It must be used freely for several months in the advanced stages of the disease. *P. friederichsthalianum*, of Central America, has had similar properties attributed to it.

Polytrichum. *Polytrichum juniperinum* Hedw. (Fam. *Polytrichaceae*.) *Herba Adianti Aurei. Rock-brake Herb. Female Fern Herb. Perce Mousse. Frauenhaar. Jung Femhaar. Widertot. Wolfgerste. Hair Cap Moss. Robin's Rye. Golden Maidenhair.*—This indigenous moss is stated by William Wood to be a powerful diuretic, and, when given indefinitely in infusion, very useful in dropsy. (*Am. J. M. S.*, N. S., xxvii, 267.) Ariel Hunter confirms these statements. (*N. J. Med. Rep.*, ix, 417.)

Pongamia. *Pongamia glabra* Vent. (Fam. *Leguminosae*.)—*Pongamia* or *kurung oil* is expressed from the seeds of an East Indian tree. It is deep yellow to reddish-brown, fluid at 15.6° C. (60° F.), but below that it is solid with sp. gr. of 0.9352 (*P. J.*, 72, p. 492). It is especially commended in *pityriasis versicolor* and other parasitic skin diseases. (*P. J.*, February, 1883.)

Poplar Buds. *N. F. IV. Populi Gemmae. Balsam Poplar Buds. Balm of Gilead Buds.*—"The *air-dried*, closed winter leaf-buds of *Populus nigra* Linne or *Populus balsamifera* Linne (Fam. *Salicaceae*), collected early in the spring. Preserve the buds in tightly-closed containers of glass or tin." *N.F.*

In most trees of the genus *Populus*, the leaf-buds are covered with a resinous exudation, which has a peculiar, agreeable, balsamic odor, and a bitterish, balsamic, somewhat pungent taste. It is abundant in the buds of *Populus nigra* L., or the *black poplar* of Europe, which are official in some parts of that continent. They contain resin and a peculiar volatile oil. The buds of *P. balsamifera* L., the *Balsam Poplar* or *Tacamahac*, growing in the northern parts of North America and Siberia, are also highly balsamic; and a resin is said to be furnished by the tree. The buds are obtained from *P. canadicans* Ait and are often called *Balm of Gilead buds*. Poplar buds are described in the *N. F. IV* as "conical, pointed, up to 2 cm. in length and from 2 to 5 mm. in thickness, consisting of closely imbricated scales, externally brown and glossy, glutinous with fragrant resin. Odor pleasant, balsamic; taste aromatic and bitter." The virtues of the *poplar buds* are probably analogous to those of the turpentine and balsams. They have been used in pectoral, nephritic, and rheumatic complaints, in the form of a tincture, and a liniment, made by macerating them in oil, has been applied externally in local rheumatism. The *unguentum populeum*, *Pommade de Bourgeons de Peuplier*, is made, according to the directions of the French Codex, from 100 Gm. each of the dried contused leaves of white poppy, belladonna, henbane, and black nightshade, and 800 Gm. of dried poplar buds. The leaves are moistened with 400 Gm. of alcohol and allowed to stand twenty-four hours in a closed vessel; 4000 Gm. of lard is now added and the mixture heated gently during three hours, stirring frequently, the crushed poplar buds are then added and allowed to digest for ten hours at a gentle heat, and the whole strained and cooled slowly. This is an anodyne ointment, employed in Europe in painful local affections. It has been ascertained that poplar buds are capable of imparting a principle to ointments which obviates their

tendency to rancidity. Poplar buds are an ingredient of *Syrupus Pini Strobi Compositus*, N. F. and of *Syrupus Pini Strobi Compositus cum Morphina*, N. F.

The bark of *P. tremuloides* Michx., or *American aspen*, and of *P. tremula* L., or *European aspen*, is possessed of tonic properties, and has been used in *intermittent fever*. In the bark of the latter Braconnot found *salicin*, $C_{13}H_{18}O_7$, and another crystallizable principle which he named *populin*, $C_{20}H_{22}O_8 + 2H_2O$. It is in these, probably, that the febrifuge properties of the bark reside. They may be obtained by precipitating a saturated decoction of the bark with solution of lead subacetate, filtering, precipitating the excess of lead by sulphuric acid, again filtering, evaporating, adding animal charcoal towards the end of the evaporation, and filtering the liquor while hot. Salicin gradually separates, upon the cooling of the liquor, in the form of crystals. If, when this principle has ceased to crystallize, the excess of sulphuric acid in the liquid be saturated by a concentrated solution of potassium carbonate, the populin will be precipitated. If this be pressed between folds of blotting paper, and redissolved in boiling water, it will be deposited, upon the cooling of the liquid, in the crystalline state. The leaves of *P. tremula* are also said to yield more populin than does the bark. It is probable that both principles exist in the bark of *P. tremuloides* and other species. Schaak (*A. J. P.*, 1892, 226) found a bitter principle in the bark of *P. alba* L., which was most likely populin. Populin is very light and white, of a bitter, sweetish taste, analogous to that of licorice. It is soluble in 1896 parts of cold and about 70 parts of boiling water, and is more soluble in boiling alcohol. It loses its two molecules of water of crystallization at $100^{\circ} C.$ ($212^{\circ} F.$), and at $180^{\circ} C.$ ($356^{\circ} F.$) it fuses to a colorless liquid, from which at a higher temperature benzoic acid may be sublimed. Acetic acid and the diluted mineral acids dissolve it, and, upon the addition of an alkali, let it fall unchanged. Piria first showed it to be *benzoyl salicin*, $C_{13}H_{17}(C_7H_5O)O_7 + 2H_2O$. He then decomposed it and prepared salicin from it. Populin has been prepared synthetically by Schiff and by Dobbin and White. (*P. J.*, 73, p. 233.) When populin is boiled with baryta water or milk of lime, the benzoic acid precipitated by ferric chloride, the excess of iron removed by lime, and the excess of lime by carbon dioxide, the remaining liquid yields salicin on evaporation. The same conversion may be effected by heating populin with an alcoholic solution of ammonia to $100^{\circ} C.$ ($212^{\circ} F.$). Piria obtained from populin 28.9 per cent. of benzoic acid. (*P. J.*, xv, 378.) T. L. Phipson, basing his experiments upon the results of Piria, has succeeded in preparing populin artificially by combining salicin and benzoic acid. Nothing more is necessary than to dissolve the two substances in alcohol, and to concentrate the solution. Crystals are formed having all the characters of populin, and consisting of salicin and benzoic acid combined in the proportion of their equivalents. (*Chem. News*, Dec. 6, 1862, 278.) Dobbin and White make populin from salicin and benzoyl chloride. (*Y. B. P.*, 1904, 506.) The flower-buds of *P. tremuloides* yielded a bitter resin to R. Glenk. It was of yellowish-brown color, strong, hop-like odor, and had a melting point of $51^{\circ} C.$ ($123.8^{\circ} F.$). (*A. J. P.*, 1889, 240.)

Poppy Capsules. *N. F. IV. Papaveris Fructus. Papaveris Capsulae.* Br., 1898. *Papaver*, U. S., 1870; *Capsules de Pavot blanc ou Pavot officinal*, Fr. Cod.; *Fructus Papaveris immaturi*, P. G.; *Unreife Mohnkopfe, Kapsein des Weissen Mohns, Mohnkapsein, Mohnkopfe*, Gr.; *Papavero*, It.; *Cabezas de amapola*, Sp.—" The dried,

fully grown, unripe fruit of *Pavaver somniferum* Linne (Fam. *Papaveraceae*). Separate and reject the seeds before using the fruit in pharmaceutical preparations." N. F.

Poppy capsules were official in the Br. Pharmacopoeia, 1898; they have been admitted to the N. F. IV. In England the poppy has been largely cultivated for its capsules, which are gathered as they ripen, and taken to market enclosed in bags. The N. F. directs them to be collected before they are quite ripe, as they then contain more of the active milky juice. When ready for collecting they are a yellowish-green color. They are occasionally imported, but, as no effect is produced by them which cannot be as well obtained from opium, they are little employed.

Dried *poppy capsules* vary in size from the dimensions of a small egg to those of the fist. They differ also in shape according to the variety of the poppy from which they are procured. On the Continent two sub-varieties of the white poppy are recognized, the *long*, and the *round* or *depressed*. Of these, according to Aubegier, the long are richest in morphine, and his conclusions are confirmed by Meurein, who also found the largest capsules most efficient. Those commonly found in commerce are spheroidal, flattened below, and surmounted by a crown-like expansion—the persistent stigma—which is marked by numerous diverging rays that rise somewhat above the upper surface and appear to be prolongations of partial septa, or partitions, proceeding along the interior circumference of the capsule from the top to the bottom. In the recent state, the seeds, which are very numerous, adhere to these septa, but in the dried capsule they are loose in its cavity, and the N. F. directs that they should be separated before the capsule is used. They are described in the N. F. as "globular or ovoid, usually from 3 to 3.5 cm. in diameter, but varying in size, more or less sunken or depressed on the sides, contracted at the base into a sort of neck immediately above a tumid ring at the point of attachment with the stalk; crowned at the summit with the seven- to fifteen-rayed stigma disk; outer wall of pericarp smooth, hard, grayish-yellow to brownish-yellow, often marked with black spots; interior surface rugose, finely striated transversely, and bearing thin, brittle, membranous placentae which extend from the sutures toward the center, and bear on their faces and edges numerous, minute, conspicuously reticulated, reniform white seeds. Odorless; taste slightly bitter.

"Macerate 1 Gm. of the powdered Capsules for two hours with 10 mls of water containing 1 per cent. of hydrochloric acid, and filter; the filtrate yields distinct precipitates with iodine T.S. and with potassio-mercuric iodide T.S.

" The powdered drug is grayish-yellow, and, when examined under the microscope, exhibits fragments of the epicarp composed of thick-walled polygonal cells, the cells of the outer layer non-porous, up to 0.05 mm. in diameter and with occasional stomata, the latter up to 0.035 mm. in length; the cells of the inner layer of the epicarp often with numerous simple pores; portions of the soft, spongy sarcocarp consisting of isodiametric or irregular parenchyma and branching milk ducts, the latter up to 0.06 mm. in width, of variable length and with thin, non-porous walls; fragments of the inner wall of the pericarp and the outer wall of the placental tissue composed of polygonal or somewhat elongated cells with porous walls, up to 0.06 mm. in width and up to 0.3 mm. in length, the walls of the latter cells often slightly lignified; spiral and

annular tracheae up to 0.035 mm. in width and reticulate tracheae up to 0.06 mm. in width; sclerenchyma cells few with simple or oblique pores; starch grains few, small, somewhat rounded; fragments of the reticulately pitted seed-coat very few or absent. Poppy Capsules yield not more than 10 per cent. of ash." *N. F. IV.*

On the continent of Europe, the poppy is cultivated largely for its seeds, which yield about fifty per cent. of an excellent fixed oil on expression. *Poppy seed oil* is of a pale golden color, liquid at 5.5° G. (42°F.), easily dried, inodorous, and of a pleasant flavor. It is bleached by exposure in thin layers to the sun. (*P. J.*, March, 1874, p. 731.) It belongs to the class of drying oils, ranking after linseed and hemp seed oils in power.

Dried poppy heads, though analogous to opium in medicinal properties, are exceedingly feeble. They are nevertheless asserted to have proved fatal, in the form of decoction, to a child. The case, reported by F. L. Winckler, was that of a babe, in the stomach of which he found a little morphine, but no meconic acid. (*N. R. Pharm.*, 1867, xvi, 38.) They are sometimes employed in decoction, as an external emollient and anodyne application, and, in emulsion, syrup, or extract, are used internally, in Europe, to calm irritation, promote rest, and produce generally the narcotic effects of opium.

The dose is from ten to twenty grains (0.65-1.3 Gm')-

Portulaca. *Portulaca oleracea* L. *Garden or Common Purslane.* (Fam. *Portulacaceae.*) —This fleshy annual, common in cultivated and waste grounds, has been considered a cooling diuretic, and recommended in scurvy and urinary affections. The seeds have been considered anthelmintic, but are inert.

Potentilla.—*Potentillareptans* L., the creeping cinquefoil of Europe, growing in waste places from Massachusetts to Ohio, and *Potentillacanadensis* L., one of the common cinquefoils of America (Fam. *Rosaceae*), have each been used as astringents in *diarrhea, chronic catarrhs, night sweats*, etc. According to J. C. Peacock (*A. J. P.*, 433, 1900), dried *P. norvegica* L. contains four, and *P. canadensis* thirteen, per cent. of tannic acid. (See *P. J.*, 1911, 350.)

Primula.—The leaves of the various species of this genus produce irritation when handled, due to a secretion in the glandular hairs. For a study of primula dermatitis, see Forster, *J. A. M. A.*, 1910, lv, p. 642. From the roots of *Primula grandiflora*, Bongault and Alland have separated a crystalline polyatomic alcohol, *primulite*, which is said to be identical with the hepatomic alcohol, volemite. (*C. R. A. S.*, 135, 796.) Two glucosides, *primverin* and *primulaverin*, and an enzyme, *primverase*, were isolated by Goris and Mascne. (*Chem. Cb.*, 1910, No. 3.)

Prinos. *Black Alder. Winterberry. Feverbush. Prinos*, Fr., G.—The U. S. P. formerly recognized under this name the bark of *Ilex verticillata* (L.) A. Gray (*Prinos verticullatus* L.) (Fam. *Aquifoliaceae*). This shrub, of which there are 3 well recognized varieties, grows in the United States from Canada to Florida, and west to Missouri and Wisconsin, frequenting low, wet places. The berries, which have a bitter,

sweetish, somewhat acrid taste, are sometimes used medicinally for the same purposes as the bark. The dried bark occurs in " thin, slender fragments, about 1 Mm. thick, fragile, outer surface brownish ash-colored, with whitish patches and blackish dots and lines, the corky layer easily separating from the green tissue; inner surface pale greenish or yellowish; fracture short, tangentially striate; nearly inodorous, bitter, slightly astringent." U. S., 1880. It has no odor, but a bitter and slightly astringent taste. Boiling water extracts its virtues. William J. Lerch failed to find berberine in it. (*A. J. P.*, 1873, 251.)

Black alder has been considered tonic and astringent, and has been used in *diarrhea* and as a substitute for Peruvian bark, but has no anti-periodic properties. In cases of flabby or ill-conditioned ulcers it is popularly used both locally and internally in decoction (two ounces in three pints of water boiled to a quart); dose, from two to three fluidounces (60-90 mils).

Prioria. *Prioria Copaifera* Griseb. (Fam. *Leguminosae*.)—The oil tree is a native of the West Indies. The seeds are edible and in Panama are sold under the names of *Cativa* or *Amanza muger*. The tree yields an exudate which is known as the gum of the oil tree. This is a thick, adhesive liquid, resembling copaiba, usually turbid on account of a greenish substance, which, however, finally subsides, leaving a clear, brownish-yellow liquid. For chemical study, see *A. J. P.*, Jan., 1898.

Protea. *Protea mellifera* Thunb. (Fam. *Proteaceae*.) *Sugar Bush*.—A plant growing in South Africa, from the leaves of which Merring Beck in 1886 obtained proteacin. Merck and Hesse subsequently named the principle leucodrin. Hesse found the leaves to yield from 2 to 5 per cent. of hydroquinone associated with proteacic acid. (*P. J.*, 1896, 426.)

Prune. *Prunum*. *N. F. IV. Prunes. Pruneau noir*, Fr. Cod. *Pflaume, Zwetsche*, Gr.—"The partly dried ripe fruit of *Prunus domestica* Linne (Fam. *Rosaceae*)." *N. F. IV. U.S. VIII.* "The dried ripe fruits of *Prunus domestica* Linn., var. *Juliana*, DC." *Br.*

Prunus domestica or the cultivated prune or plum tree is so well known as to render a minute description unnecessary. The varieties of the tree produced by cultivation are very numerous. Nearly one hundred are to be found in the British gardens. Though at present growing wild in various parts of Europe, it is thought to have been brought originally from Asia Minor and Syria. It is the partly dried ripe fruits only that are official in the *N. F. IV.* They are officially described as " oblong, ellipsoidal, more or less compressed, 3 to 4 cm. long; externally brownish-black, shrivelled; the sarcocarp sweet and acidulous; putamen hard, smooth or irregularly ridged; the seed, shaped like that of the almond but smaller and of a bitter-almond taste." *N. F. IV.* The prunes brought to our market come chiefly from the south of France, the best from Bordeaux. They are derived from the variety of the tree named *Juliana* by Linnaeus. The fresh fruit, called *Prune de Saint-Julien* by the French, is of an oval shape, nearly an inch in length, and of a deep violet color. It is prepared by drying in the sun, after having been exposed to the heat of an oven. The finest prunes, used on the tables of France, are prepared from the larger kind of plums, such as the *Saint Catharine*, and

Reine Claude or *greengage*. An inferior sort is brought from Germany.

Prunes have a feeble odor, and a sweet mucilaginous taste, which is generally also somewhat acid. They contain uncrystallizable sugar, malic acid, and mucilaginous matter. The following is given as the average of nine analyses of dried prunes. Water 29.30 per cent., nitrogenous material 2.35 per cent., fat 0.53 per cent., free acid 2.72 per cent., sugar 44.35 per cent., other nitrogen-free material 17.89 per cent., woody fiber (not including the stone) 1.48 per cent., ash 1.38 per cent. (Konig, *Nahrungsmittel*, ii, 397, 1880.) In Hungary a kind of brandy (*Zwetschenbranntwein*), containing about 40 per cent. of alcohol, is obtained from them, which in some districts is largely consumed. Bonneberg, a German chemist, has extracted from prunes crystallizable sugar equal to that of the cane.

Prunes are laxative and nutritious, and, stewed with water, form an excellent diet in costiveness. Imparting their laxative properties to boiling water, they serve as a pleasant and useful addition to purgative decoctions. Their pulp is used in the preparation of laxative confections. Too largely taken, they are apt to occasion flatulence, griping, and indigestion. Prunes were dropped from the former U. S. Pharmacopoeia, but admitted to the National Formulary IV because confection of senna, which was the only preparation in which prunes entered, was not admitted to the U. S. P. IX, but confection of senna is now official in N. F. IV.

Prunella. *Prunella vulgaris* L. *Self-heal. Heal-all. Carpenter Weed. Brunella vulgaris. Paquerette*, Fr. *Braunelle, Braunheil*, G.—A small perennial labiate herb, which is common both in Europe and the United States. It was formerly used in *hemorrhages* and *diarrhea*, and as a gargle in *sore throat*.

PRUNUS VIRGINIANA. U. S. (Br.)

WILD CHERRY Prun. Virg. [Wild Black Cherry Bark]

"The stem-bark of *Prunus serotina* Ehrhart (*Prunus virginiana* Miller) (Fam. *Rosaceae*), collected in autumn and carefully dried. Preserve Wild Cherry in tightly-closed containers, protected from light." U. S. "Wild Cherry Bark is the bark of *Prunus serotina*, Ehrft., collected in autumn." Br.

Pruni Virginianae Cortex, Br., Wild Cherry Bark; Virginian Prune Bark; Rum, Whisky, or Cabinet Cherry, Wild Black Cherry; *Ecorce de Cerisier de Virgiuie*, Fr.; *Wild-kirschenrinde, Amerikanischer Zierstrauch*, G.

The genus *Prunus* now includes the plums, almonds, peaches, apricots, and cherries, and comprises about one hundred and twenty species. They are generally distributed in the temperate regions of the northern

hemisphere. In the United States there are about forty indigenous species.

The name *P. virginiana* was applied by Miller (*Diet.*, ed. 8, No. 3), and not Linnaeus, to *P. serotina* Ehr. *P. virginiana* L., commonly called *wild cherry* or *choke cherry*, is distinguished from *P. serotina* Ehr., known more properly as *wild black cherry*, by the following characteristics: *P. virginiana* L. has deciduous calyx lobes; oblong-obovate pointed endocarp (or stone); leaves broadly oval to oblong-obovate, and usually abruptly acuminate; inner bark with a rather disagreeable odor. *P. serotina* Ehr. has persistent calyx lobes; the endocarp (or stone) oblong-obovate, usually gradually acuminate; leaves oblong or lanceolate-oblong, usually gradually acuminate; the inner bark and leaves possess an aromatic odor. The British name, "Virginian Prune Bark," for the bark is misleading; Virginian Peach Bark or Virginian Almond Bark would have been no more of a misnomer. The official species is, according to Michaux, one of the largest productions of the American forest. Trees were observed by that botanist on the banks of the Ohio, from eighty to one hundred feet high, with trunks from twelve to fifteen feet in circumference, and undivided to the height of twenty-five or thirty feet. But as usually met with in the Atlantic States the tree is much smaller. In the open fields it is less elevated than in forests, but sends out more numerous branches, which expand into an elegant oval summit. The trunk is regularly shaped, and covered with a rough blackish bark, which detaches itself semicircularly in thick narrow plates. The leaves are alternate, oval-oblong, or lanceolate-oblong, acuminate, unequally serrate, smooth on both sides, of a beautiful brilliant green; the petioles are furnished with one or more reddish conspicuous glands. The flowers are small, white, and occur - in long-erect or spreading racemes. They appear in May, and are followed by globular drupes, about the size of a pea, and when ripe of a shining blackish-purple color. For a paper on the structure of species of *Prunus*, by E. S. Bastin, see *Proc. A. Ph. A.*, 1895, 211.

This tree is distributed from Ontario south to Florida, and westward to Dakota, Nebraska, Kansas, Indian Territory, and Eastern Texas. It extends along the mountain ranges of Western Texas, Mexico, and Pacific regions of Central America, Colombia, and Peru. In the United States it was once common throughout the Appalachian region. In the neighborhood of Philadelphia it affects open situations, growing solitarily in the fields and along fences, and seldom aggregated in woods

or groves. It is highly valued by the cabinet-makers for its wood, which is compact, fine-grained, susceptible of polish, and of a light red tint which deepens with age. The leaves have been found by Procter to yield volatile oil and hydrocyanic acid on distillation, and in such proportion that a water distilled from them might with propriety be substituted for the cherry-laurel water. (*Proc. A. Ph. A.*, 1858, 325.) The fruit has a sweetish, astringent, bitter taste, and is much used in some parts of the country to impart flavor to spirituous liquors. The bark is obtained indiscriminately from all parts of the tree, though that of the roots is thought to be most active. The revisers of the Pharmacopoeia believe with J. S. Perot that the bark is stronger when collected in autumn than in the spring; from a portion gathered in April Perot obtained 0.0478 per cent. of hydrocyanic acid, and from another in October 0.1436 per cent., or about three times as much. (*A. J. P.*, xxiv, 111.) The bark should be preferred recently dried, as it deteriorates by keeping. A. B. Stevens (*Proc. A. Ph. A.*, 1895, 226; 1896, 215), after testing many specimens, reached the conclusion that bark procured from different parts of the same tree varied in the yield of hydrocyanic acid, the value being in this order: 1, root; 2, twigs; 3, trunk; the bark from young trees yielding more glucoside than that from old trees. Jos. L. Lemberger (*A. J. P.*, 1872, 303) believes that tannic acid is most abundant in the bark in October and November. On the other hand, Grace E. Cooley (*A. J. P.*, August, 1897) concludes that there is more tannic acid in the bark during the active growth of the spring than in the autumn. She further states that in the spring and autumn the bark contains its maximum percentage of starch; so that if the bark, whether powdered or whole, contains much starch in its parenchymatous cells, it has been collected after the time of leaf-fall in the autumn or before the unfolding of the leaves in the spring. Occasionally barks find their way into commerce as *Prunus Virginiana* which yield no odor of hydrocyanic acid when moistened and are probably obtained from other than the official wild cherry. (See Bastin, *A. J. P.*, 1895, and Finnemore, *P. J.*, 72.)

Moser points out that collectors frequently mistake *P. virginiana* L. or choke cherry for *P. serotina* Ehrh. or *black cherry*, which is the official source of wild cherry bark. He presents a description of the two trees and of the characteristic features of their barks. (*A. J. P.*, 1909, lxxxii, p. 579.) Farwell reports that the bark of *P. demissa* (Nutt.) Walpers, a tree from west of the Rocky Mountains, has been found in commerce. It is much darker and the lenticels are much more prominent. The

preparations made from it resemble the official wild cherry bark in color, odor and taste.

Properties.—Wild cherry bark is officially described as follows: "Usually in transversely curved pieces from 2.5 to 8 cm. in length and from 0.5 to 4 mm. in thickness; outer surfaces light brown or greenish-brown, smooth, except for numerous lenticels from 3 to 4 mm. in length; inner surfaces light brown, longitudinally striate and occasionally fissured; fracture short, granular; odor distinct, bitter almond-like when macerated in water; taste astringent, aromatic, and agreeably bitter. Under the microscope, sections of Wild Cherry show a tendency for the separation in radial segments or bands of the phloem tissues from the rather broad medullary rays; periderm usually of a few layers of cells; outer bark from young twigs with 1 or 2 nearly continuous layers of cells, the latter being of very irregular shape, often branching and with thick lamellated, porous walls; medullary rays extending in more or less scythe-shaped groups from the cambium to the outer bark, from 1 to 10 cells in width, some of the cells occasionally being modified to stone cells; between the medullary rays occur numerous small groups of stone cells, resembling those of the outer bark and occasionally modified to sclerenchymatous fibers; calcium oxalate mostly in crystal fibers consisting of monoclinic prisms, from 0.015 to 0.04 mm. in diameter, also in rosette aggregates from 0.01 to 0.04 mm. in diameter; starch grains numerous, occurring in the medullary rays and parenchyma. The powder is light brown; when examined under the microscope it exhibits bast-fibers and stone cells with thick, strongly lignified walls; crystal fibers with monoclinic prisms and rosette aggregates of calcium oxalate, from 0.01 to 0.04 mm. in diameter; starch grains nearly spherical, from 0.003 to 0.004 mm. in diameter." *U. S.*

"In curved pieces or irregular fragments not more than three millimetres thick. Frequently covered with a smooth, thin, reddish-brown, papery cork, or, if this has been removed, exhibiting a greenish-brown cortex; marked with transversely elongated lenticels. Fracture short, granular; fractured surface reddish-grey. Inner surface reddish-brown, striated or reticulately fissured. In the bark numerous groups of sclerenchymatous cells of characteristic shape, but no typical bast fibers; in the parenchymatous cells minute starch grains and prismatic crystals of calcium oxalate. Slight odor; taste astringent, aromatic and bitter, recalling that of bitter almonds." *Br.*

In the fresh state, or when treated with water, it emits an odor resembling that of peach leaves. Its taste is agreeably bitter and aromatic, with the peculiar flavor of the bitter almond. It imparts its sensible properties to water, either cold or hot, producing a clear reddish infusion closely resembling Madeira wine in appearance. Its peculiar flavor and its medicinal virtues are injured by boiling, in consequence partly of the volatilization of the principles upon which they depend, partly upon a chemical change effected by the heat. From an analysis by Stephen Procter, it appears to contain starch, resin, tannin, gallic acid, fatty matter, lignin, red coloring matter, salts of calcium, potassium, and iron. He obtained also a volatile oil, associated with hydrocyanic acid, by distilling the same portion of water successively from several different portions of the bark. William Procter proved that, as in the case of bitter almonds, the volatile oil and hydrocyanic acid do not exist ready formed in the bark, but are the result of the reaction of water with amygdalin, which he ascertained to be one of its constituents. In order, however, that this change may take place, he affirmed that the agency of another principle, probably analogous to, if not identical with, emulsin or the synaptase of Robiquet, was also essential, and, as this principle becomes inoperative at the boiling temperature, one can understand how decoction may interfere with the virtues of the bark. (*A. J. P.*, x, 197.) The bitterness appears to be due to the fluorescent substance described below which confirms Procter, who found the bitterness of an extract of the bark to remain after it had been wholly deprived of amygdalin. Stevens and Judy (*A. J. P.*, 1895, 482, 534) found that the thick bark contains more amygdalin and consequently yields more HCN than the thin bark. The thick bark contains amygdalin, etc., 4.12 per cent., and HCN from 0.32 to 0.35 per cent.; the thin bark, amygdalin, etc., 3.16 per cent., and HCN from 0.24 to 0.27 per cent. F. B. Power and Henry Weimer, on the other hand, state that the bark does not contain crystallizable amygdalin, that the ferment principle is not emulsin, and that it cannot be isolated by an analogous process. The bitter principle, which appears to be the fluorescent substance, has the character of a glucoside, and crystallizes in colorless needles. (*West. Drug.*, 1887, p. 331.)

R. Rother (*A. J. P.*, 1887, p. 286), in searching for the fluorescent principle of wild cherry bark, obtained a reddish crystalline substance, soluble in water, chloroform, ether, and alcohol, the solution of which fluoresced strongly on addition of ammonia. Rother says that it does not agree in crystalline form with mandelic acid, but may be a derivative of

it.

Uses.—Wild cherry bark has the stomachic effects of the simple bitters but is comparatively infrequently employed for this purpose. On the theory that hydrocyanic acid is a cough sedative, wild cherry bark has been popularly employed in the treatment of *bronchitis* of various types, but is of doubtful service.

Dose, from thirty to sixty grains (2.0-3.9 G-m.).

Off. Prep.—Syrupus Pruni Virginianae, *U. S., Br.*; Tinctura Pruni Virginianae, *Br.*; Elixir Taraxaci Compositum (from Fluidextract), *N. F.*; Emulsum Olei Morrhuæ cum Pruno Virginia (from Fluidextract), *N. F.*; Fluidextractum Pruni Virginianae, *N. F.*; Infusum Pruni Virginianae, *N. F.*; Syrupus Cimicifugæ Compositus, *N. F.*; Syrupus Pint Strobi Compositus, *N. F.*; Syrupus Pint Strobi Compositus cum Morphinae, *N. F.*; Vinum Pruni Virginianae, *N. F.*; Vinum Prunus Virginianae Ferratum (from Wine), *N.F.*

Psoralea.—Of this genus (Fam. *Leguminosae*) various species are useful. The tubers of *P. esculenta* L. are employed by the Indians of the Northwestern United States, and by the settlers, as articles of food, being the *prairie turnip* or *prairie potato*, the *tipsinah* and *taahgu* of the Indians. C. Richardson found in it nearly 70 per cent. of starch, and 5 per cent. of a new, rapidly crystallizing sugar, which has not been further investigated. *P. glandulosa* L., *culen*, *yolochiahiti*, of the Mexican Pharmacopoeia, yields a leaf which is used as a tonic or anthelmintic, and an emetic root. *P. bituminosa* L., of Europe, and *P. physodes* Dougl., of California, are popularly considered tonic and emmenagogue, the former being presented under the name of *Herba Trifolii Bituminosi*. *P. pedunculata* (Mill.) Vail. (*P. melilotoides* Michx.) (*Congo root*, *Bob's root*, *Samson's snakeroot*), of Virginia, has been recommended as an aromatic bitter tonic, especially useful in chronic diarrhea. The part employed is the root, from which MacNair obtained about 2 per cent. of a volatile oil, having the specific gravity 0.93, a pungent and bitter taste, and a neutral reaction; also a bitter principle, but not tannin. For further description, see *A. J. P.*, July, 1889; also 14th and 16th editions of *U. S. D. P. corylifolia* L., of India, yields an oleoresin which is used in the treatment of *leucoderma* and other skin diseases. (*P. J.*, Sept., 1881.) Mann and Griffiths obtained from the seeds of *P. corylifolia* 13.7 per cent. of a thick brownish oil and 37.2 per cent. of an alcoholic extract which yielded by purification 9.2 per cent. of a resinoid. (*P. J.*, 1912, 260.)

Ptelea. *Ptelea trifoliata*, L. and the variety *Mollis* T. and G. *Wafer Ash. Wing Seed. Shubby Trefoil. Hop Tree. Orme a trois feuilles*, Fr. *Hopfenbaitm, Kleebaum*, G. (Fam. Rutacece.) —This is a shrub with 3-foliolate leaves growing in rocky places from Long Island to Minnesota and southward. The root bark has a peculiar somewhat aromatic odor, and a bitter, persistently pungent, and slightly acrid, yet not disagreeable taste.

Steer obtained from it an oleoresin of an acrid and bitter taste and the alkaloid *berberine*. An alkaloid, *arginine*, $C_6H_{14}O_2N_4$, is stated also to be present in the root. (A. J. P., 1867, 337.) It was formerly employed among the physicians of the Western States in the treatment of *dyspepsia*, and generally in diseases requiring a mild, non-irritating, bitter tonic.

Pulmonaria. *Pulmonaria officinalis* L. *Lungwort*. *Pulmonaire*, Fr. *Lungenkraut*, G. (Fam. *Boraginaceae*.)—An herbaceous perennial, European plant, sometimes cultivated. The leaves have been employed in catarrh, hemoptysis, and consumption, but their virtues are doubtful.

Pulsatilla. N. F. IV. *Pasque Flower*. *Meadow Anemone*.—"The dried herb of *Anemone Pulsatilla* Linne, *Anemone pratensis* Linne, or of *Anemone Ludoviciana* (Nuttall) Heller (Fam. *Ranunculaceae*), without the presence of more than 5 per cent. of foreign matter." N. F.

The plants are common throughout Europe and should be employed in the fresh condition. The drug is collected at the time of flowering of the plants which extend from March to May. The drug is frequently sold in the dry condition and should be carefully preserved.

The genus *Anemone* is composed of small herbal plants growing in almost all the temperate countries of the world, and probably possessed very generally of the acrid rubefacient properties of the *Ranunculaceae*.

Pulsatilla was official in the U. S. P. 1890 and has been admitted to the N. F. IV. It has been introduced to make the tincture of *pulsatilla* of the strength of 10 per cent., with a menstruum of 3 volumes of alcohol with 1 volume of water. It is described by the N. F. as follows:

"Leaves and flowering scapes matted, silky-villous; basal leaves with petioles up to 30 cm. in length, the latter hollow, often purplish in color, the blades twice or thrice deeply three- or four-parted or pinnately cleft, the lobes linear and acute, the base of the petiole more hairy than above and frequently attached to the short root-stock; flowering scapes up to 30 cm. in length, solid in the lower portion and hollow in the upper part, with sessile, involucrel dissected leaves near the flower, occasionally with remains of the dull purple hairy sepals and the dense-woolly, plumose-tailed akenes. Nearly odorless; taste very acrid.

"The powder, when examined under the microscope, shows numerous simple, thick-walled hairs up to 2.5 mm. in length and up to 0.02 mm. in thickness; tracheae up to 0.03 mm. in breadth with spiral markings or with simple or bordered pores; fragments of epidermal tissue with stoma, the latter being broadly elliptical and up to 0.05 mm. in length; some epidermal cells with wavy vertical walls; calcium oxalate crystals and starch grains few or absent. *Pulsatilla* yields not more than 10 per cent. of ash." N. F.

The *A. ludoviciana* Nutt. (*Pulsatilla ludoviciana* (Nutt.) Heller, *A. nuttalliana* Gray),

an American species, growing in Minnesota and other parts beyond the Mississippi, has been employed with supposed advantage by W. H. Miller of St. Paul, in *chronic diseases of the eyes*, in *cutaneous eruptions*, and in *syphilitic affections*. A. W. Miller found *anemonin* in it. (*A. J. P.*, 1862, p. 300; see also *A. J. P.*, xlv, 299.) *A. nemorosa* L., which is common in Europe, is said to act as a poison to cattle, producing bloody urine and convulsions. It is stated also to have proved, when applied to the head, a speedy cure for tinea capitis. It is probable that the American *A. quinquefolia* L., at first described as a variety of *A. nemorosa*, has similar properties. The American *Pasque Flower* (*A. patens* L., var. *Wolfgangiam* (Bess.) Koch), formerly known as *A. patens* L. var. *nuttaliana* Gray, was recognized as a source of pulsatilla. This plant is also designated as *Pulsatilla hirsutissima* (Pursh.) Britt.

Beckurts obtained from pulsatilla *anemone camphor* by treating in each case the aqueous distillate of *A. nemorosa*, *A. pratensis*, and *A. pulsatilla* with chloroform. It is unstable, splitting easily into anemonin and anemonic acid, the latter, when treated with alkalies, yielding *anemoninic acid*, $C_{10}H_{12}O_6$. (*P. J.*, 1885, 365.) The formula of anemonin is $C_{10}H_8O_4$. It is decomposed at temperatures above $152^{\circ} C.$ ($305.6^{\circ} F.$), and dissolves in alkalies with yellow color, changing at the same time into *anemonic acid*, $O_{10}H_{10}O_5$. When treated with nascent hydrogen in an acid solution, anemonin yields *hydroanemonin*, $O_{10}H_{12}O_4$, which crystallizes from boiling petroleum in large colorless laminae which contain 1 molecule of HgO , melt at $78^{\circ} C.$ ($172.4^{\circ} F.$), and distil without decomposition at from 210° to $212^{\circ} C.$ ($4100-4140 F.$) under a pressure of 10 mm. Hydroanemonin is much more stable than anemonin.

Medicinal Properties and Uses.—Pulsatilla is a violent irritant, producing when taken in sufficient amount excessive vomiting and purging, with pain, hematuria, tremors, dyspnea, and collapse. The statements of the physiological action of anemonin vary so much that there can be little doubt that different experimenters have used different substances under the same name. Noel and Lambert (*A. J. P.*, 1897) affirm that it has no action upon the heart but affects powerfully the central nervous system, producing in the lower animals progressive paralysis of spinal origin. On the other hand, Bronevski (*Med. Press*, Aug., 1886) affirms that anemonin affects very powerfully not only the nerve centers but the heart itself. The strength of commercial anemonin is variable. Broudegeest gives the fatal dose for the rabbit as 200 mgm. per kilo, while in Noel and Lambert's experiments 0.16 gramme per kilo was required to kill a guinea-pig. Authors place the dose for man at from five-sixths to one and one-half grains (0.05-0.096 Gm.) a day, in divided amounts.

It has been claimed for pulsatilla that it acts powerfully upon the genitalia in men and women, and is useful in *dysmenorrhea* and *ovarian irritation*; also *epididymitis* and *orchitis*. Our own experience with it is in accord with that of many practitioners—that unless given in infinitesimal dose, with much ceremony, it fails to achieve any good in these various cases, so that the effect which sometimes follows its use in hysterical women is of psychical origin. Noel and Lambert especially commend a fluid extract made from the fresh herb, of which they state that from seventy-five to one hundred and twenty-five minims (4.6-7.8 mls) may be exhibited in the course of twenty-four hours. The dose of the dried powder is commonly given as from two to three grains

(0.13-0.2 Gm.), but probably much larger amounts can be safely taken.

PULVERES

POWDERS

Poudres, *Fr.*; Puvern, *G.*; Polveri, *It.*; Polvos, *Sp.*

The form of powder is convenient for the exhibition of substances which are not given in very large doses, are not very disagreeable to the taste, have no corrosive property, and do not deliquesce rapidly on exposure.

With regard to keeping powders in well-stoppered bottles, it is asserted by Herouard, a French pharmacist, that this plan, instead of preserving some powders, tends to their more speedy and certain change. Whatever pains may be taken in drying drugs previously to powdering them, most of them during the process attract moisture, so as to put themselves in this respect in equilibrium with the surrounding air; and, if enclosed in this state in air-tight vessels, they are exposed to injurious influence from their own absorbed water, which, vaporized in hot weather, is in the colder seasons condensed on the inner surface of the vessel and determines a movement of fermentation, and even cryptogamic growths appear in some instances. The best method of preservation, the author thinks, is to enclose the powders in strong paper bags of a 'blue or gray color, so as to exclude the light, while the air has exit or entrance through the porous walls. Whatever may be our theoretical opinions on the point, Herouard asserts the fact, as the result of observation, that powders keep best in this way, and his statement coincides with our own experience. The powders may be more likely to cake or harden into aggregate masses; but this disadvantage is easily counteracted by a new pulverization when required. (*J. P. C.*, Aout, 1862, p. 98.) From these statements the inference may be drawn that, where powders are kept in air-tight bottles, they should be thoroughly dried, after pulverization, before being enclosed, and many, such as ergot, rhubarb, etc., should be kept in paper boxes or cartons.

In relation to substances most liable to injury from these causes, the best plan is to powder them in small quantities as wanted for use.

Powders may be divided into the *simple*, consisting of a single substance, and the *compound*, of two or more mixed together. The latter

only are embraced under the present head. In the preparation of the compound powders, the ingredients, if of different degrees of cohesion or solidity, should be pulverized separately and then mixed. Deliquescent substances, and those containing fixed oil in large proportion, should not enter into the composition of powders intended to be kept,—the former because they render the preparation damp and liable to spoil, the latter because they are apt to become rancid and impart an unpleasant odor and taste. When deliquescent substances are extemporaneously prescribed, the apothecary should enclose them before delivery in waxed paper or other impervious covering; and the same remark is applicable to volatile powders, as ammonium carbonate and camphor. The lighter powders may in general be administered in water or other thin liquid; the heavier, such as those of metallic substances, require a more consistent vehicle, as syrup, molasses, honey, or one of the confections. Resinous powders, if given in water, require the intervention of mucilage or sugar. For many powders the *cachet de pain* affords the best method of administration.

These very useful articles are wafers made of unleavened bread in such a manner that they offer a concavity, so that when two are placed face to face there is a space in which a powder may be contained. They are of different sizes and capacities, the largest readily holding as much as ten grains of quinine. In filling them, one wafer is placed upon a board, and the requisite amount of medicine is put in it; then a second wafer, whose interior margin has been wetted, is laid upon the first and pressed down upon it. When taken, they should be dipped in water, placed immediately upon a teaspoon containing a little water, and swallowed with a gulp of fluid. For most powders of disagreeable taste, cachets afford the best method of administration.

Gelatin capsules are extensively used for the administration of drugs in powdered form and are admirably adapted for this purpose if the dose is not too large, as they are readily filled and easily taken by the patient.

In the act of powdering, the whole substance in the mortar should not be beaten until completely pulverized, as the portion already powdered interferes with the action of the pestle upon the remainder, while the finer matter is apt to be dissipated, so that there is a loss of time and of material. The proper plan is to sift off the fine powder after a short continuance of the process, then to return the coarser parts to the mortar, and to repeat several times this alternate pulverization and

shifting, until the process is completed. Care should be taken to mix thoroughly the several portions of fine powder thus obtained.

PULVIS AMYGDALÆ COMPOSITUS. Br.

COMPOUND POWDER OF ALMONDS

Confectio Amygdalae; Conserva Amygdalarum; Confection of Almond; Conserve d'Amandes, *Fr.*; Mandelconserve, *G.*

"Sweet Almonds, 60 grammes; Refined Sugar, in powder, 30 grammes; Gum Acacia, in powder, 10 grammes. Blanch and dry the Almonds; reduce them to a coarse powder; mix the Gum Acacia and Sugar; add to the powdered Almonds; mix." *Br.*

This is the old *Almond Confection* in powder form. It is intended to afford a speedy method of preparing the almond mixture, which, when made immediately from the almonds, requires much time, and which cannot be kept ready made. But from its liability to be injured by keeping, it was omitted from the U. S. Pharm., which directs the emulsion of almond to be made immediately from the ingredients.

Off. Prep.—Mistura Amygdalae, *Br.*

PULVIS AROMATICUS. U. S. (Br.)

AROMATIC POWDER Pulv. Arom.

Pulvis Cinnamomi Compositus, Br.; Compound Powder of Cinnamon; Poudre des Epicea, *P. des Aromates*, Poudre aromatique, *Fr.*; Aromatisches Pulver, Gewurzpulver, *G.*

"Saigon Cinnamon, in No. 60 powder, thirty-five grammes [or 1 ounce av., 103 grains]; Jamaica Ginger, in No. 60 powder, thirty-five grammes [or 1 ounce av., 103 grains]; Cardamom Seed (deprived of pericarps), fifteen grammes [or 231 grains]; Myristica, freshly grated, fifteen grammes [or 231 grains], to make one hundred grammes [or 3 ounces av., 231 grains]. Triturate the cardamom seed and the myristica with a portion of the saigon cinnamon, until they are reduced to a fine powder; then add the remainder of the cinnamon and the ginger, and rub them together until they are thoroughly mixed." *U. S.*

"Cinnamon Bark, in powder, 25 grammes; Cardamom Seeds, in powder, 25 grammes; Ginger, in powder, 25 grammes. Mix." *Br.*

Properties.—"Light reddish-brown; with a strong, distinctive, aromatic odor; when examined under the microscope it exhibits characteristic starch grains of ginger, being ellipsoidal or ovoid, slightly beaked and from 0.005 to 0.06 mm. in diameter; numerous yellowish-brown, brownish-red and occasional blackish fragments, the cellular structure of which is not distinct; occasional stone cells, the lumina being filled usually with a reddish-brown amorphous substance or containing air; occasional fragments with sclerenchymatous fibers; calcium oxalate crystals, in short raphides, few." *U. S.*

The Aromatic Powder of the U. S. P. IX does not differ essentially from that formerly official. The British and American powders now closely resemble, each other. The U. S. process contains nutmeg and the British does not. The cardamom seeds should always be deprived of their pericarps before being weighed, and the powder, when prepared, should be kept in well-stoppered bottles.

Uses.—The aromatic powder is stimulant and carminative, and the U. S. preparation may be given in the dose of from ten to thirty grains (0.65-2.0 Gm.), in cases of *enfeebled digestion* with flatulence; but it is chiefly used as a corrigent and adjuvant of other medicines. A mixture of aromatic powders in the form of a cataplasm is much used as a mild rubefacient, especially in nausea and vomiting, being applied over the epigastrium. Such a mixture is commonly called *spice plaster* and will be found in the N. F. IV (Part III), under the title *Pulvis Aromaticus Rubefaciens*. It contains clove, cinnamon, ginger, and capsicum, and the mixed powder may be distributed in a thin flannel bag, quilted in position, and the whole wet with bathing whisky when applied and covered with oiled silk.

Aromatic Sugar.—Wm. L. Turner proposed a mode of obtaining the effects of the aromatic powder in certain cases where the use of the powder itself would be inconvenient. He prepared an aromatic sugar by submitting eight ounces of the freshly prepared powder to percolation with stronger alcohol to exhaustion, pouring the percolate over eight ounces of sugar, and evaporating at a low heat. The sugar thus prepared may be added to mixtures, solutions, etc., requiring aromatic addition. (*A. J. P.*, 1869, p. 118.)

Dose, ten to twenty grains (0.65-1.3 Gm.).

Off. Prep.—Fluidextractum. Aromaticum, *U.S.*

PULVIS BUTEÆ SEMINUM. Br.

POWDER OF BUTEA SEEDS

"Soak Butea Seeds in Distilled Water; carefully remove the integuments; dry and powder the kernels." *Br.*

Uses.—(See *Butea Semina.*)

PULVIS CATECHU COMPOSITUS. Br.

COMPOUND POWDER OF CATECHU

Pulvis Qambir Compositus, *N.F.*; Poudre de Cashcuttie composee, *Fr.*; Zusammengesetztea Katechupulver, *G.*

"Catechu, in powder, 40 grammes; Kino, in powder, 20 grammes', Krameria Root, in powder, 20 grammes; Cinnamon Bark, in powder, 10 grammes; Nutmeg, in powder, 10 grammes. Mix." *Br.*

This preparation is also official in the N. F..

The dose of this agreeable preparation is from fifteen to thirty grains (1-2 Gm.).

PULVIS GLYCYRRHIZÆ COMPOSITUS.

U. S., Br.

COMPOUND POWDER OF GLYCYRRHIZA

Pulv. Glycyrrh. Co. [Compound Licorice Powder]

Poudre de Reglisse composee, Poudre pectorale, *Fr.*; Pulvis Liquiritiae Compositus, *P. G.*; Brustpulver, Pulvis Pectoralia Kurellae, *G.*

"Senna, in No. 80 powder, one hundred and eighty grammes [or 6 ounces av., 153 grains]; Glycyrrhiza, in No. 80 powder, two hundred and thirty-six grammes [or 8 ounces av., 142 grains]; Washed Sulphur,

eighty grammes [or 2 ounces av., 360 grains]; Oil of Fennel, four grammes [or 62 grains]; Sugar, in fine powder, five hundred grammes [or 17 ounces av., 279 grains], to make one thousand grammes [or 35 ounces av., 120 grains]. Mix the oil of fennel thoroughly with about one-half of the sugar, then add the remainder of the sugar and the other ingredients, and mix thoroughly. Finally, pass the powder through a No. 80 sieve, pulverize the residue if any should be left on the sieve, add to the sifted powder, and mix thoroughly. Keep it in well-closed containers." *U. S.*

"Senna Leaves, in powder, 16 grammes; Liquorice Root, in powder, 16 grammes; Fennel Fruit, in powder, 8 grammes; Sublimed Sulphur, 8 grammes; Refined Sugar, in powder, 52 grammes. Mix." *Br.*

Properties.—"Greenish-yellow to greenish-brown with a fennel-like odor; when mounted in water or hydrated chloral T.S. and examined under the microscope, Compound Powder of Glycyrrhiza shows fragments of glycyrrhiza with their characteristic yellow fibers associated with crystal fibers, large tracheae with elliptical, bordered pores and cells containing numerous, spherical starch grains varying from 0.002 to 0.02 mm. in diameter; also fragments of senna as shown by their characteristic, more or less bent, unicellular, non-glandular hairs, from 0.1 to 0.35 mm. in length, fragments of epidermis with elliptical stomata and their 2 neighboring cells and fragments with crystal fibers; upon the addition of potassium hydroxide T.S. to aqueous mounts of the powder, some of the fragments are immediately colored a yellowish-red, changing to a reddish-brown. Introduce 0.1 Gm. of Compound Powder of Glycyrrhiza into a test tube, moisten it with 2 mils of alcohol, then add 10 mils of water, boil the mixture, allow it to cool and then filter; the filtrate is of a pale yellowish-brown color, which changes immediately to a yellowish-red on the addition of a drop of potassium hydroxide T.S. Compound Powder of Glycyrrhiza is free from an odor of hydrogen sulphide." *U. S.*

This official preparation, which was introduced into the U. S. P., 1880, was identical with that of the German Pharmacopoeia, and in the 1885 revision of the British Pharmacopoeia the preparation was made nearly to correspond, being slightly deficient in senna. The U. S. P., 1890, replaced the powdered fennel with oil of fennel, increasing the proportion of powdered licorice correspondingly which is an improvement,-as powdered fennel is variable in quality; great care should be used, however, to employ only fresh oil of fennel. The object of

the oil of fennel is patent, but the advantage to be gained by the use of washed sulphur in the proportion of only 8 per cent. must be purely imaginary. In our opinion, an improvement would be the substitution of two grammes each of powdered cinnamon and cloves for four grammes of the sugar, to correct the griping effect which is frequently produced.

Dose, thirty to sixty grains (2.0-3.9 Chn.), used as an agreeable laxative.

PULVIS JALAPÆ COMPOSITUS. U. S., Br.

COMPOUND POWDER OF JALAP Pulv. Jalap. Co. [Pulvis Purgans]

Pulvis Purgans, Pulvis Jalapae Tartratus, Pulvis Catharticus; Poudre de Jalap composee, *Fr.*; Jalapenpulver mit Weinstein, *G.*

"Jalap, in No. 60 powder, thirty-five grammes [or 1 ounce av., 103 grains]; Potassium Bitartrate, in fine powder, sixty-five grammes [or 2 ounces av., 128 grains], to make one hundred grammes [or 3 ounces av., 231 grains]. Mix the powders intimately by trituration and pass the product through a No. 60 sieve." *U. S.*

"Jalap, in powder, 30 grammes; Acid Potassium Tartrate, in powder, 60 grammes; Ginger, in powder, 10 grammes. Mix." *Br.*

Properties.—"Very light brown; when examined under a microscope it exhibits numerous, sharp-angular, colorless fragments mostly somewhat rectangular and with straight edges varying from 0.03 to 0.3 mm. in length, slowly soluble in water or hydrated chloral T.S. and polarizing light with a strong display of colors (fragments of crystals of potassium bitartrate), numerous starch grains of jalap, readily distinguished without the use of iodine T.S., usually single, occasionally 2- to 3-compound, and varying from 0.003 to 0.035 mm. in diameter; occasional fragments of laticiferous vessels and parenchyma with yellowish-brown walls, or tracheae with bordered pores, and rosette aggregates of calcium oxalate from 0.01 to 0.035 mm. in diameter, that occur in jalap." *U. S.*

The rubbing of the bitartrate with the jalap is thought to favor its more minute division, while it increases its hydragogue effect. A combination of these two ingredients, though with a larger proportion of cream of

tartar (see *Jalapa*), forms a good cathartic in dropsy.

Dose, of the powder, from thirty grains to a drachm (2.0-3.9 Gm.).

PULVIS KALADANÆ COMPOSITUS. Br.

COMPOUND POWDER OF KALADANA

"Kaladana, in powder, 30 grammes; Acid Potassium Tartrate, in powder, 60 grammes; Ginger in powder, 10 grammes. Mix." *Br.*

This powder is used as a cathartic.

Dose, from ten to sixty grains (0.65-3.9 Gm.).

PULVIS KINO COMPOSITUS. Br.

COMPOUND POWDER OF KINO

Pulvis Kino et Opii Compositus, *N. F.*, Compound Powder of Kino and Opium; *Pulvis Kino cum Opio*, *Br.* 1804; Powder of Kino and Opium; *Poudre de Kino Opiacee*, *Fr.*; *Kinopulver mit Opium*, *G.*

"Kino, in powder, 75 grammes; Opium, in powder, 5 grammes; Cinnamon Bark, in powder, 20 grammes. Mix. This Powder contains 5 per cent. of Opium." *Br.*

The *N. F.* powder is practically identical with the *Br.*.

This is an anodyne astringent powder, useful in some forms of *diarrhea*, but of which the composition would be better left to extemporaneous prescription, as the proportion of the ingredients should vary with the circumstances. Twenty grains contain one grain of opium.

Dose, from five to twenty grains (0.32-1.3 Gm.).

PULVIS RHEI COMPOSITUS. U. S., Br.

COMPOUND POWDER OF RHUBARB Pulv. Rhei Co.

Magnesia and Rhubarb, Gregory's Powder; *Poudre de Rhubarbe composee*, *Fr.*; *Pulvis Magnesise cum Rheo*, *P. G.*; *Kinderpulver*, *Pulvis Infantum*, *s. P.* *Antacidus*, *G.*

"Rhubarb, in No. 60 powder, twenty-five grammes [or 386 grains]; Magnesium Oxide, sixty-five grammes [or 2 ounces av., 128 grains]; Jamaica Ginger, in No. 60 powder, ten grammes [or 154 grains], to make one hundred grammes [or 3 ounces av., 231 grains]. Rub the rhubarb and ginger together, then gradually add the magnesium oxide and continue the trituration until they are thoroughly mixed, then pass through a No. 60 sieve." *U. S.*

"Rhubarb Root, in powder, 22 grammes; Light Magnesia, 66 grammes; Ginger, in powder, 12 grammes. Mix." *Br.*

Properties.—" A pinkish-white, mobile powder, becoming darker on exposure to moisture; when examined under the microscope it exhibits flue particles of magnesium oxide, numerous starch grains and characteristic fragments of vegetable tissues; starch grains of ginger, more or less elliptical or ovoid, frequently with a prominent beak, from 0.005 to 0.06 mm. in diameter; starch grains of rhubarb, single or compound, either spherical or polygonal, often with a central cleft, from 0.002 to 0.02 mm. in diameter; mounts made with hydrated chloral T.S. give a strong effervescence and show more clearly the fragments of reticulate tracheae, the reddish-brown parenchyma of rhubarb with numerous small starch grains or rosette aggregates of calcium oxalate, varying from 0.05 to 0.1 mm. in diameter. With solutions of the alkalis many of the fragments of rhubarb become of a deep red color." *U. S.*

This is a good laxative antacid, well adapted to bowel complaints, especially in children.

Dose, for an adult, from one-half to one drachm (2.0-3.9 Gm.); for a child two or three years old, from five to ten grains (0.32-0.65 Gm.).

PULVIS SCAMMONIÆ COMPOSITUS. Br.

COMPOUND POWDER OF SCAMMONY

"Scammony Resin, in powder, 50 grammes; Jalap, in powder, 35 grammes; Ginger, in powder, 15 grammes. Mix." *Br.*

This does not appear to us a very eligible preparation.

Dose, from ten to twenty grains (0.65-1.3 Gm.).

PULVIS TRAGACANTHÆ COMPOSITUS. Br.

COMPOUND POWDER OF TRAGACANTH

"Tragacanth, in powder, 15 grammes; Gum Acacia, in powder, 20 grammes; Starch, in powder, 20 grammes; Refined Sugar, in powder, 45 grammes. Mix." *Br.*

This is applicable to the general purposes of the demulcents, but is chiefly employed in Great Britain as a vehicle for heavy insoluble powders.

Dose, one-half to one drachm (2.0-3.9 Gm.).

Punaria Ascochingae.—This plant was said to belong to the *Compositae* and was native in Argentine; was asserted to be free from alkaloids, but to contain a glucosidal resin which is its active principle. Zehden (*Med. Woch.*, 1906, No. 35) found it useful in *asthma* when the powder, made up into pastilles called *asthma carbon*, is burned and inhaled.

Holmes (P. J., 1908, lxxx, 316) says there is no plant known by this name and that the same substance was introduced many years ago and was really obtained from *Brachycladi stuckertii*.

Pycnanthemum. *P. flexuosum* (Walt.) Bsp. (*P. linifolium* Pursh.) *Dysentery Weed.*—This American mint is popularly used in bowel complaints; its hot infusion is diaphoretic. (See *A. J. P.*, 1894, 65, 169; *Ph. Rund.*, 1896, 32.)

A volatile oil was obtained by E. R. Miller by distilling the leaves and flowering tops of *P. pycnanthemoides* (See *Proc. Alabama Pharm. Assoc.* 1910, 58.)

PYRETHRUM. U. S. (Br.)

PYRETHRUM Pyreth. [Pellitory Root]

"The dried root of *Anacyclus Pyrethrum* (Linne) Dc Candolle (Fam. Compositae). Preserve Pyrethrum in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects." *U. S.* "Pyrethrum Root is the dried root of *Anacyclus Pyrethrum* DC." *Br.*

Pyrethri Radix, *Br.*; Pyrethrum Root; Radix Pyrethri Romani; Spanish Chamomile, Long-wort, Pellitory of Spain; Pyrethre officinal, *Fr. Cod.*; *P. vrai*, Salivaire, *Fr.*; Bertram-wurzel, Romische Bertramwurzel, *G.*; Pelitre (Raiz de), *Sp.*

Anacyclus Pyrethrum is perennial, and sends up numerous stems, usually trailing at the base, erect in the upper portion, eight or ten inches high, and terminated by one large flower. The leaves are doubly pinnate, with narrow, nearly linear segments of a pale-green color. The florets of the disk are yellow; the rays white on their surface, and reddish or purple beneath and at their edges.

The plant is a native of Northern Africa, the Levant, and the Mediterranean coast of Europe, being also cultivated. The root is the part used under the name of pellitory, or *pellitory of Spain*.

The German Pharmacopoeia formerly recognized the root of *Anacyclus officinalis* Hayne (*A. Pyrethrum* Schrader), a plant cultivated in Magdeburg. The roots are smaller and thinner, attaining a length of 25 cm. and a thickness of 5 cm. They are externally grayish-brown; the bark is not radiating and does not contain many stone cells, such as are present in the official pyrethrum. The taste resembles that of the official drug but is even more pungent.

Properties.—Pyrethrum is officially described as "nearly cylindrical, slightly tapering, usually in pieces from 2.5 to 10 cm. in length and from 5 to 20 mm. in diameter; externally dark brown, deeply longitudinally furrowed and somewhat wrinkled, occasionally bearing short, tough, hair-like rootlets, crown more or less annulate', and occasionally tufted with coarse fibers or with long, soft-woolly, nearly straight, 1-celled hairs; fracture short; bark dark brown with 1 or 2 circular rows of resin ducts, closely adhering to the light yellow, radiate, porous wood, in the medullary rays of which occur 1 to 3 rows of resin ducts; odor distinct; taste sweetish, pungent, very acrid, tingling and producing a strong sialagogue effect. The powder is light to dark brown; when examined under the microscope it exhibits numerous spherical or irregular masses of inulin, the nature of which is especially seen with polarized light, and lignified fragments of the woody tissues and stone cells associated with cork; inulin in spherical granules or irregular masses, from 0.01 to 0.1 mm. in diameter, which is not affected by the addition of iodine T.S.; trachea; with simple pores and reticulate or scalariform thickenings, usually associated with wood parenchyma and with few or no wood fibers; stone cells in groups, the cells more or less tabular in outline and

with thick, yellowish porous walls; cork in yellowish-brown or dark brown fragments. Pyrethrum yields not more than 5 per cent. of ash." *U. S.*

"Usually from five to ten centimetres long, and from ten to fifteen millimetres thick; un-branched, nearly cylindrical, or frequently tapering towards both extremities; the crown often bearing a tuft of nearly colorless hairs. Outer surface brown and longitudinally wrinkled. Fracture short. In transverse section, numerous, narrow, yellowish wood-bundles alternating with wider, brownish-grey medullary rays; in the cortex and medullary rays scattered, yellowish-brown oleo-resin ducts; in the parenchymatous tissue inulin, but no starch. Characteristic odor; taste pungent, salivant." *Br.*

Its analysis by Koene gives, in 100 parts, 0.59 of a brown, very acrid substance, of a resinous appearance, and insoluble in potassium hydroxide (this is stated to contain *pelletinin*), 1.06 of a dark brown, very acrid, fixed oil, soluble in potassium hydroxide; 0.35 of a yellow acrid oil, also soluble in potassium hydroxide; traces of tannin; 940 parts of gum; inulin; 7.60 parts of potassium sulphate and carbonate, potassium chloride, calcium phosphate and carbonate, alumina, silica, etc., and 19.80 of lignin, besides loss. (See *A. J. P.*, viii, 175.) Buchheim (*A. E. P. P.*, v, 458) claims to have discovered as the active principle an alkaloid, pyrethrine, which, treated with alcoholic potassium hydroxide, splits up like piperine, and yields *pyrethric acid*. Schneegans (*Proc. A. Ph. A.*, 1897, 736) has obtained this pyrethrine in long branched needles united in tufts, melting at 46° C. (114.8° F.), with an extremely burning taste. It is soluble in absolute alcohol, acetone, ether, strong acetic acid, chloroform, and carbon disulphide, yields a yellow solution, which soon changes to red.

A *false pellitory root* has been identified by E. M. Holmes as the product of *Corrigiola telephiifolia*. It is readily distinguished from the true root by its being softer and more flexible, by its having a distinctly sweetish taste, and especially by the transverse section of the root, which is of a yellowish-white color, with from three to five pale opaque concentric rings, each alternating with a narrower translucent horny ring.

Uses.—Pellitory is a powerful irritant, used

**The Dispensatory of the United States of America
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Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Quamacai.—The wood of *Paullinia Thalict trifolia* (fam. *Sapindaceae*), a native of Brazil, has been used in *beri-beri* and *rheumatic affections*. It is also used externally in diaphoretic baths.

QUASSIA. U. S. (Br.)

QUASSIA Quass. [Bitter Wood]

"The wood of *Picrasma excelsa* (Swartz) Planchon, known in commerce as Jamaica Quassia, or of *Quassia amara* Linne, known in commerce as Surinam Quassia (Fam. *Simarubaceae*)." *U. S.* "Quassia Wood is the wood of the trunk and branches of *Picraena excelsa*, Lindl." *Br.*

Quassiae Lignum, *Br.*; Jamaica Quassia, Quassia Wood; Bitter Wood; Bitter Ash; Quassie Amere ou Bois amer de Surinam, *Fr. Cod.*; Bois de Quassie, Quassie de la Jamaïque, *Fr.*; Lignum Quassia, *P. G.*; Quassiaholz, Fliegenholz, *G.*; Quassia, Quassia della Giammaica, *It.*

"In logs of varying length, or in chips or raspings; yellowish white, tough and dense, but easily split. In longitudinal section, elongated cells containing single crystals of calcium oxalate; in transverse section, medullary rays mostly two or three cells wide. No odor; taste intensely bitter." *Br.*

The genus *Picrasma* is represented by eight species, which are found in the warmer regions of the Old and New World. They all possess a bitter wood and bark.

Picrasma excelsa (Swartz) Planchon (*Picraena excelsa* Lindley), as its name implies, is a lofty tree, sometimes attaining the height of not less

than one hundred feet, with a straight, smooth tapering trunk, which is often three feet in diameter near its base, and is covered with a smooth, gray bark. The leaves are pinnate, the leaflets being petiolate and oblong pointed and arranged in opposite pairs, with a single leaflet at the end. The flowers are small, of a yellowish-green color, and disposed in panicles. They are polygamous and pentandrous. The fruit is a small black drupe. This species inhabits Jamaica and the Caribbean Islands, where it is called bitter ash. Most of the commercial quassia is obtained from this tree.

Quassia amara, or bitter quassia, is a small branching tree or shrub, with alternate leaves, consisting of two pairs of opposite pinnae, with an odd one at the end. The leaflets are elliptical, pointed, sessile, smooth, of a deep green color on their upper surface, and paler on the under. The common footstalk is articulated and winged. The flowers, which are hermaphrodite and decandrous, are bright red, and terminate the branches in long racemes. The fruit is a two-celled capsule containing globular seeds. *Quassia amara* is a native of Surinam, and is found in Brazil, Guiana, Colombia, Panama, and the West Indies, as also in some tropical countries of the Old World. Its root, bark, and wood were formerly official. They are excessively bitter, as in fact are all parts of the plant. For the botanical description and history of *Quassia amara*, see J. U. Lloyd, *West. Drug.*, 1897, 7; also Gilling (*P. J.*, 1908, lxiii, p. 30).

Properties.—Quassia is at first whitish, but becomes yellow by exposure, and sometimes has blackish spots or markings, due to the presence of the mycelium of a fungus. The two varieties are thus officially described:

"*Jamaica Quassia*.—Usually in chips, raspings or shavings, occasionally in small cubes or billets; yellowish-white or bright yellow, with a few light gray pieces somewhat coarsely grained; fracture tough, fibrous; odor slight; taste bitter. Under the microscope, sections of Jamaica Quassia show large tracheae either single or in groups of 2 to 5, the walls being marked by numerous, small, bordered pores, and the contents being often of a yellowish color; medullary rays mostly 1 to 5 cells wide and from 10 to 20 rows deep; calcium oxalate, in crystal fibers near the medullary rays, in 4- to 6-sided prisms, from 0.006 to 0.03 mm. in length; wood fibers with thin walls and oblique pores; starch granules few, spherical or ellipsoidal, from 0.01 to 0.015 mm. in diameter.

"*Surinam Quassia*.—The crude drug and microscopic sections closely resemble the Jamaica variety; tracheae usually single or in pairs, sometimes in groups of 3 or 4; medullary rays in narrower and larger groups than in the Jamaica variety, from 1 to 4 cells wide and from 10 to 30 rows deep; calcium oxalate crystals few or entirely absent, thus distinguishing the variety from Jamaica Quassia." *U. S.*

Quassia imparts its active properties, with its bitterness and yellow color, to water and alcohol. Its virtues depend upon a peculiar bitter crystallizable principle, denominated *quassin*, which was first discovered by Wiggers, who assigned it the formula $C_{10}H_{12}O_3$. Quassin is white, opaque, unalterable in the air, inodorous, and of an intense bitterness, which in the solutions of this principle is almost insupportable. The bitterness is pure, and resembles that of the wood. When heated, quassin melts like a resin. It is but slightly soluble in water, 100 parts, at $54^{\circ} C.$ ($129.2^{\circ} F.$) dissolving only 0.45 part, and that slowly. By the addition of salts, especially of those with which it is associated in quassia, its solubility is strikingly increased. It is also but slightly soluble in ether, but is very soluble' in alcohol, more so in that liquid hot than cold, and the more so the purer it is. Quassin is perfectly neutral, though both alkalies and acids increase its solubility in water. It is precipitated by tannic acid from its aqueous solution, which is not disturbed by iodine, chlorine, corrosive sublimate, the salts of iron, sugar of lead, or even lead subacetate.

Oliveri and Denaro (*A. J. P.*, 1885, p. 29) obtained quassin in a thoroughly pure, crystallized state, and made a complete study of it. They give it the formula $C_{32}H_{44}O_{10}$. It melts at 210° to $211^{\circ} C.$ (410° - $411.8^{\circ} F.$), and is very soluble in alcohol, chloroform, and acetic acid, but only sparingly so in ether. Its aqueous solution becomes yellow on exposure to the air, is dextrorotatory, excessively bitter, and reduces Fehling's solution. When quassin is heated to $90^{\circ} C.$ ($194^{\circ} F.$) for some hours with diluted sulphuric acid (4 per cent.) it yields *quasside*, $C_{32}H_{42}O_9$, a white, amorphous, bitter substance, formed from quassin by removal of H_2O ; no glucose could be detected in the mother liquors. Bromine forms a derivative which seems to have the formula $C_{32}H_{41}Br_3O_9$. If quassin is heated with concentrated hydrochloric acid in sealed tubes for four hours at $100^{\circ} C.$ ($212^{\circ} F.$), methyl chloride is formed and a colorless substance deposited, which the authors call

quassic acid, $C_{28}H_{38}O_6(COOH)_2$. This is far less soluble in alcohol than quassin, and crystallizes in silky needles, which melt at $245^\circ C.$ ($473^\circ F.$), and reduce Fehling's solution and ammoniacal silver nitrate in the cold. The authors consider quassin as the methyl ether of this quassic acid, as follows:



The real nature of quassin is at present somewhat doubtful, it being probably that distinct substances have been confounded by chemists. Dymock and Warden believe that they have obtained quassin from the wood of *Picrasma quassioides* (Ham.) Benn. of India. According to the researches of Massute (*A. J. P.*, 1890, p. 338), *Quassia amara* contains four principles, which, are different from those of *Picrasma excelsa*. By shaking an alcoholic extract of quassia wood with chloroform he obtained a mixture of crystals, from which, eventually, four bitter principles, differing in melting point and solubility, were separated. One of these melting at 210° to $211^\circ C.$ (410° - $411.8^\circ F.$), and another melting at 239° to $242^\circ C.$ (462.2° - $467.6^\circ F.$), were in too small a quantity to be further examined, but the former agreed in melting point and crystalline form with the quassin of Wiggers ($C_{32}H_{40}O_{10}$). Of the other two. one melted at 215° to $217^\circ C.$ (419° - $422.6^\circ F.$), and is represented by the formula $C_{35}H_{46}O_{10}$, while the other melted at 221° to $226^\circ C.$ (429.8° - $438.8^\circ F.$), and is represented by $C_{37}H_{50}O_{10}$. From the wood of *Picrasma excelsa* two crystalline compounds were separated by Massute, both having lower melting points than either of the compounds from *Q. amara*. One was in needles, melted at $204^\circ C.$ ($399.2^\circ F.$), and had the composition $C_{35}H_{46}O_{10}$, while the other was in prisms, melted at 209° to $212^\circ C.$ (408.2° - $413.6^\circ F.$), and had the composition $C_{36}H_{46}O_{10}$. Both of these are homologues of a third crystalline principle, $C_{29}H_{34}O_{10}$, melting point 212° to $216^\circ C.$ (413.6° - $420.8^\circ F.$), which occurs with them. When the *picrasmin*, $C_{35}H_{46}O_{10}$, above referred to, melting at $204^\circ C.$ ($399.2^\circ F.$), is heated with hydrochloric acid, it is changed like quassin into an acid, which in this case has the formula $C_{33}H_{42}O_{10} + 5H_2O$, and is called *picrasmic acid*. It appears, therefore, that each wood represents a different series of homologous compounds.

Uses.—Quassia was introduced into medicine about the middle of the 18th century by a negro of Surinam, named Quassi, who acquired

considerable reputation in the treatment of the malignant fevers of that country by a secret remedy, which he was induced to disclose to Rolander, a Swede, for a valuable consideration. Specimens were taken to Stockholm by this gentleman in the year 1756, and the medicine soon became popular in Europe. The name of the negro has been perpetuated in the generic title of the plant. But the quassia of Surinam is now comparatively little used, it having been superseded by the product of *Picrasma excelsa* from the West Indies.

Quassia is among the most powerful of the simple bitters, useful in *failure of appetite* due to gastric debility, and in overdoses capable of sufficiently irritating the stomach to produce vomiting. Its active principle, *quassin*, has been studied by Comparden, who asserts that in moderate doses it acts as a stimulant to the salivary, hepatic, and renal secretions, and in overdoses causes burning pain in the oesophagus, with headache, nausea, vertigo, vomiting, diar-rhea, and muscular cramps. It is also stated that if given in doses of six-tenths of a grain (0.04 G-m.) before meals it increases markedly the alvine discharges, and that it is especially useful in constipation from debility of the muscular and intestinal coats. The dose of pure quassin is three-tenths of a grain (0.02 Gm.).

An infusion of quassia, two ounces in a pint of water, affords a valuable and safe injection for *seat-worms*.

Syrupus Quassiae.—This syrup is used in the preparation of a harmless fly-poison. Macerate, during twenty-four hours, 1000 parts of quassia wood with 5000 parts of water, then boil for half an hour, set aside for twenty-four hours, and press; mix the liquid with 150 parts of molasses, and evaporate to 200 parts. A weaker decoction of quassia does not kill the flies. From this the *Fly Water* or *Fly Plate* is prepared as follows: Mix when needed, and dispense without filtering, 200 parts of syrup of quassia, 50 parts of alcohol, and 750 parts of water. It is used by moistening with the mixture a cloth or filtering paper on a plate.

Quassia is given in infusion, tincture, extract, or fluidextract. Some dyspeptic patients who have become habituated to its bitterness, chew the wood occasionally with benefit.

Dose, five to ten grains (0.32-0.65 Gm.).

Off. Prep.—Infusum Quassiae, Br.; Tinctura Quassiae, U. S., Br.; Extractum Quassiae, N. F.; Fluidextractum Quassiae, N. F.

Quebracho Colorado and *Quebracho Gum* are respectively the wood and the dried juice or aqueous extract of the *Schinopsis Lorentzii* (Gries.) Engl. (fam. *Anacardiaceae*), a large tree growing in the Argentine Republic. The wood is very heavy, hard, and of a reddish-brown color. (See *A. J. P.*, 1879, p. 152; also Penzoldt, loc. cit.; *P. J.*, xii.) *Quebracho Colorado* has been used as a substitute for the true quebracho, but is essentially different from it, and probably is a simple astringent and gastro-intestinal stimulant, although Penzoldt claims that it is similar in its action, but much weaker than quebracho blanco. The extract, which contains about 70 per cent. of tannin, is extensively used in the tanning of leather. In appearance it is somewhat intermediate between kino and logwood extract. Perkin and Gunnell have determined the yellow coloring matter of the wood of quebracho Colorado to be identical with *fisetin*, $C_{15}H_{10}O_6$, the coloring matter of young fustic, *Rhus Cotinus* L. It occurs in glistening yellow needles, dyeing similarly to quercetin, and yields compounds with mineral acids. Its benzoyl and acetyl derivatives have also been prepared. Fused with alkalis it yields protocathechuic acid and probably resorcinol. Ellagic and gallic acids have also been obtained from the wood, these being probably formed during the isolation of the fisetin. (*A J. P.*, Nov., 1896, 626.)

Quercus. N. F. IV (U. S. VIII). Oak. White Oak Bark. Stone Oak. Scarce de Chene, Fr. Cod. Cortex *Quercus*, P. G. Eichenrinde, G. *Quercia*, Corteccia de quercia. It.—" The dried bark of the trunk and branches of *Quercus alba* Linne (Fam. *Fagaceae*), deprived of the periderm." N. F.

There are about sixty-five species of oak found in the United States. Many of these are applied to important practical purposes. *Quercus Robur*, or *European oak*, has a very wide distribution. It is the common British oak, constitutes a large part of the European forests, and has spread itself over almost the whole northern section of Asia and along the northern coast of Africa. There are two distinct varieties of it, one, *pedunculata*, with sessile or shortly stalked leaves and the acorns on long peduncles; the other, *sessiflora*, with the leafstalks more or less elongated and the acorns either sessile or provided with a very short peduncle. The dried bark of the smaller branches of this tree were formerly recognized by the Br. Pharmacopoeia under the name of *Quercus Cortex*.

Of all the American species, the *white oak* approaches the nearest, in the character of its foliage and the properties of its wood and bark, to *Q. pedunculata*, of Great Britain. Its trunk and large branches are covered with a whitish bark, which serves to distinguish it from most of the other species. The leaves are regular and obliquely divided into oblong, obtuse, entire lobes, which are often narrowed at their base. When full grown, they are smooth and light green on their upper surface, and glaucous beneath. Some of the dried leaves remain on the tree during the whole winter. The acorns are large ovoid or ellipoidal, contained in rough, shallow, grayish cups, and supported singly or in pairs upon peduncles nearly 2.5 cm. in length.

The white oak abounds from Ontario to Maine and Minnesota, and extends southward. It is the most highly valued for its timber of all the American oaks, except the *live oak*, *Q. virginiana* Mill. (*Q. virens* Ait.), which is preferred in ship building. The bark is sometimes used for tanning, but the barks of the *red* and *Spanish oaks* are preferred. All parts of the tree, with the exception of the epidermis, are more or less astringent, but this property predominates in the fruit and bark.

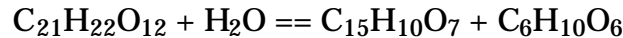
White oak bark, deprived of its epidermis, is of a light-brown color, of a coarse, fibrous texture, and not easily pulverized. It occurs "in nearly flat pieces, from 2 to 10 mm. in thickness; externally light brown, becoming darker with age, rough-fibrous; fracture uneven, coarsely fibrous. Odor distinct; taste strongly astringent; not tingeing the saliva yellow when chewed. *Quercus* yields not more than 7 per cent. of ash." *N. F. IV.* The medicinal value of oak bark depends on the presence of a considerable proportion of tannin. The proportion of this ingredient varies with the size and age of the tree, the part from which the bark is derived, and even the season when it is gathered. It is most abundant in the young bark, and the English oak is said to yield four times as much in spring as in winter. H. Davy found the inner bark most abundant in tannin, the middle portion or cellular integument much less so, and the epidermis almost wholly destitute as well of this principle as of extractive. Kraemer examined the tannin of white oak bark (*A. J. P.*, 1890, p. 236) and assigned to it the formula $C_{29}H_{27}O_{13}$, which was later confirmed by Trimble (*Tannins*). The tannin yields upon sublimation a principle resembling pyrocatechin and upon fusion with potassium hydrate a phenol similar to protocatechinic acid. Dilute solutions of white oak tannin are colored olive-brown with ferric chloride T.S. and possess a slight fluorescence.

The tannic acid of the oak barks is known as *quercitannic acid*, and has, according to Lowe (*Zeit. An. Chem.*, 20, p. 208), two forms, one soluble in water, of the formula $C_{28}H_{28}O_{14}$, and the other difficultly soluble, $C_{28}H_{24}O_{12}$. Both are changed by the loss of water into *oak red*, $C_{28}H_{22}O_{11}$. Neither is a glucoside. Gerber discovered in European oak bark a peculiar bitter principle upon which he conferred the name of quercin. This quercin Husemann considers to have been only impure quercite (or oak sugar).

Quercus velutina Lam., or *black oak*, is one of our largest trees, frequently attaining the height of eighty or ninety feet. Its trunk is covered with a deeply furrowed bark, of a black or dark brown color. The leaves are ovate-oblong, pubescent, slightly sinuated with oblong, aculeate lobes. The fructification is biennial. The acorn is globose, flattened at top, and placed in a saucer-shaped cup.

Black oak bark has a more bitter taste than that of the other species, and may be distinguished also by staining the saliva yellow when it is chewed. Its cellular integument contains a coloring principle, capable of being extracted by boiling water, to which it imparts a brownish-yellow color, which is deepened by alkalis and rendered brighter by acids. Under the name of quercitron, large quantities of this bark, deprived of its epidermis and reduced to coarse powder, are sent from the United States to Europe, where it is used for dyeing wool and silk of a yellow color. The coloring principle is called quercitrin. Herzig (*J. Chem. S.*, 1893, 413) found that its

composition is expressed by the formula $C_{21}H_{22}O_{12} + 2H_2O$, and this is confirmed by Rudolph. (*Ph. Post*, 1893, 529.) The reaction for its decomposition is



the products being *quercetin* and *isodulcite* in equal molecules.

Quercitrin forms yellowish crystals, which, pulverized, yield a citron-yellow powder. It is neutral in reaction, is odorless, and in the dry condition tasteless, but in hot aqueous or alcoholic solution has a bitter taste. It fuses at 160° to 200° C. (320°-392° F.) to a resinous mass. It is almost insoluble in cold water, sparingly soluble in hot water, and easily soluble in alcohol and alkaline solution. Besides this principle, the bark contains much quer-citannic acid; but it is less used in tanning than the other barks, in consequence of the color which it imparts to the leather, and it was dropped from the U. S. P., 1890, on account of its decoction staining so decidedly.

Quercitrin has been found in various other plants, as in the leaves of *Rutagraveolens*, and the flower buds of *Capparis spinosa*, *Sophora japonica*, and *Æsculus Hippocastanum*, or horse chestnut. (*Chem. Gaz.*, May 2, 1859, p. 161.) As this principle is capable of assuming various colors under various chemical influences, the idea has been advanced that it might be the coloring principle of flowers.

Acorns, besides the bitter and astringent principles of the bark, contain a peculiar saccharine matter (*quercite*), which is insusceptible of the vinous fermentation. (*J. P. C.*, 3e ser., xx, 335.) They are sometimes used as a tonic or astringent, and a decoction made from roasted acorns has been long employed in Germany as a remedy in *scrofula*. Before roasting they should be deprived of their shells, and the cotyledons, according to Dausse, should lose, during the process, 28 per cent. of their weight. (*Ph. Cb.*, Oct. 9, 1850, p. 687.) From half an ounce to an ounce may be prepared and taken like coffee at breakfast (Richter).

The National Formulary IV admitted quercus mainly in order to provide a process for the fluid-extract, *Fluidextractum Quercus*, N. F., which was formerly in the U. S. VIII; it is made with a menstruum of five volumes of alcohol, four volumes of water and one volume of glycerin, followed by diluted alcohol. The medical value of oak-bark depends solely upon its tannin. Because of its cheapness it is often used where an external astringent wash is desired. Thus it is employed as an injection in *leucorrhœa* and *hemorrhoids*, as a wash for flabby *ulcers* and similar purposes.

QUILLAIAE CORTEX. Br.

QUILLAIA BARK

"Quillaia Bark is the dried inner part of the bark of *Quillaja Saponaria*, Molina." Br. "The dried bark of *Quillaja Saponaria* Molina (Fam.

Rosaceae), deprived of the periderm." *N. F.*

Quillaja, *N.F.*; Soap-tree Bark; Soap Bark; Quillaia, *Pharm.* 1880; Panama Bark; Panama (Bois de), *Fr. Cod.*; Ecorce do Quillaya, *Fr.*; Seifenrinde, *G.*

The name of this genus is said to be derived from the popular name of the tree *Quillay*, which in turn comes from the Chilian word *quillean*, to wash.

Quillaja Saponaria Molina is a tree of moderate size, with alternate oval or oblong leaves having entire or slightly denticulate margins. Staminate and pistillate flowers grow on the same branch, are axillary, pedunculate, and without corolla. The calyx of the pistillate flower persists in fruit, and has its limb deeply divided into five oval acute segments. The bark is thick, the wood very hard. This tree was first described by the famous Abbe Giovanni Ignazio Molina in the *Saggio sulla Storia naturale del Chili*, published at Bologna, in 1782; second edition, 1810. (Translated into German, I. D. Brandis, Leipsic, 1786; into French, Gruvel, Paris, 1789; into English, London, 1809; also Middletown, Conn., 1880.) It is first noticed by systematic writers in the second (Gmelin's) edition of the *Syst. Nat.*, tome ii, p. 767. The tree is a native of Peru and Chili, but is now cultivated in Northern Hindostan, where it is said to resist well the frosts of winter, and to be flourishing.

Properties.—Soap bark is officially described in the Br. as "in flat pieces, from three to eight millimetres thick, but varying considerably in length and width. Outer surface brownish-white, or, where the outer bark has been incompletely removed, reddish or blackish-brown, and longitudinally striated. Inner surface white or yellowish-white and smooth. Fracture splintery and laminated, the tangential surfaces of the lamina; often exhibiting glistening prismatic crystals of calcium oxalate. In transverse section, chequered with delicate radial and tangential lines; medullary rays four cells wide; numerous irregular groups of bast fibres of varying size; scattered starch grains from four to six microns in diameter. Powdered Quillaia Bark is strongly sternutatory; water vigorously shaken with it forms copious persistent froth. Odor not marked; taste astringent and acrid. Ash not more than 15 per cent." *Br.*

It is described in the *N. F. IV* as "in flat pieces of variable length, from 3 to 8 mm. in thickness, or in small chips; outer surface brownish-white, often with small patches of cork attached, otherwise nearly smooth;

inner surface yellowish-white, nearly smooth, with occasional circular depressions, conical projections of transverse channels; fracture uneven and strongly fibrous, the laminae oblique to each other. Odor slight; taste acrid. The powder is strongly sternutatory, and contains calcium oxalate in monoclinic pyramids and prisms from 0.035 to 0.2 mm. in length. Quillaja yields not more than 10 per cent. of ash." *N. F.*

The fracture exhibits, when slightly magnified, glistening prismatic crystals. Quillaja bark is histologically distinguished and its powder recognizable, by the large and numerous prismatic calcium oxalate crystals, which are from 0.035 to 0.200 mm. long.

When bruised and macerated in water quillaja bark imparts to that liquid the property of frothing like soap when agitated. This has been found by Fleury, Jr., and Boutron-Chalard to be owing to the existence of a *saponin* in the bark. The bark contains neither tannic acid nor any bitter principle. The formula of saponin, given by Rochleder, was $C_{32}H_{54}O_{18}$, and Schiaparelli agreed with him. Stiitz, however (*Ann. Ch. Ph.*, 218, 231), gives it as $C_{19}H_{30}O_{10}$, and this is now accepted for the saponin of quillaja bark. Saponin is slowly decomposed by dilute acids into *sapogenin*, $C_{14}H_{22}O_2$, and a glucose. R. Robert (*Chem. Central.*, 1893, i, 32) gives a list of one hundred and forty plants which contain bodies of the saponin class. He arranges them under several formulas which seem to form an homologous series. Thus, $C_{17}H_{26}O_{10}$ he terms Saponin I (*senegin* or *quillaia sapotoxin*); $C_{18}H_{28}O_{10}$ is Saponin II (Schnnedeberg's *digitonin* or *saprorubrin*); $C_{19}H_{30}O_{10}$ is Saponin III (*quillain* or *quillaiac acid*); $C_{20}H_{32}O_{10}$ is *cyclamin*, Paschki's *digitoxin*, or *sarsaparill-saponin*; $C_{22}H_{36}O_{10}$ is *sarsasaponin*; $C_{26}H_{44}O_{10}$ is *parillin*.

G. Melliers states that there is present in quillaja bark a carbohydrate which he has identified as *saccharose*. (*P. J.*, Feb., 1901, 161.)

Uses.—In diluted form quillaia saponin is irritant to all tissues, and when concentrated it kills by its local action both muscular and nervous tissue. As was first discovered by H. Kohler, when injected into the leg of the frog in minute quantity it produces not only motor weakness but a rapid loss of sensibility, so that reflex movements can no longer be caused by irritating the foot. The paralysis seems to affect especially the

peripheral nerve endings, since irritation of the nerve trunk, although incapable of causing contraction of the muscles supplied by it, elicits pain, cries and other evidences of sensibility. Muscles with which saponin comes in contact become unexcitable and pass into a condition resembling post mortem rigidity. According to Kohler, this occurs without change in the microscopic structure, but Przybyszewski found that in the neighborhood of the injection where the saponin was abundant the muscles underwent structural changes similar to those of myositis. In the frog saponin produces not only local symptoms, but after a time widespread paralysis, with final arrest of the cardiac movements. Given internally to mammals it causes violent gastro-intestinal irritation, progressive loss of power, disturbance of respiration and circulation, and usually clonic and tonic convulsions, which are probably secondary to the perturbations of the cardiac and respiratory functions.

Injected into the circulation in rabbits and dogs, according to the researches of Przybyszewski, it causes fall of the arterial pressure, with great disturbance of the respiration and finally cardiac arrest. According to Kohler, the action of the drug upon the heart is antagonistic to that of digitalin, so that the application of sufficient quantities of saponin to the frog's heart which has been arrested by the local application of digitalin will bring about a return of pulsations, while, on the other hand, digitalin is capable of putting aside cardiac arrest from saponin. As has been shown by Ransom (*D. M. W.*, xxvii), saponin has a powerfully destructive action upon the red blood corpuscles, due to an extraordinary tendency which it has to unite with their cholesterin. The action of saponin upon the respiratory centres is very great, the injection of large doses being followed by immediate arrest of respiration, the heart continuing to beat for some time. As it exists in agrostemma seeds, saponin has several times caused death in the human species. The symptoms have been headache, vertigo, vomiting, hot skin, rapid feeble pulse, progressive muscular weakness, and finally coma. Following out the experiments of Kobert, Ulenburg and Keppler tried saponin as a local anesthetic, but found that it was not practically convenient for use; nor were the essays of Kobert with the glucoside as an antipyretic more encouraging.

According to Kobert (*Gaz. Med. de Paris*, xiv, 2, 1883), saponin of commerce is composed chiefly of two substances, quillaic acid and sapotoxin. For method of preparation, see *T. G.*, vol. ii, 540. The quillaic

acid is said to be extraordinarily poisonous, three-one-thousandths of a grain for each pound of body weight injected into the veins of a cat being sufficient to cause death, although thirty grains administered by the mouth are safely borne. Lohmann (*P. J.*, 73, 477) affirms that chemically pure saponin is not injurious when taken by the stomach.

Both the active principles, quillaiac acid and sapotoxin, of quillaja bark are violent local irritants. In a case of poisoning by quillaiac acid (*T. G.*, xi) the symptoms were violent vomiting, with epigastric pain, increased diuresis and cystic irritation, accompanied by cold sweats, feeble pulse, threatened syncope, and other evidences of collapse.

Sapotoxin, when in sufficient concentration and amount, is a fatal poison to all forms of protoplasm. Given to the lower animals in very large toxic dose it produces violent convulsions with death from failure of the respiration. When in smaller quantities it causes violent *dysenteric diarrhea*, with ecchymotic hyperaemia, oedema, and necrotic destruction of the intestinal mucous membrane. The smallest lethal doses are said to produce great weakness, death occurring- after some days through collapse and general paralysis without intestinal symptoms. In such cases, when the drug is administered hypodermically, a severe hemor-rhagic inflammation occurs at the place of injection. Fatty preparations of sapotoxin applied to the sound skin produce redness and burning with, after repeated applications, painful pus-tulation. Both sapotoxin and quillaiac acid have the power of breaking down the red blood corpuscles, but it is not apparent that such destruction plays an important role in poisoning by these substances except at the point of injection after hypodermic use.

On account of the active principles of soap bark being the same as those of senega, and to some extent of sarsaparilla, Kobert has proposed the use of quillaja as a cheap substitute for these much used drugs. As a stimulating expectorant he uses a decoction (five parts to two hundred) in doses of a tablespoonful for the adult. As a substitute for syrup of senega Power suggests the *syrup of quillaja*, prepared by adding four parts of the fluidextract (made by the process for fluidextract of arnica root) to sufficient syrup to make twenty-five parts. (*P. J.*, Oct., 1886.)

Quillaja is much used in the arts for washing silk, cloth, and other fabrics, for which soap would not be suitable. It is an emulsifying agent, but unless ordered by the physician should never be used by the

pharmacist in the preparation of emulsions, on account of its active medicinal properties.

It has also been largely used in the production of foam on non-alcoholic carbonated beverages. This use has been criticized as harmful and it is now prohibited by law in many jurisdictions.

Off. Prep.—Liquor Picis Carbonis, *Br.*; Tinctura Quillajae, *N. F. (Br.)*.

Quina Morada.—This drug, growing in Bolivia and the Argentine Republic, and there credited with the therapeutic values of cinchona is produced by *Pogonopus Tubulosus* (Rich.) K. Sch. (Fam. *Rubiaceae*). It has been studied by Arata and Canzoneri, who find in it a blue fluorescent substance, moradin, and an alkaloid, *moradeine*. (*P. J.*, April, 1890.)

Quinoa.—The *Chenopodium Quinoa* Willd. (Fam. *Chenopodiaceae*), is largely cultivated in Southern Peru and Southern Chili, often above the height at which barley and rye will ripen, for the sake of its seeds. These are about the size of white mustard seeds, but flatter, and afford a flour resembling somewhat oatmeal. The starch grains are very small, and constitute about 40 per cent. of the grain, which also contains 5 per cent. of sugar, 7% of casein, and 11 of albumen and other protein compounds. One variety, the *red quinoa*, contains a bitter principle in the seed husks, and is used to some extent as an emetic and antiperiodic. (*A. J. P.*, 1872, 559.)

The Dispensatory of the United States of America Twentieth Edition (1918)

Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. Michael Moore]

Randia. *Randia dumetorum* Lam. (Fam. *Rubiaceae*).—The fruit of this East India shrub is used by the natives as a fish poison, and is said to act in man as an irritating emetic. According to the *Pharmacographia Indica*, each fruit contains about four grains (0.26 Gm.) of saponin, besides valeric acid. The tincture has been used by James Sawyer (*L. L.*, 1891) as an antispasmodic.

Ranunculus. *Crowfoot. Renoncule, Fr. Hahnenfuss, G.*—Most of the plants belonging to the genus *Ranunculus* have similar acrid properties, and, from their close resemblance, are confounded under the common name of buttercup. *R. bulbosus* L. was formerly in the Secondary List of the U. S. Pharmacopoeia; but *R. sceleratus* L. had attracted more attention in Europe, and *R. acris* L. and *R. flammula* L. were recognized by the Dublin College. In all these species the plant itself is a violent irritant, producing when chewed excessive inflammation in the mouth and throat, and, when swallowed toxic gastritis which may be fatal. The acrid principle appears to be volatile; according to Bigelow, it is yielded to water in distillation. Clarus discovered, in *R. sceleratus* L., besides the acrid volatile oil, a nearly inert resin, and a narcotic principle called *anemonin* or *anemone camphor*, $C_{15}H_{12}O_6$. The volatile oil is soluble in ether, and is decomposed, on standing, into a white amorphous substance having acid properties (*anemonic acid*), $C_{15}H_{14}O_7$, and into anemonin. (*Brit. and For. Med.-Chir. Rev.*; 1859, 181.) Rochebrune states that he has separated from *R. aquatilis* L., *R. flammula* L.; *R. sceleratus* L. and *R. bulbosus* L., crystalline alkaloids to which he has given the name of *ranunculinne*, although their identity is doubtful. These alkaloids are violent irritants and active cardiac poisons. (*Toxicolog. Africaine*, i.) Before the introduction of cantharides the green buttercup plants were much employed as vesicants.

Reseda. *Reseda Luteola* L. Weld. *Dyer's Weed. Herbe Jaune, Gaude, Fr. Wau, Gelbkraut, Harnkraut, Gr.* (Fam. *Resedaceae*).—An annual European plant, naturalized on roadsides and ballast from Massachusetts to Pennsylvania. The plant grows to a height of 6 dm., possesses alternate lanceolate leaves and small greenish-yellow flowers. It is inodorous, and has a bitter taste, which is very persistent. Volhard showed that allyl thiocyanate, $C_3H_5.SCN$ (volatile oil of mustard), was present in the root, and Chevreui obtained from it by sublimation a peculiar yellow

coloring matter, which he called *luteolin*. Hiasiwetz and Pfaundler (1805) assign to it the formula $C_{15}H_{10}O_6 \cdot 2H_2O$ and find it to be tetrahydroxyflavone. This forms yellow crystals of silky luster, insoluble in water, soluble in alcohol. It dissolves in alkalis with deep yellow color. It is used especially in silk dyeing. A. G. Perkin (*J. Chem. S.*, 1896) investigated the salts of luteolin, and called attention to the similarity of its properties to those of *fisetin*. In medicine it has been employed as a diaphoretic and diuretic, but it is now used only for dyeing purposes.

RESINA. U. S., Br.

ROSIN Resin. [Resin,Colophony]

"The residue left after distilling the volatile oil from the concrete oleoresin obtained from *Pinus palustris* Miller and from other species of *Pinus* (Fam. *Pinaceae*)." *U. S.* "Resin is the residue left after the distillation of the oil of turpentine from the crude oleo-resin (crude turpentine) of various species of *Pinus*." *Br.*

Colophone ou Arcanson, *Fr. Cod.*; Resine blanche, Resine jaune, *Fr.*; Colophonium, *P. G.*; Kolophonium, Geigenharz Fichtenharz, *G.*; Colofonia, Pece greca, *It.*; Cologonia, Pez griega, *Sp.*

After the distillation of the volatile oil from the turpentine (see *Terebinthina*), a resinous matter remains, which on the continent of Europe is called *colophony*, but with us is commonly and now officially known by the name of *rosin*. It is the *Resina* of the U. S. and British Pharmacopoeias. It is sometimes called *resina flava*, or *yellow rosin*. When this, in a state of fusion, is strongly agitated with water it acquires a distinct appearance, and is denominated *resina alba*, or *white rosin*. The ports from which rosin is shipped are Wilmington, N. C., Charleston, S. C., and Savannah, Ga. The exports of rosin in 1904 amounted to 2,585,-108 bbls., valued at \$6,621,870; and in 1905 to 2,310,275 bbls., valued at \$7,069,084.

Common or *yellow rosin*, in its purest state, is beautifully clear and pellucid, but much less so as usually found in commerce. Its color is yellowish-brown with a tinge of olive, and more or less dark, according to its purity and the degree of heat to which it has been exposed in its preparation. Sometimes it is almost black. It is rather heavier than water. It is completely liquid at 152.5° C. (306° F.), begins to emit bubbles of gas at 157.5° C. (316° F.), and is decomposed at a red heat.

The official description is as follows: "Rosin usually occurs in sharp, angular, translucent, amber-colored fragments, frequently covered with a yellow dust, brittle at the ordinary temperature; fracture shiny and shallow-conchoidal; odor and taste slightly terebinthinate. It is freely soluble in alcohol, ether, benzene, glacial acetic acid, or fixed or volatile oils, it is also dissolved by dilute solutions of the fixed alkali hydroxides. Its alcoholic solution is acid to litmus. Specific gravity: 1.07 to 1.09 at 25° C. (77° P.). It is easily fusible and burns with a dense yellowish smoke. Incinerate about 2 Gm. of Rosin; not more than 0.05 per cent. of ash remains. The acid number of Rosin is not less than 150." *U. S.*

"Translucent, of a light amber color, compact, brittle, pulverisable; fracture shining; odor and taste faintly terebinthinate. Soluble in alcohol (90 per cent.), in ether, benzene, and carbon disulphide. Readily fusible; burns with a dense yellow flame and much smoke, leaving no appreciable ash." *Br.*

The composition of rosin is expressed by the formula $C_{44}H_{62}O_4$, which is the formula ascribed to *abietic anhydride*. Jean, however (*Chem. News*, xxvi, 207), has separated two other resinoid substances in addition to abietic acid. Lewkowitzsch (*Chem. Analysis of Oils*, etc., 2d ed., 236) states that rosin also contains varying quantities of unsaponifiable matter—viz., hydrocarbons due to the partial breaking up of the acid on distilling the pine rosin. This may vary from 5 to 9 per cent. in the American rosin. For a paper on abietic acid by Mead and Kremers, see *Proc. A. Ph. A.*, 1893, 198. By shaking coarsely powdered rosin with dilute alcohol and warming, it is converted into *abietic acid*, $C_{44}H_{64}O_5$, obviously an hydroxide of the first. Rosin may be considered, therefore, as abietic acid anhydride, $C_{44}H_{62}O_4$. Rosin, when it is boiled with alkaline solutions, forms greasy salts of abietic acid, the so-called rosin soaps which are used in admixture with other soaps. As the acid is dibasic, these salts contain two atoms of alkali metal in combination. Rosin, distilled by itself, yields the so-called "rosin-oil," of which two fractions are taken separately—the first that distilling under 360° C. (680° F.), and the second that over 360° C. (680° F.)—and some 31 per cent. of fixed gases. The lighter fraction is known commercially as *rosin essence*, and is, according to Renard (*J. Chem. S.*, Aug., 1884, p. 843), composed of hydrocarbons, representing almost all series, from the paraffin series to the terpenes, including pentane and hexane, amylene and hexylene, toluene, xylene, and cumene, the tetra- and hexa-

hydrides of all three of these, terebenthene and cymene. Several aldehydes and acids of the fatty series, such as isobutyric and valeric, were also recognized. The heavier fraction, or rosin oil in the stricter sense of the word, is composed of polymers of the hydrocarbons C_nH_{2n-2} , which readily resinify by the absorption of oxygen. This accounts for the use of rosin oil as an adulterant of linseed oil in the manufacture of printers' ink. When distilled with superheated steam, rosin yields benzene and toluene. *Sylvic acid*, formerly considered to be a constituent of rosin, is now regarded as a decomposition product of abietic acid. Similarly *pinic* and *pimaric acids*, announced as found in rosin, are impure products, although the latter acid, or one of the same name, is found in galipot resin. Propionic acid has, according to Renard, been obtained in abundance from the tar produced by the destructive distillation of rosin. (*A. Pharm.*, 1886, p. 939.)

A. Tschirch and B. Studer determined the nature of the constituents of American rosin. According to Mohr, the principal plant yielding the turpentine from which the American rosin is obtained is *Pinus palustris* Mill.; to some extent also, *P. heterophylla* Ell.; rarely *P. echinata*, *P. Taeda* and *P. scopida*. The sample under examination (presumably from *P. palustris*) was completely soluble in the ordinary solvents for resin, including petroleum benzin, in which some other varieties of rosin are only partly soluble. Its alcoholic solution is strongly acid in reaction. Its sp. gr. at 15° C. (59° F.) was 1.090. Its composition was proved to be as follows:

1. Acids soluble in ammonium carbonate: α -abietinic acid, $C_{19}H_{28}O_2$, forming an insoluble lead salt, 30 per cent. β -abietinic acid, $C_{19}H_{28}O_2$, not forming a lead salt, 22 per cent. 2. Acid soluble in sodium carbonate: γ -abietinic acid, $C_{19}H_{28}O_2$, insoluble in ammonium carbonate, 31.06 per cent. 3. Volatile oil, 0.4 to 0.7 per cent. 4. Resen, 5 to 6 per cent.

The impurities amounted only to 0.1 per cent., the loss in operation, however, to 10 per cent. Fahrion having proposed a method for the differentiation of different rosins, based upon their relative solubility in petroleum benzin, the authors determined the amount of solvent necessary to dissolve 1 Gm. of rosin, freshly powdered, and old powder; also abietinic acids and the resen in petroleum benzin, with the following results:

Rosin, old powder, 1 Gm. required...	400	mils
Rosin, fresh, 1 Gm. required.....	60	mils
α -Abietinic acid, 1 Gm. required.....	500	mils
β -Abietinic acid, 1 Gm. required.....	100	mils
γ -Abietinic acid, 1 Gm. required.....	100	mils
Resen	50	mils

These results show that all the resin-acids, as well as the rosin, are more or less soluble in petroleum benzin, and that fresh rosin is more readily soluble than the isolated acids, a peculiarity which has also been noticed in the case of other bodies. On the other hand, old rosin is much less soluble in petroleum benzin than is fresh rosin. (*A. Pharm*; Oct., 1903, 495-522.)

White rosin differs from the preceding only in being opaque and of a whitish color. These properties it owes to the water with which it is incorporated, and which gradually escapes upon exposure, leaving it more or less transparent. A new and very interesting class of derivatives from colophony or rosin has been prepared by Eugen Schaal, of Feuerbach, Germany, and introduced into commerce under the name of *ester gums*. These are the *glyceryl, methyl, and ethyl esters of abietic acid*, made by heating the resin acid and the alcohol under pressure until saponification takes place. The product is then distilled off under reduced pressure. These "ester gums" are being used to advantage as substitutes for copal, damar, and kauri gums in varnish making.

Uses.—Rosin is important as an ingredient of ointments and plasters, but is rarely used internally. It has been given in chronic enteritis, five grains of the powder. According to Olmstead, it has the property of preventing the oxidation of fatty substances, and thus contributes to the preservation of ointments. (*A. J. P.*, xxii, 325.)

Off. Prep.—Ceratum Resinae, *U. S. (Br.)* ; Emplastrum Calefaciens, *Br.*; Emplastrum Resinae, *U. S., Br.*; Emplastrum Saponis, *Br.*; Ceratum Resinae Compositum, *N. F.*; Linimentum Terebinthinaa (from Rosin Cerate), *U. S.*

RESINA JALAPÆ. U. S. (Br.)

RESIN OF JALAP Res. Jalap.

"Jalap Resin is a mixture of resins obtained from Jalap" *Br.*

Jalapae Resina, *Br.*; Resine de Jalap, *Fr. Cod.*; Jalapenharz, *G.*; Resina di gialappa, *It.*; Resina de jalapa, *Sp.*

"Jalap, in No. 60 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, Water, each a sufficient quantity. Moisten the powder with five hundred mils [or 16 fluid-ounces, 435 minims] of alcohol, and pack it in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding alcohol, until the percolate ceases to produce more than a slight turbidity when dropped into water. Distil off the alcohol until the percolate is reduced in weight to two hundred and fifty grammes [or 8 ounces av., 358 grains], and add the latter slowly, with constant stirring, to three thousand mils [or 101 fluidounces, 212 minims] of water. When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice, by decantation, with fresh portions of one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms] each of hot water. After having drained off all of the liquid, transfer the resin to a porcelain dish and heat it to dryness on a water-bath." *U. S.*

"Exhaust coarsely powdered Jalap with Alcohol (90 per cent.). Recover most of the alcohol by distillation; pour the concentrated solution thus obtained into eight times its volume of Distilled Water; allow the resin that separates to subside, wash with Distilled Water, and dry at a gentle heat." *Br.*

Extract of Jalap was formerly official. It has been dropped from both the U. S. and British Pharmacopoeias. Resin of Jalap has taken its place in both authorities.

Properties.—Resin of jalap is officially described in the U. S. Pharmacopoeia as in "yellow to brown colored masses or fragments, breaking with a resinous, glassy fracture and translucent at the edges,

or as a yellowish-gray to yellowish-brown powder, having a slight, peculiar odor, and a somewhat acrid taste. It is permanent in the air. Resin of Jalap is soluble in alcohol in all proportions; insoluble in carbon disulphide, benzene, or fixed or volatile oils. Its alcoholic solution is faintly acid to litmus. Add 1 Gm. of the powdered Resin to 10 mils of chloroform in a stoppered flask and shake the mixture occasionally during one hour. Then filter, evaporate the filtrate in a tared dish and dry the residue to constant weight at 100° C. (212° F.) ; it weighs not more than 0.3 Gm. Add 1 Gm. of the powdered Resin to 10 mils of ether in a stoppered flask and shake the mixture occasionally during one hour. Then filter, evaporate the filtrate in a tared dish and dry the residue to constant weight at 100° C. (212° F.); it weighs not more than 0.12 Gm. (*rosin, orizaba, or other resins*). It is slowly but completely soluble in 5 times its weight of ammonia water, and the solution does not become gelatinous on standing. When this solution is acidified with hydrochloric acid, only a slight turbidity appears (*rosin, guaiac, or other resins*). When Resin of Jalap is heated at 100° C. (212° F.), no material loss in weight is observed (*water*). When Resin of Jalap is triturated with distilled water, the latter does not become colored, none of the Resin dissolves (*soluble impurities*), and the water does not have a bitter taste (*aloin*). Shake 0.02 Gm. of Resin of Jalap with 5 mils of ether, filter and evaporate the ethereal filtrate on a piece of filter paper; no greenish-blue color is produced by the application of a drop of ferric chloride T.S. to the filter paper (*guaiac*). One Gm. of Resin of Jalap when dissolved in 50 mils of alcohol, containing 1 mil of phenolphthalein T.S., requires not more than 0.5 mil of half-normal alcoholic potassium, hydroxide V.S. to produce a red color (*acid resins*). Dissolve 0.02 Gm. of Resin of Jalap in 2 mils of glacial acetic acid and add a few drops of sulphuric acid; the mixture does not acquire a pink color (*rosin*).” *U. S.*

“In dark-brown opaque fragments, translucent at the edges; brittle, breaking with a resinous fracture; readily reduced to a pale-brown powder. Characteristic odor; taste acrid. Readily soluble in alcohol (90 per cent.). When 1 gramme of the powdered Resin is triturated with 20 millilitres of water and filtered, the filtrate is almost colorless. ^ solution of 0.1 gramme in 10 millilitres of solution of sodium hydroxide, boiled for a few moments and cooled, when acidified with hydrochloric acid may become opalescent but not immediately turbid (absence of certain other resins). Not more than 15 per cent. of the powdered Resin is soluble’ in ether (absence of scammony resin).” *Br.*

The U. S. resin, although pure enough for practical purposes, is still colored. To obtain it colorless, the powdered jalap should be mixed, before percolation, with an equal quantity of finely powdered animal charcoal, and, previously to the introduction of this mixture into the percolator, half the quantity of animal charcoal, similarly powdered, should be packed in the bottom of the percolator. The coloring matter is thus left behind, and the resulting tincture, treated as directed in the process, yields the resin as white as starch. Resin of jalap consists of two portions, one of which is hard and insoluble in ether, the other is soft and soluble in that menstruum, the former constituting about 90 per cent. It is insoluble in oil of turpentine. (Squire.) For its chemical properties, see *Jalapa*. It was at one time supposed that the purgative properties resided chiefly, if not exclusively, in the hard resin, but experiments by John C. Long appear to prove that the soft resin is equally energetic.

Guaiac, rosin, and other resinous substances are said to be sometimes fraudulently added to the resin of jalap. Guaiac may be detected by the green color it produces when a few drops of solution of sodium or calcium chloride are added to an alcoholic solution of the suspected resin. (*J. P. C.*, 3e ser., x, 357.) When pure jalap resin is dissolved in an alkaline solution, it is not precipitated by the addition of sulphuric or hydrochloric acid, having been converted, through the agency of the alkali, into an acid soluble in water. All the adulterating resins yield precipitates under the same circumstances. The resins of scammony and of fusiform jalap act in this respect like the true jalap resin, but are distinguishable by being wholly soluble in ether, while jalap resin is not. (*N. R. Pharm.*, No. 1, 1854.)

Power and Rogerson (*P. J.*, 1909, lxxxiii, p. 7) find that the products heretofore obtained from jalap as the active principle possesses the attributes of a homogeneous substance. They found the resin of jalap to be a body of very complex composition, but did not determine any single principle to which its purgative action might be attributed. (See Jalap for the chemistry of the resins.)

It is now generally believed that the resin of jalap is the sole purgative principle of jalap, the gummy extractive being either simply diuretic or wholly inert. To obviate the occasional harshness of the resin, it has been advised to triturate it with milk sugar, potassium sulphate, almond

emulsion, or other substance calculated to separate its particles. It may be conveniently made into pills with mucilage or alcohol. (Hasselby, *P. J.*, 2d ser., vii, 231.)

Dose, two to five grains (0.13-0.32 Gm.).

Off. Prep.—*Pilulas Catharticae Compositae, U. S.*; *Pilulae Catharticae Vegetabiles, N. F.*

RESINA PODOPHYLLI. U. S. (Br.)

RESIN OF PODOPHYLLUM Res. Podoph. [Podophyllin]

Podophylli Resina, Br.; Podophyllum Resin; Resin of May-Apple; Resine de Podophyllum Peltatum, *Fr. Cod.*; Podophyllum, *P. G.*; Podophyllin, Podophyllumharz, *G.*; Podofillina, *It.*; Podofilino, *Sp.*

"Podophyllum, in No. 60 powder, one thousand grammes [or 35 ounces av., 120 grains]; Hydrochloric Acid, ten mils [or 162 minims]; Alcohol, Water, each, a sufficient quantity. Moisten the powder with five hundred mils [or 16 fluidounces, 435 minims] of alcohol, and pack it in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding alcohol, until the percolate ceases to produce more than a slight turbidity when dropped into water. Distil off the alcohol until the percolate is reduced to the consistence of a thin syrup, and pour this slowly, with constant stirring, into one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms] of water, mixed with the hydrochloric acid and cooled to a temperature below 10° C. (50° F.). When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice, by decantation, with fresh portions of one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of cold water. Spread it in a thin layer upon a strainer and dry the Resin by exposure to the air, in a cool place, protected from the light. Should it coalesce during the drying, or aggregate into lumps having a glossy surface, break it into pieces, and powder it in a mortar. Preserve it in well-closed containers, protected from light." *U. S.*

"Podophyllum Rhizome, in No. 40 powder, 1000 grammes; Alcohol (90

per cent.), Distilled Water, Hydrochloric Acid, of each a sufficient quantity. Exhaust the Podophyllum with the Alcohol by percolation; recover the greater part of the alcohol by distillation; pour the resulting liquid into eight times its volume of Distilled Water acidified with one twenty-fourth of its volume of Hydrochloric Acid, constantly stirring; after twenty-four hours collect the deposited resin, wash with Distilled Water, and dry at a temperature not exceeding 40° C. (104°F.)." *Br.*

The British Pharmacopoeia (1885) abandoned the use of hydrochloric acid, as it is not necessary if the tincture is evaporated to the consistence of thick honey. Hydrochloric acid was directed in the 1898 revision as it seems to aid the precipitation when the tincture is not so concentrated. The color and yield of resin of Podophyllum may be made to vary by adding alum, acids, or other substances to the water. It darkens if dried with the aid of heat, and its color is indeed no indication whatever of its quality. The average yield of resin is about 5 per cent.

Resin of Podophyllum has usually a light-brown color, an acrid bitter taste, and a slight odor of the rhizome. It consists of two resins, one soluble both in ether and alcohol, the other in alcohol only. The resin extracted by ether constitutes, according to John W. Cadbury, 75 per cent. of the whole (*A. J. P.*, July, 1858, p. 301), according to Harvey Alien, 80 per cent. (*Ibid.*, May, 1859, p. 206.)

For further description of the composition of these resins see *Podophyllum*. Gordon and Merrell (*Proc. A. Ph. A.*, 1902, p. 343) have proposed a method of valuing resin of podophyllum, based upon the content of picro-podophyllin and submit a method of assay.

Properties.—It is officially described as "an amorphous powder varying in color from light brown to greenish-yellow, turning darker when subjected to a temperature exceeding 25° C. (77° F.), or when exposed to light. It has a . slight, peculiar odor and a faintly bitter taste. *It is very irritating to the eyes, and to mucous membrane.* It is soluble in alcohol with only a slight opalescence. The alcoholic solution is faintly acid to litmus. Not less than 75 per cent. of Resin of Podophyllum is soluble in ether and not less than 65 per cent. is soluble in chloroform. A hot aqueous solution of Resin of Podophyllum deposits most of its contents on cooling, and if the cooled liquid is filtered, the filtrate has a bitter taste, and turns brown upon the addition of a few drops of ferric chloride T.S. It is soluble in potassium or sodium hydroxide T.S., forming

a deep yellow liquid, which gradually becomes darker on standing, and from which the Resin is reprecipitated by acids. Add 0.4 G-m. of Resin of Podophyllum to 3 mls of 60 per cent. alcohol, introduce 0.5 mil of potassium hydroxide T.S., and gently shake the mixture; it does not gelatinize (*difference from Resin obtained from Podophyllum Emodi*). Resin of Podophyllum yields not more than 1.5 per cent. of ash." *U. S.*

"An amorphous powder, varying in color from pale yellow to deep orange-brown. Taste bitter. Entirely or almost entirely soluble in alcohol (90 per cent.) and in solution of ammonia; precipitated from the former solution by water, from the latter by acids. Partly soluble in ether. Ash not more than 1 per cent." *Br.*

The official resin is soluble in alkaline solutions, from which it is precipitated by acids, in this respect differing strikingly from the resins of jalap and scammony. It is insoluble in oil of turpentine. For discussion of the solubilities of the fresh resin, see G-. M. Beringer (*A. J. P.*, 1894, 11). The name Podophyllin, given to it by the eclectic practitioners, who have long' been in the habit of using this resin, is inappropriate, and should be abandoned.

Lohmann (*Proc. N. J. Pharm. Assoc.*, 1896, 51) states that the fresh drug does not yield as large a percentage of resin as the same drug would if tested after being stored for several years; his experiments led him to the conclusion that in the order of value of resin of podophyllum obtained by various methods, that made by precipitation with water alone came first, that made by the U. S. P. process second, and that made by precipitation with solution of alum last. Dohme and Kelly (*D. C.*, 1903, 251), replying to statements in a paper by Lohmann (*Proc. A. Ph. A.*, 1903, 317) regarding the yield of resin from Podophyllum, state that: 1, the yield from the method of pouring an alcoholic extract into water was 5 per cent.; 2, from pouring an alcoholic extract into acidulated water 5.5 per cent., and 3, from pouring an alcoholic extract into acidulated water containing 5 per cent. of alum, 4.9 per cent. See also Podophyllum. The color by process 1, is grayish-white; 2, light brown; 3, greenish-yellow. The value of resin of podophyllum is accurately estimated by the percentage of podophyllotoxin that it yields. Nearly all of the resin of podophyllum in commerce is made by the alum process, has a deep yellow color and is not wholly soluble in alcohol.

There has been much difference of opinion as to the relative activity of

the two resins composing it, some maintaining that both are active, others that the activity resides mainly, if not exclusively, in the resin soluble in ether. It is difficult to resist the evidence of the experiments of Cadbury, who states in the paper above referred to that, while half a grain of the ethereal resin acted energetically, and a cathartic effect was produced by even one-fourth of a grain, the portion insoluble in that menstruum was given in the dose of one grain without any effect whatever. Moreover, this evidence was subsequently confirmed by the experiments of F. B. Power. (*A. J. P.*, xlvi, 227.) It is asserted by Power, and confirmed by Maisch (*Ibid*; 226), that the purgative principle of Podophyllum is soluble in hot water. The researches of Power (*A. J. P.*, l, p. 369), Maisch (*P. J.*, 1880, p. 621), Quereschi (*Ber. d. Chem. Ges.*, xii, p. 683), and Podwyssotzki have established the fact that Podophyllum does not contain berberine or any alkaloid, and that its activity is due to principles in the resins. (See *Podophyllum*.)

Uses.—Resin of Podophyllum is a mixture of the active and inert principles of the rhizome. Resin of Podophyllum is a powerful cathartic, occasionally producing some griping and nausea, but capable of being favorably modified by combination, and of being very usefully employed in connection with other cathartics, to give them increased energy. It was at one time supposed to be especially cholagogue, but this belief has been of late discredited. A small proportion of extract of belladonna or hyoscyamus mitigates its irritant action. Care must be taken in handling it in quantity, as it is a powerful irritant, frequently producing conjunctivitis.

Dose, one-eighth to one-fourth of a grain (0.008-0.016 Gm.).

Off. Prep.—Tinctura Podophylli, *Br.*; Pilulae Aloes et Podophylli Compositae, *N. F.*; Pilulae Aloes, Hydrargyri et Podophylli, *N. F.*; Pilulae Aloini Compositae, *N. F.*; Pilulee. Catharticae Vegetabiles, *N. F.*; Pilulae Colocynthis et Podophylli, *N. F.*; Pilulse Laxativae Post Partum, *N. F.*

RESINA SCAMMONIÆ. U. S. (Br.)

RESIN OF SCAMMONY Res. Scamm.

" Scammony Resin is a mixture of resins obtained from Scammony Root or from Orizaba Jalap Root." *Br.*

Scammoniae Resina, *Br.*, Scammony Resin; Resin de Scammonee, *Fr. Cod.*; Scammoniaharz, *G.*; Kesina di scammonnea, *It.*

"Scammony Root in No. 30 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, Water, each, a sufficient quantity. Moisten the scammony root with sufficient alcohol, pack it in a cylindrical percolator, then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed, gradually adding alcohol, until the percolate ceases to produce more than a slight turbidity when dropped into water. Distil off the alcohol until the percolate is reduced to the consistence of thin syrup, and pour this slowly, with constant stirring, into one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of hot water. When the precipitate has subsided, decant the supernatant liquid, wash the precipitated Resin twice by recantation with fresh portions of one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms] each of hot water and dry the Resin on a water bath." *U. S.*

"Exhaust the coarsely powdered Root with Alcohol (90 per cent.). Recover most of the alcohol by distillation; pour the concentrated solution thus obtained into eight times its volume of Distilled Water; allow the resin that separates to subside, wash it with Distilled Water, and dry at a gentle heat." *Br.*

The *U. S. IX* and *Br. Pharmacopoeia 1914* are in accord on the advisability of preparing *Resin of Scammony* from the dried root. This result has been brought about by the practical inability to secure pure resin of scammony from the countries in which the plant grows. Adulteration and sophistication for centuries have at last wrought havoc and the pharmacopoeias have been compelled to make scammony resin from scammony root. For an account of the collection of scammony and the sophistications and adulterations, see *U. S. D.*, 19th edition, page 1099.

Resin prepared from the root and scammony obtained by evaporating the milky juice of the plant are practically identical. The elaborate researches of H. Spirgatis (*A. J. P.*, xlvii, 421) appear to have established the identity of the two products. A. Hess, however (*A. J. P.*, 1875, p. 210), states that the resin obtained from the root contains tannic acid.

The advantage of the preparation is that the resin is obtained free from the inert matters with which it is often associated in the scammony of commerce. When pure virgin scammony can be procured, any preparation is unnecessary. Obtained according to the U. S. process, the resin is of a dirty greenish-brown color, with a feeble odor and taste of scammony, and is very soluble in ether, alcohol, and boiling proof spirit. When purified with animal charcoal it has a pale brownish-yellow color, and is without odor or taste, and retains its purgative property.

“Resin of Scammony consists of brownish, translucent masses or fragments, breaking with a glossy, resinous fracture; odor characteristic and agreeable. It is soluble in alcohol in all proportions, and not less than 95 per cent. is soluble in ether (distinction from *resin of jalap* and *resin of false scammony*). When triturated with water, it does not form an emulsion. Ammonia water and solutions of the alkali hydroxides dissolve it with the aid of gentle heat, and from these solutions the Resin is not re-precipitated by dilute acids. Its solution in alcohol does not give a blue color with ferric chloride T.S. or with solution of hydrogen dioxide (*guaiac*). Sulphuric acid does not turn red when stirred in a porcelain dish with an equal weight of Resin of Scammony (rosin). Resin of Scammony yields not more than 1 per cent. of ash.” *U. S.*

"Brownish, translucent, brittle fragments, breaking with a resinous fracture; readily reduced to a pale-brown powder. Characteristic, agreeable odor; taste acrid. Readily soluble in alcohol (90 per cent.). When 1 gramme of the powdered Resin is triturated with 20 millilitres of water and filtered, the filtrate is almost colorless. A solution of 0.1 gramme in 10 millilitres of solution of sodium hydroxide, boiled for a few moments and cooled, when acidified with hydrochloric acid, may become opalescent but not immediately turbid (absence of certain other resins). Not less than 75 per cent. soluble in ether." *Br.*

The resin of scammony is liable to adulteration. Jalap resin may be detected by its partial insolubility in rectified ether, which dissolves that of scammony in all proportions. Sulphuric acid is the best test for common rosin or colophony, producing instantaneously with this substance an intense red color, while with the resin of scammony it causes no immediate change. For the tests for guaiac, the reader is referred to that article on p. 536. (See also A. J. P., xxiv, 158.) The presence of other resins may be known by the precipitates yielded when

sulphuric acid is added to the alkaline solution, the resin of scammony agreeing with that of jalap in not affording a precipitate under such circumstances. Chas. Bullock has found the resins of scammony, of jalap, and of Podophyllum to be insoluble in benzene, thus enabling any resin soluble in this liquid, which may be employed in the sophistication, to be readily detected. When rubbed with unskimmed milk, the resin of scammony forms a uniform emulsion, which is not distinguishable from rich milk itself. This is a very excellent mode of administration. The resin should always be given either rubbed up with some mild powder or in emulsion.

L. Lutz (*Pharm. Ztg.*, 1912, xxiii, p. 232) states that the behavior of the resin with iodine when examined microscopically affords a method of distinguishing resin from a number of its substitutes and adulterants.

Uses.—Scammony resin is an energetic cathartic, likely to occasion griping, and sometimes operating with harshness. It was known to the ancient Greek physicians, and was much employed by the Arabians, who used it as a purgative and externally in skin diseases. On account of its occasional violence, it is seldom administered, except in combination with other cathartics, the action of which it promotes, while its own harshness is mitigated. It should be given in emulsion with mucilage, sugar, almonds, licorice, or other demulcent, and its disposition to gripe may be counteracted by the addition of an aromatic.

Dose, from four to eight grains (0.26-0.5 Gm.).

Off. Prep.—Extractum Colocynthis Compositum, *U. S.*, *Br.*; Pilula Colocynthis Composita, *Br.*; Pilula Colocynthis et Hyoscyami, *Br.*; Pilula Scammonii Composita, *Br.*; Pulvis Scammonii Compositus, *Br.*; Pilulae Aloes, Hydrargyri et Scammonii Compositae, *N. F.*; Pilulae Colocynthis Compositae, *N. F.*; Pilulae Colocynthis et Hyoscyami, *N. F.*; Tinctura Jalapae Composita, *N. F.*

RESINÆ

RESINS

The official Resins, with a single exception, constitute a peculiar class of preparations, made by exhausting the substances from which they are obtained by alcohol, and then precipitating the resinous matter from the

tincture by the addition of water, which abstracts the alcohol by its stronger affinity. It is obvious that the resins thus prepared are different substances from the alcoholic extracts, which contain all the ingredients of the medicine which alcohol is able to take from it. This set of substances has been much employed by the practitioners styling themselves "eclectics," but with great lack of discrimination. They have applied names to these resinous precipitates which, in their proper scientific use, are employed to designate neutral proximate principles of plants, generally representing more or less completely the effects of the plants respectively on the system; as we say *columbin*, *quassin*, *santonin*, etc., themselves proper proximate principles, and representing the virtues, in part at least, of *calumba*, *quassia santonica*, etc., from which they are obtained, and from which they derive their names. By applying similar names to their precipitated resins, such as podophyllin, iridin, cemicifugin, etc., i.e., to the impure resins obtained by precipitating the tinctures of *Podophyllum*, *iris versicolor*, *cemicifuga*, etc., they justify the suspicion either that they ignorantly believe them to be in fact the active principles of these medicines respectively, or that, knowing better themselves, they seek to impose such a conviction upon the ignorant. The fact is that the substances thus obtained, and thus named, are impure resins, which may possibly contain more or less of the active principles mixed with them, but are not entitled to names which imply that they are distinct proximate principles themselves.

Resins are solid, brittle, of a smooth and shining fracture, or in powder and generally of a yellowish-brown color. When perfectly pure, they are probably inodorous and often insipid; but, as usually found, they have a slight odor, and a somewhat acrid or bitterish taste. Their sp. gr. varies from 0.92 to 1.2 They are fusible by a moderate heat, decomposed at a higher temperature, and in the open air take fire, burning with a yellow flame and much smoke. Insoluble in water, they are addition of water. With pure potassium and sodium hydroxides they unite to form soaps, which are soluble in water, and the same result takes place when they are heated with solutions of the alkaline carbonates. Concentrated sulphuric acid dissolves them with mostly soluble in ether and the volatile' oils, and in alcohol; and their alcoholic and ethereal solutions afford precipitates upon the mutual decomposition, and nitric acid converts them into artificial tannin. They readily unite by fusion with wax and the fixed oils.

Losch recommends the following process for rendering the resins as

white as possible. Boil together 5 parts of the resin, 1 of carbonate of potassium or of sodium, and 20 of water, until a perfectly homogeneous mass is obtained; allow this to cool, and pass into it sulphurous acid, which saturates the alkali, and precipitates the resin in white flakes. Finally, wash the precipitate well with water, and dry it. (*J. P. C.*, June, 1856, p. 465.)

Rhamnus Cathartica. N. F. IV. *Buckthorn Berries. Bacce Spinae Cervinae.*—"The dried, ripe fruit of *Rhamnus cathartica* Linne (Fam. Rham-nacece), without the presence of more than 5 per cent. of the unripe fruit or other foreign matter." *N. F.*

The *R. cathartica*. Linn, or common buckthorn, grows in Europe along with *R. Frangula*, and has become naturalized in this country. Its bark is probably often sold for the official *Frangula*. It is distinguished by its more spreading, thorny habit, and its dioecious flowers, which are thickly clustered in the axils and have their parts in fours. The leaves are more acute, have their margins finely serrate and their lateral veins mostly proceeding from the proximal half of the midrib. The fruit is black.

The berries which are ripened in September, are of the size of a pea, round, somewhat flattened at top, black, smooth, shining, with four seeds in a green, juicy parenchyma. Their odor is unpleasant, their taste bitterish, acrid, and nauseous. Their blackish, expressed juice was formerly recognized in the Br. Ph. under the name of *Rhamni succus*.

It is reddened by the acids, and from deep green is rendered light by the alkalies. Upon standing it soon begins to ferment, and becomes red in consequence of the formation of acetic acid. Evaporated to dryness, with the addition of lime or an alkali, it forms the color called by painters *sop-green*. The dried fruit of another species, *R. infectoria*, yields a rich yellow color, and is employed in the arts under the name of French terries.

The National Formulary IV describes buckthorn berries as follows: "Flattened, globoid or ovoid, from 4 to 8 mm. in diameter; externally purplish-black, wrinkled from shrinking of the mesocarp in drying; three-to four-celled, each cell containing a brown, triangular-convex, seed-like nutlet; in the fully dried, ripe fruit the pedicel is usually lacking. Odor faint, unpleasant; taste at first sweetish, then nauseating and bitter; it colors the saliva purplish-red. When macerated in water the drupe readily assumes its original globular shape, about 1 cm. in diameter. The expressed pulp is colored red by acids and greenish-yellow by alkalies. Shake out an aqueous infusion of *Rhamnus Cathartica* with ether, separate the ethereal solution and shake it with 5 per cent. ammonia water; the ammonia solution assumes a cherry-red color. The unripe fruit, which is to be rejected, is green to greenish-brown, firm, furrowed, pedicel usually attached; very bitter; it colors the saliva greenish-yellow. *Rhamnus Cathartica* yields not more than 5 per cent. of ash." *N. F.*

The blackish, expressed juice of Buckthorn berries was formerly recognized in the Br. Ph. under the name of *Rhamni Succus*. It has the color, odor, and taste of the

parenchyma, is reddened by the acids, and from deep green is rendered light green by the alkalies. Upon standing it soon begins to ferment, and becomes red in consequence of the formation of acetic acid. Evaporated to dryness, with the addition of lime or an alkali, it forms the color called by painters *sap-green*. The dried fruit of another species, *R. infectoria*, yields a yellow color, and is employed in the arts under the name of *French berries*.

Tschirch and Polacco, in 1900, investigated the constituents of buckthorn berries and found certain yellow coloring substances. The researches of N. Waljaschko and N. Krassowski since demonstrated that the fruits of *R. cathartica* contain the same yellow coloring matters as are contained in the fruits of *R. infectoria* and *R. tinctoria*, namely, *quercetin* and *rhamninn*, both existing in *R. cathartica* in the form of glucosides, which are split up by the action of an enzyme contained in the fruits: *Rhamninn*, for example, from the glucoside *xanthorhamninn*. The yellow coloring matters of Tschirch and Polacco, therefore, cannot be regarded as pure substances. They also extended the investigations of the former concerning the purgative substances contained in buckthorn fruits, with results confirming the theory advanced by Tschirch. They found the fruits to contain about 2 per cent. of emodin-substances and as cleavage products of the glu-cosides obtained by the action of ferments from the emodin-substances: *Emodin*, identical with *frangula emodin* and *rhamnosid*; the *emodin* of *rhamnoxanthin* ($C_{21}H_{20}O_8 + H_2O$), which is isomeric but not identical with frangulin; *rhamnonigrin*, and a resin like body containing emodin. Other constituents found in buckthorn berries are: fixed oil, succinic acid, glucose, galactose, rhamnose, and a pentose, but of the four sugars only glucose was present in the free state, the others being derived from the glucosides. (*Ph. Ztg.*, 1909, No. 16, 159.) Tschirch and Bromberger (*Schw. Woch. f. Ch. v. Ph.*, 1912, p. 193) report the following constituents found in a 15 Kilo sample upon which they did considerable work: *Rhamno-sterin*, $C_{18}H_{28}O_2$; *rhamno-fluorin*, $C_{14}H_{12}O_6$; *emodin*, $C_{15}H_{10}O_2$; *iso-emodin*, $C_{15}H_{10}O_5$; *chrysophanol* ($C_{14}H_5O_2$) $CH_3(OH)_2$. A fluidextract and a syrup of buckthorn berries are contained in the N. F.

The *dose* of the dried berries is from ten to twenty grains (0.65-1.2 Gm.). Among other species of *Rhamnus* which have claimed attention are *R. Wightii*, W. & A., a common shrub of Madras and Bombay (*P. J.*, Feb., 1888), and *R. californica*, Eschsch. (*R. humboldtiana*, Roem. and Schult.), of Mexico, which S. E. Sosa states sometimes produces paralysis in children (*El Estudio*, 1890). (See also *Cascara Sagrada*.)

RHEUM. U. S. (Br.)

RHUBARB

"The rhizomes and roots of *Rheum officinale* Baillon, *Rheum palmatum* Linne, and the var. *tanguticum* Maximowicz (Fam. *Polygonaceae*), and probably other species of *Rheum* grown in China and Thibet, deprived of most of the bark tissues and carefully dried. Preserve Rhubarb in tightly-closed containers, adding a few drops of chloroform or carbon

tetrachloride, from time to time, to prevent attack by insects." *U. S.* "Rhubarb is the rhizome of *Rheum officinale*, 'Baill., and other species of *Rheum*, collected in China and Thibet, deprived of most of the cortex, and dried." *Br.*

Rhei Rhizoma, *Br.*; Rhubarb Root; Rhubarbe de Chine, *Fr. Cod.*; Rhubarbe, *Fr.*; Rhabarber, *G.*; Rabarbaro, *It.*; Ruibarbo, *Sp.*; Hainoung, *Chin.*; Schara-modo, *Thibet.*

Notwithstanding the length of time that *rhubarb* has been in use, it has not yet been determined from what precise plant the Asiatic drug is derived, the remoteness of the region where it is collected, and the jealous care with which the monopoly of the trade is guarded, having prevented accurate information.

The terms *rha* and *rheon*, from the former of which were derived the names *rhabarbarum* and *rhubarb*, and from the latter the botanical title *Rheum*, were applied by the ancients to a root which came from beyond the Bosphorus, and which is supposed, though upon somewhat uncertain grounds, to have been the product of *Rheum rhaponticum* L., growing on the banks of the Caspian Sea and the Volga, This species was also at one time believed to be the source of the medicine now in use; but the true rhubarb has long been known to be wholly distinct from the Rhapontic, and derived from a different source. It was not until the year 1732 that any probable information was obtained as to its real origin. At that time plants were received from Russia by Jussieu in France, and Rand in England, which were said to be of the species affording the genuine rhubarb, and were named by Linnaeus, under this impression, *Rheum Rhabarbarum*, a title which has since given way to *Rheum undulatum*. Subsequently, Kaau-Boerhaave obtained from a merchant, who dealt in the rhubarb of Tartary, some seeds which he said were those of the plant producing the root sold by him. These, having been planted, yielded two species of Rheum. *R. undulatum*, and another which Linnaeus named *R. palmatum*. Seeds transmitted by Mounsey from St. Petersburg to Hope, and planted in the botanic garden at Edinburgh, produced the latter species, and the same was also raised at Upsal from a root received by Linnaeus from De Gorter, and was described in 1767 by the younger Linnaeus, two years after the appearance of Hope's paper in the Philosophical Transactions. Thus far the evidence appears equally in favor of *R. palmatum* and *R. undulatum*. Colonel Przewalski concluded from personal observation

that *R. palmatum* produces rhubarb; but the specimens of the root which he brought to St. Petersburg were stated by Dragondorff to be essentially different from true rhubarb. Claims have also been made from time to time for various other species of *Rheum* as sources of the drug. Pallas, upon exhibiting the leaves of *R. palmatum* to some Bucharian merchants, was told that the leaves of the rhubarb plant were entirely different in shape, and the description he received of them corresponded more closely with those of *R. compactum* than any other known species. Seeds of this plant were, moreover, sent to Miller from St. Petersburg as those of the true Tartarian rhubarb. Wallich, superintendent of the botanical garden at Calcutta, received seeds that were said to be those of the plant which yielded the Chinese rhubarb, growing on the Himalaya Mountains and the highlands of Tartary. These produced a species not previously described, which Wallich named *R. Emodi*, from the native title of the plant. It is the *R. australe* of Don and of Colebrooke, and has been ascertained to afford a root which, though purgative, is very unlike the official rhubarb. In 1867, French missionaries in Southeastern Thibet forwarded to Soubeiran of Paris, live specimens of a plant which they asserted to yield the true rhubarb, and Baillon subsequently described the flowering plant under the name of *R. officinale*. Its root resembles the true rhubarb, but the most careful cultivation has failed to obtain an identical product, and it cannot yet be considered as settled how far the commercial drug is obtained from it, Senier found that, as raised in England, the root of *R. officinale* yielded less than half the percentage of extract obtained from the East Indian drug. In ten grain doses the extract was decidedly cathartic.

Tschirch in discussing the origin of Chinese Rhubarb has come to the conclusion that that obtained from Szetschwan, "southern" rhubarb, is derived from *Rheum officinale*, while that obtained from Kukunoor, "northern" rhubarb, is the product of *Rheum palmatum tanguticum* (*A. Pharm.*, 1907, p. 680; and *S. W. P.*, 1910, xlviii, 292).

Hosseus (*P. J.*, 1911, 87, p. 429) as a result of study of material furnished by Tafel, a Tibetan explorer, concludes that the best medicinal rhubarb is derived from *R. palmatum*. He believes that the belief that some of it comes from the *R. officinale* or other species is due to the fact that Tibetans dig up the root of these other species of rhubarb for the purpose of deceiving Europeans.

All the plants of this genus are perennial and herbaceous, with large branching roots, which send forth vigorous stems from four to eight feet or more in height, surrounded at their base with numerous very large petiolate leaves, and terminating in lengthened branching panicles, composed of small and very numerous flowers, resembling those of the *Rumex* or dock. There is some difficulty in arranging the species, in consequence of the tendency of the cultivated plants to form hybrids, and it is frequently impossible to ascertain to which of the wild type's the several garden varieties are to be referred. Lindley, *Flora Medica*, states that *R. rhaponticum*, *R. hybridum*, and *R. compactum*, and their hybrids, are the common garden rhubarbs.

R. officinale Baillon is described in the *Pharmacographia* "as a perennial, noble plant, resembling the common garden rhubarb, but of larger size. It differs from the latter in several particulars: the leaves spring from a distinct crown rising some inches above the surface of the ground; they have a subcylindrical petiole, which, as well as the veins of the under side of the lamina, is covered with a pubescence of short erect hairs. The lamina, the outline of which is orbicular, cordate at base, is shortly 5- to 7-lobed, with the lobes coarsely and irregularly dentate; it attains 4 to 4¹/₂ feet in length, and rather more in breadth. The first leaves in spring display before expanding the peculiar metallic red hue of copper."

Besides the species already mentioned, *R. leucorrhizum*, growing in the Kirgheeze desert in Tartary, *R. capsicum*, from the Altai Mountains, *R. webbianum*, *R. speciforme*, and *R. moorcraftianum*, natives of the Himalaya Mountains and *R. crassinervium* and *R. hybridum*, cultivated in Europe, but of unknown origin, yield roots which have either been employed as purgatives or possess properties more or less analogous to those of official rhubarb, though they have not entered into general commerce. In Java, the root of an indigenous species is used as a purgative. According to the analysis of J. H. Schmidt, it contains more chrysophan and emodin, and less chrysophanic and rheotannic acids, than does the official drug.

According to Aitchison (*Nature*, July 9, 1885), a rhubarb plant has been found in Northern Afghanistan in which there are usually only three enormous root leaves four feet long and five feet broad, lying flat upon the ground. The fruit is large and of a brilliant scarlet. The root is said to possess purgative properties, but the fruit is preferred, and is given in

the form of a decoction.

Rhubarb is produced abundantly in the elevated lands of Tartary, about the lake Koko Nor, and is said to be cultivated in the neighboring Chinese province of Shensee, and in that of Sechuen. From these sources it is generally supposed that our supplies of Russian and Chinese rhubarb were exclusively derived; but the root is also collected in Bootan and Thibet, on the north of the Himalaya Mountains, and it is probable that the plant pervades the whole of Chinese Tartary. It flourishes best in a light sandy soil. It is stated by Bell, who, on a journey from St. Petersburg to Peking had an opportunity of observing it in a growing state, that it is not cultivated by the Tartars, but springs up spontaneously, in tufts, wherever the seeds have fallen upon the heaps of loose earth thrown up by the marmots. In other places the thickness of the grass prevents their access to the soil. The root is not considered sufficiently mature for collection until it has attained the age of six years. It is dug up twice a year in Tartary, in the spring and autumn; in China not till the winter. After removal from the ground, it is cleaned, deprived of its cortical portion and the smaller branches, and then divided into pieces of a convenient size. In China these are bored with holes, and strung upon cords to dry—according to Bell, about the tents and on the horns of sheep; according to Sievers, under sheds, by which the rays of the sun are excluded, while the air has free access. The Chinese are said first to place the pieces on a stone slab heated by fire beneath, and afterwards to complete the drying process by exposing them to the sun and air. In Bootan the roots are hung up in a kind of drying room, in which a moderate and regular heat is maintained. Much time and attention are devoted to the preparation of the root, and Sievers states that a year sometimes elapses from the period of its collection before it is ready for exportation. A large proportion of its weight is lost in drying, according to some accounts four-fifths, according to others not less than seven-eighths. It is probably in order to favor the drying that the periderm is removed. Rhubarb which has been dried by artificial heat is known commercially as high dried and often can be recognized by its more or less blackened surface, and its heavy, scarcely fragrant odor. The trade in rhubarb is said to have formerly centered in the Chinese town of Sinin, where a Bucharian company or family was established which possessed a monopoly of this trade in consideration of a tribute paid to the government. At present rhubarb is chiefly purchased for the European trade at the town of Hankow, on the upper Yangtse, the yearly export reaching over 5000 peculs (pecul =

133.33 lbs.). There were formerly two varieties of Asiatic rhubarb, the Russian and the Chinese, but at present little or no rhubarb finds its way overland to Europe. As long back as 1687, the Russian government subjected the export of rhubarb from China into Russia to official surveillance, and finally monopolized the trade entirely. At Kiakhta a very rigorous inspection of the drug was enforced, the selected pieces being finally sewed into linen sacks pitched and coated with hide. All the pieces which did not pass examination were committed to the flames, and the remainder was sent to St. Petersburg. This variety was sometimes called *Turkey rhubarb*, from the circumstance that it was formerly derived from the Turkish ports, whither it is said to have been brought from Tartary by caravans through Persia and Anatolia. Inferior parcels of the root, which could not pass the inspection of the Russian authorities, were said to enter Russia by Tashkend, and to be known to the druggists of that country by the name of *Tashkend rhubarb*. Russian rhubarb no longer occurs in commerce. The description of it is given in the U. S. D., 19th edition, page 1061.

CHINESE RHUBARB (*India Rhubarb, Rheum Sinense vel Indicum*) is in cylindrical or roundish pieces, sometimes flattened on one or both sides, of a dirty brownish-yellow color externally, appearing as if the cortical portion of the root had been removed by scraping, and the surface rendered smooth and somewhat powdery by attrition. The best pieces have a rather close and compact texture, and, when broken, present a ragged uneven surface, variegated with intermingled shades of dull red, yellowish, and white, which are sometimes diversified or interrupted by darker colors, and especially marked with dark lines so arranged as to form an internal ring of star-like spots. The pieces are generally perforated with small holes, intended for convenience of suspension during the drying process, and portions of the suspending cord are not unfrequently found remaining in the holes. According to Elborne (*P. J.*, xv, 497), Chinese rhubarb is the product of *R. palmatum* and *R. officinale*, the first variety has a red-grained fracture with white latticework veins, while the second variety has a longitudinal ramification of white veins with a black-grained fracture. Chinese rhubarb has a peculiar somewhat aromatic odor, and a bitter, astringent taste, is gritty when chewed, imparts a yellow color to the saliva, and affords a yellowish powder with a reddish-brown tinge. With the pieces of good quality others often come mingled, defective from decay or improper preparation. These are usually lighter, and of a dark or russet color. Like all the other varieties of rhubarb, this is liable to be

attacked by insects, and in almost every large parcel pieces may be found which have suffered from this cause. The Shensi variety is preferred, that of Sechuen and Kansuh are less valuable.

Chinese rhubarb is the only kind recognized by the U. S. P., and is officially described as " sub-cylindrical, barrel-shaped, or conical pieces known in commerce as 'rounds,' or in plano-convex pieces known in commerce as 'flats' or in irregularly formed pieces, frequently with perforations. It is hard and moderately heavy; attaining a length of 17 cm. and a diameter of 10 cm., often cut in pieces of variable form and size; outer surfaces yellowish-brown, mottled, with alternating, longitudinal striae of grayish-white parenchyma and reddish or brownish medullary rays; small stellate groups of fibro-vascular tissue and occasionally reddish-brown cork patches, smooth and sometimes covered with a bright, brownish-yellow powder; fracture uneven and granular, presenting a characteristic mottled appearance; odor aromatic, characteristic; taste characteristic, slightly bitter and astringent, gritty when chewed and tingeing the saliva yellow. Under the microscope, sections of Rhubarb show numerous thin-walled parenchymatous cells containing either a large number of starch grains or a single large rosette aggregate of calcium oxalate; scattered among the parenchyma are stellate groups of compound fibro-vascular bundles, the latter composed of narrow medullary rays separating the wedges, having large tracheae in the outer part and separated by a prominent cambium from an internal phloem or sieve; among the grayish-white parenchyma of the inner bark occur narrow, yellowish-brown, irregular medullary rays. Not more than 15 per cent. of the drug should show a hollow or dark central area. The powder is bright orange-yellow to yellowish-brown; becoming red with alkalis; when examined under the microscope it exhibits calcium oxalate in rosette aggregates, mostly from 0.05 to 0.1 mm. in diameter, occasionally attaining a diameter of 0.15 mm.; starch grains numerous, somewhat spherical, single or 2- to 4-compound, each with a single cleft, from 0.002 to 0.02 mm. in diameter; tracheal fragments few, mostly reticulate, occasionally spiral. Boil 0.1 Gm. of powdered Rhubarb with 10 mls of an aqueous solution" of potassium hydroxide (1 in 100); allow it to cool, filter, acidulate the filtrate with hydrochloric acid and shake it with 10 mls of ether; on standing the ethereal layer is colored yellow. Shake this ethereal solution with 5 mls of ammonia water; the latter is colored cherry-red (presence of *emodin*) and the ethereal layer remains yellow (presence of *chrysophanic acid*). Rhubarb, when exhausted with diluted alcohol,

yields not less than 30 per cent. of dry extract. Rhubarb yields not more than 13 per cent. of ash." *U. S.*

"In compact, firm, cylindrical, barrel-shaped, conical or plano-convex pieces, often perforated, the perforation sometimes containing a fragment of cord. Surface rounded or slightly angular, but not shrunken, marked with reddish-brown lines embedded in a whitish ground-substance; usually covered with a bright brownish-yellow powder. Fracture granular and uneven, the pinkish-brown fractured surface exhibiting numerous reddish-brown points and lines on a white ground-substance. For a short distance within the cambium the structure is radiate; within this there' is a more or less distinct ring of closely approximated vascular bundles with central bast and radiating, reddish-brown medullary rays; in the parenchymatous cells abundant starch grains, an amorphous yellow substance and very large cluster-crystals of calcium oxalate. In powdered Rhubarb large cluster-crystals of calcium oxalate, often more than 100 microns in diameter, simple or compound starch grains, the single grains seldom exceeding 20 microns in diameter, fragments of reticulated vessels and of parenchymatous tissue, and small yellowish masses and globules which assume a reddish-pink color with solution of ammoniac it is free from added starch and from sclerenchymatous cells and fibres. Characteristic, somewhat aromatic odor; taste bitter, slightly astringent. Ash not more than 15 per cent." *Br.*

EUROPEAN RHUBARB.—In various parts of Europe, particularly in England, France, Belgium, and Germany, the rhubarb plants have been cultivated for many years, and considerable quantities of the root were at one time brought into the market. At present it appears not to be imported into the United States.

English Rhubarb.—This formerly came in two forms. In one the root was cut and perforated in imitation of the Russian. The pieces were of various shapes and sizes, sometimes cylindrical, but more commonly flat, or somewhat lenticular, and of considerable dimensions. In the other, the so-called *stick rhubarb*, the pieces were somewhat cylindrical, five or six inches long by an inch or less in thickness, and more or less irregular upon the surface, as if they had shrunk unequally in drying. English rhubarb (from *Rheum rhaponticum*) is lighter than the Asiatic, more spongy, and often somewhat pasty under the pestle. It is redder, and when broken exhibits a more compact and regular marbling, the

pinkish lines being arranged like rays from the centre towards the circumference. The " star-like spots " are either wanting or very few and scattered. The powder also has a brighter yellow tint. The odor is feeble and less aromatic than that of the Asiatic varieties; the taste is astringent and mucilaginous, with little bitterness, and the root, when chewed, scarcely feels gritty between the teeth, and but slightly colors the saliva. Few crystals of calcium oxalate are discoverable by means of the microscope. Much English rhubarb is obtained from *R. officinale*, and is put on the market in flat, concave, and convex pieces weighing from three to four ounces each. Externally the convex surface has deep longitudinal furrows and a longitudinal ramification of conspicuous veins, giving rise to an appearance of net-vein markings. In the centre of the concave surface is a small hole similar to that formerly seen in Russian rhubarb. On the inner surface the stellate markings resemble very closely those found in the East Indian rhubarb. The fracture of this form is not red, but shows a whitish parenchymatous tissue with blackish veins. When rapidly grown in rich soil, English rhubarb is lighter, more spongy, and less active than when slowly grown without high cultivation. It is probable that the powder is used to adulterate that of true Asiatic rhubarb, but of this we have no positive evidence.

French Rhubarb. Rhapontic Rhubarb. Crimea Rhubarb.—The rhubarb produced in France is, according to Guibourt, chiefly from *R. rhaponticum*, *R. undulatum*, and *R. compactum*, that of *R. palmatum*, which most closely resembles the Asiatic, having been found to degenerate so much as not to be a profitable object of culture. Most of the French rhubarb is produced in the neighborhood of L'Orient, in the department of Morbihan, and the spot where it grows has, from this circumstance, received the name of Rheumpole. Two kinds were described by Guibourt, both under the name of *Rhapontic root*—one proceeding from the *R. rhaponticum*, growing in the gardens in the environs of Paris; the other, from this and the two other species above mentioned, cultivated at Rheumpole.

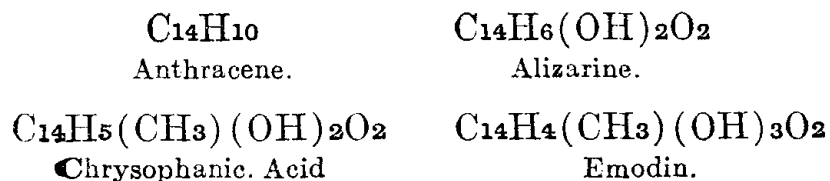
Rhapontic rhubarb is still found to some extent in European markets. Tschirch has proposed a ready method for detecting the admixture. It depends on the insolubility in ether of the crystalline principle rhaponticin or ponticin. (*A. Pharm.*, 1905, p. 443; and *S. W. P.*, xliii, p. 253.) Hesse has also made an elaborate study on the chemistry of rhapontic root grown in Austria. (*J. f. prakt. Chem.*, 1908, lxxvii, p. 320.)

The *rhapontic* root differs in section from true rhubarb by its distinctly radiated structure, unbroken by the peculiar arrangement (star-like spots) of the vascular tissue which occurs in true rhubarb.

Choice of Rhubarb.—In selecting good rhubarb, without reference to the commercial variety, those pieces should be preferred which are moderately heavy and compact, of a bright color, brittle, presenting when broken a fresh appearance, with reddish and yellowish veins intermingled with white, of an odor decidedly aromatic, of a bitter and astringent not mucilaginous taste, feeling gritty and staining the saliva yellow when chewed, and affording a powder either bright yellow, or yellow with but a slight reddish-brown tinge. When very light, rhubarb is usually rotten or worm-eaten; when very heavy and compact, it is of inferior species, culture, or preparation. Rotten, worm-eaten, or otherwise inferior rhubarb is often powdered, and colored yellow with turmeric, and the shavings left when Chinese rhubarb is trimmed for powdering, or to imitate the Russian, are applied to the same purpose. The stellate markings observed in the cut or broken surface of the Chinese rhubarb has been believed by various pharmacologists to be of great practical value in determining the true character of the rhizome and especially in enabling a distinction between the Chinese and European rhubarb to be made. There has been a general concurrence with the statements of Tschirch that the star spots are never present in the root, occurring only in the rhizome. In an elaborate re-examination of this subject by Jakabhasy, however, the star spots were found in the root as well as in the root stock and also in the European as well as in the Asiatic rhubarb. Nevertheless, Jakabhasy states that it is possible to distinguish the two rhubarbs by the fact that in the European Rhubarb the star spots occur in greater number on the longitudinal section while in the Chinese rhubarb they are present on the transverse section, where they form a circle. He believes also that the superabundance of starch and the lack of crystals in the star spots are diagnostic of the European drug. When the rhubarb is powdered these characteristics are not available, under which circumstances the percentage of ash seems to be valuable. The Chinese rhubarb, unless of very inferior quality yields from 8 to 25 per cent.; the European 1.3 to 6 per cent. of ash. According to Jakabhasy, Shensi is the best, Shanghai the poorest, and Canton the intermediate variety of Chinese rhubarb. Of the European the English is the most, the French next, and the Austrian the least active.

Chemical Properties.—Rhubarb yields all its activity to water and alcohol. The infusion is of a dark reddish-yellow color, with the taste and odor of rhubarb, and the residue, after sufficient maceration, is whitish, inodorous, and insipid. By long boiling the virtues of the medicine are impaired. The first examination of rhubarb yielding results of value was that of Schlosberger and Ddpping. Besides extractive, tannic and gallic acids, sugar, starch, pectin, lignin, calcium oxalate and various inorganic salts, they discovered three coloring principles, holding an intermediate place between re'sin and extractive matter, being freely soluble in alcohol, and slightly so in water. Two of these were uncrystallizable, and denominated *brown resin* and *red resin*, or *phaeoretin* and *erythroretin*; the other, crystallizable in granular crystals, and identical with chrysophanic acid; previously discovered by Rochleder and Heldt in the yellow lichen, or *Parmelia parietina* of Sprengel. Chrysophanic acid crystallizes in golden-yellow needles or plates melting at 102° C. (215.6° F.), and is soluble in ether, alcohol, or benzene. Alkalies also dissolve it, forming fine dark red solutions. Its formula is C₁₅H₁₀O₄, and it is now: recognized as a derivative of anthracene, C₁₄H₁₀, and as closely related to alizarine, C₁₄H₈O₄. It bears to methyl-anthracene, C₁₄H₉(CH₃), the same relation that alizarine bears to anthracene. Hence, on distilling it with zinc dust, methyl-anthracene is formed from it by reduction.

De La Rue and Muller (*J. Chem. S.*, x, 298) extracted from rhubarb emodin, which crystallizes in orange-colored prisms. Its formula is C₁₅H₁₀O₅, and it is a trioxymethylanthraquinone. The relations of both this compound and chrysophanic acid to alizarine and anthracene will be better shown by writing their molecular formulas, as follows:



Kubli (*Ph. Z. R.*, 6, p. 603) obtained results both confirmatory and explanatory of those already given. He found a glucoside, *chrysophan*, C₂₇H₃₀O₁₄, which, under the influence of dilute acids or ferments, splits

up into chrysophanic acid and sugar, according to the reaction $C_{27}H_{30}O_{14} + 2H_2O = C_{15}H_{10}O_4 + 2C_6H_{12}O_6$ also a characteristic tannic acid, *rheo-tannic acid*, $C_{27}H_{30}O_{14}$, which is decomposed by dilute acids into *rheumic acid*, $C_{20}H_{16}O_9$, and sugar. Chrysophan is a yellowish powder, abundantly present in rhubarb, soluble in water or alcohol, not in ether; rheo-tannic acid is a reddish brown powder, sparingly soluble in cold water. Kubli found further a colorless neutral compound, sparingly soluble in hot water, of the formula $C_{10}H_{12}O_4$, which he did not name. He stated that chrysophanic acid is not found in rhubarb, but is produced when the root is digested in water through the breaking up of the glucoside *chrysophan*, probably under the action of a ferment. This ferment he believes to be soluble in water, but insoluble in alcohol, and that on this account an alcoholic extract of the root can be evaporated without the formation of chrysophanic acid. On the other hand, it is to the presence of this ferment that he attributes the progressive deposition of chrysophanic acid from an extract of rhubarb prepared with diluted alcohol. (*Ph. Z. R.*, xxiv, 193.) O. Hesse (*Proc. A. Ph. A.*, 1896, 549) found in addition to chrysophanic acid, $C_{15}H_8O_2(OH)_2$, and emodin, $C_{15}H_7O_2(OH)_3$, a third crystalline principle, which he named *rhein*, and ascribes to it the formula $C_{15}H_6O_2(OH)_4$. Hesse calls attention to the relation these formulas bear to one another. Rhein forms microscopic yellowish-brown scales, is insoluble in water, ether, and benzene, but sparingly soluble in alcohol. It dissolves readily in aqueous solutions of the alkalis and alkaline carbonates, forming deep purple-red solutions. Hesse also finds an amorphous resinous substance, upon which, he states, the entire activity of rhubarb depends. Dragendorff states that from 11 to 17 per cent. of arabic acid and pectose are present in rhubarb. Hunkel (*Ph. Archiv.*, Nov., 1900, 201) reviewed the investigations of various chemists and isolated tannin by the process of Lowe and a phenolic body (unnamed) which had not been previously described.

The most important researches upon the constituents of rhubarb were made by Tschirch and Heuberger (*A. Pharm.*, Nov. 21, 1902, 596, 630, and *Ph. Ztg.*, Aug. 3, 1904, 651). Their conclusions are that rhubarb contains primarily two classes of substance's. 1. *Tannoglucosides*; 2. *Anthraglucosides*. These two classes cannot be sharply separated from each other and are therefore associated together in all extractions. Both of these are characterized by their ready decomposition and conversion into secondary products, such conversion resulting even during the

treatment of the drug with ordinary solvents. Thus, the ether extraction has been found to contain the products of the hydrolysis of the anthraglucosides, namely, chrysophanic acid, emodin and rhein. It is however not proven (indeed not even probable) that the tannoglucosides combine with the anthraglucosides to form so-called double glucosides. On the contrary, the indications are that these two classes of glucosides occur beside each other; furthermore, the relatively large quantity of tannoglucosides and their hydrolytic products is noteworthy and that, therefore, the activity of rhubarb is not attributable solely to the anthraglucosides; but the activity of the latter must be materially modified by that of the tannoglucosides. To what degree the primary tanno- and anthraglucosides have become hydrolyzed in the drug itself, it is difficult to determine; it is certain, however, that the drug contains a considerable quantity of free oxy-methylantraquinones, while it is probable that the formation of the secondary glucosides results during the extraction and manipulation of the extract.

Tschireh sums up the results of the investigation as follows: Aweng's *Double Glucoside* is in its essentials identical with tannoglucoside, but contains some anthraglucoside. Aweng's *Frangulic Acid* is a secondary product of the decomposition of tannoglucoside, containing variable quantities of anthraglucoside as impurity. Kubli's *Rheumtannic Acid* and Hunkel's *Tanoid* are identical with tannoglucoside, but less pure. Kubli's and Hunkel's *Rheum Acid* is identical with *rheum red*, and therefore a product of the hydrolysis of tannoglucoside. Schlossberger and Dopping's *Aporetin* and *Phaeoretin* are impure, difficultly soluble tannoglucoside. *Erythroretin* is a mixture of chrysophanic acid, emodin and rhein. Garot's *Erythrose* is *chrysamic acid*. *Rhein*, yielding only a diacetyl derivative, cannot be regarded as being tetraoxymethyl-anthraquinone. It has the composition $C_{15}H_8O_6$ (not $C_{15}H_{10}O_6$, Hesse) which formula corresponds to a methylene ether of a tetraoxyanthraquinone. Dragendorff's, Greenish's and Elborne's *Cathartic Acid* is an impure tannoglucoside, containing anthraglucosides and some albuminoid substances. Gilson's *Chrysophan* belongs to the anthraglucosides. Aweng's Secondary Glucosides are secondary, mostly difficultly soluble hydrolytic products of the primary tanno- and probably also of the anthraglucosides.

Finally, Tschirch determined that rhubarb contains no resins whatever; that the rheo-tannoglucosides and their products of decomposition and

hydrolysis are devoid of purgative activity, and that such activity is due solely to the anthraglucosides and their derivatives. Rhubarb contains no other body besides the latter that has peristaltic effect on the intestinal tract.

As regards the rheo-tannoglucoside, its medicinal activity is confined to the tonic and mildly astringent effect produced on administering the drug. Tsehirsch (*Ph. Ztg.*, Aug. 3, 1904, 651) recommended a method for assaying rhubarb based on the volumetric estimation of the free oxymethylantraquinones, dependent on the ease with which the anthraglucosides can be hydrolyzed with sulphuric acid. See also *Proc. A. Ph. A.*, 1905, 627.

There are other interesting principles in rhubarb. Some have been disposed to ascribe its odor to a volatile oil, but this has not been isolated. The calcium oxalate is interesting from its quantity, and from the circumstance that, existing in distinct crystals, it occasions the grittiness of the rhubarb between the teeth. The proportion seems to vary exceedingly in different specimens. According to Scheele and Henry, it constitutes nearly one-third, and Queckett found between 35 and 40 per cent., while Brandes obtained only 11, Schrader only 4.5 parts in the hundred, and Dragendorff, in five samples analyzed, from 1.2 to 5.6 per cent. Little or no difference of composition has been found between the Russian and the Chinese rhubarb. The European contains but a small proportion of calcium oxalate, and is therefore less gritty when chewed. It has, however, more tannin and starch than the Asiatic.

When powdered rhubarb is heated, odorous yellow fumes rise, which are probably in part the vapor of chrysophanic acid. Its infusion is reddened by the alkalis, in consequence of their union with this acid, and their reaction on the other coloring principles. It yields precipitates with gelatin, most of the acids, ferric salts, lead acetate, mercurous nitrate, silver nitrate, stannous chloride, lime water, and solutions of quinine. Nitric acid occasions at first a turbidness, and afterwards the deposition of a yellow precipitate. The substances producing precipitates may be considered as incompatible with the infusion.

For a method of detecting the presence of turmeric in powdered rhubarb by the influence of chloroform on the coloring principles of each of these substances, and of distinguishing through the same agency between the true Chinese rhubarb and that of European origin, the reader is

referred to a paper, by W. L. Howie, contained in *A. J. P.* (Jan., 1874, 16), from *P. J.* (Nov. 15, 1873); see also *P. J.*, 1898, 126.

Uses.—Rhubarb contains cathartic principles of the anthraquinone series. It differs from drugs of this group—such as aloes, cascara, etc.—in that it has a larger percentage of tannic acid. On account of the considerable quantity of tannin its purgative action is often followed by constipation. This sequence of effects has led to its use in the treatment of diarrheas, especially of the inflammatory type, on the theory that the catharsis it caused would evacuate the irritant *materies morbi*, and that its subsequent astringency would check the excessive secretion. The logic is plausible, but erroneous. As the action of its cathartic principles is limited to the lower bowel it has very little influence in cleaning out the smaller bowel which is the more frequently involved in acute *diarrheas*. In inflammations of the colon, such as *dysentery*, its use might appear more reasonable, but even here it is greatly inferior to less irritant laxatives because it acts chiefly by virtue of its local irritant influence. Rhubarb is also widely prescribed in atonic *dyspepsia* attended with *constipation*. It is frequently combined with an alkali, either magnesia or soda.

It sometimes occasions griping. Its coloring principle is absorbed, and may be detected in the urine. By its long-continued use the perspiration, especially that of the axilla, is said to become yellow, and the milk of nurses cathartic. It gives a yellow color to the alvine discharges.

By the roasting of rhubarb its cathartic property is diminished, probably by the volatilization of the purgative principle, while its astringency remains unaffected. When so treated it is termed *torrefied rhubarb*. This mode of treatment has been sometimes resorted to in cases of *diarrhea*. By long boiling the same effect is said to be produced.

Powdered rhubarb has been usefully applied to indolent and sloughing *ulcers*. It is said to have proved purgative when sprinkled over a large ulcerated surface, and the same effect is asserted to have been produced by rubbing it, mingled with saliva, over the abdomen.

European rhubarb must be administered in double or treble the dose of true rhubarb to produce an equal effect. Few medicines are used in a greater variety of forms. It is most effectual in substance. It is frequently given in the shape of pill, combined with an equal proportion of soap

when its laxative effect is desired. The infusion is much used in cases of delicate stomach, and is peculiarly adapted to children. The syrup, tincture, and fluidextract are also useful preparations. They are all official. The formula for *mixture of rhubarb and soda* which was largely used in New York at one time will be found in the National Formulary IV. The name was changed to *Mistura Rhei Composita*.

Dose, as a purgative, from twenty to thirty grains (1.3-2.0 Gm.); as a laxative and stomachic from five to ten grains (0.32-0.65 Gm.).

Off. Prep.—Fluidextractum Rhei, *U. S.*; Extractum Rhei, *U. S., Br.*; Infusum Rhei, *Br.*; Liquor Rhei Concentratus, *Br.*; Pilulae Rhei Compositae, *U. S. (Br.)*; Pulvis Rhei Compositus, *U. S.; Br.*; Syrupus Rhei (from Fluidextract), *U. S.; Br.*; Syrupus Rhei Aromaticus (from Aromatic Tincture), *U. S.*; Tinctura Rhei, *U. S. (Br.)*; Tinctura Rhei Aromatica, *U. S.*; Tinctura Rhei Composita, *Br.*; Elixir Catharticum Compositum (from Fluidextract), *N. F.*; Fluidglyceratum Rhei, *N. F.*; Mistura Opii et Rhei Composita (from Tincture), *N. F.*; Mistura Rhei Alkalina (from Fluidextract), *N. F.*; Mistura Rhei Composita (from Fluidextract), *N. F.*; Pilulae Antiperiodicae, *N. F.*; Pilulae Antiperiodicae sine Aloe, *N. F.*; Pilulae Rhei, *N. F.*; Pulvis Rhei et Magnesias Anisatus, *N. F.*; Syrupus Sennae Aromaticus, *N. F.*; Syrupus Sennae Compositus (from Fluidextract), *N. F.*; Tinctura Antiperiodica, *N. F.*; Tinctura Antiperiodica sine Aloe, *N. F.*; Tinctura Rhei Aquosa, *N. F.*; Tinctura Rhei Dulcis, *A. F.*; Tinctura Rhei et Gentianae, *N. F.*; Tinctura Zedoarias Amara, *N. F.*; Vinum Rhei Compositum (from Fluidextract), *N. F.*

Rhizophora Mangle.—The red bark of the South American *mangrove tree* has been used for many years by the natives as a febrifuge but more recently Duque and Moreno (*S. M.*, 1905, p. 479) have claimed that it is a specific in *leprosy*. They administer a beginning dose of one fluidrachm (3.75 mils) of the fluidextract twice a day which is gradually increased until the patient is taking a fluidounce and a half (45 mils) daily.

Rhododendron. *Rhododendron Chrysanthemum* Pall. *Yellow-flowered Rhododendron. Rosebay. Snowrose. Rosage, Fr. Alpenrose, Schneerose, Gichtrose, G.* (Fam. *Ericaceae*).—The leaves of this rhododendron have long been employed in Siberia as a remedy in *rheumatism*, and to a less extent in *gout* and *syphilis*. They yield their virtue to water and alcohol, and, according to von Archangelski, contain three proximate principles; *rhododendrol*, $C_{10}H_{12}O_2$; *rhododendrin*, $C_{16}H_{22}O_7$; and a glucoside resembling digitalin and very toxic. The *dose* of the dried leaves is said to be two drachms (7.7 Gm.), given in infusion.

G. F. Kuehnel found in leaves of the "great laurel," *Rhododendron maximum* L., a common shrub in the Alleghenies from New York to Georgia, *arbutin*, *ericolin*, and *ursone*. (*A. J. P.*, 1885.)

RHŒADOS PETALA. Br.

RED POPPY PETALS

"Red-Poppy Petals are the fresh petals of *Papaver Rhoëas*, Linn." *Br.*

Corn Poppy, Corn Rose; Coquolicot, *Fr. Cod.*; Pavot rouge, *Fr.*; Wilder Mohn, Klapperrose, Llatschroaen, *G.*; Rosolaccio, *It.*; Amapola (Flor de), *Sp.*

The *red* or *corn poppy*, *Papaver Rhoëas*, is distinguished by its hairy stem, which is branched, and rises about a foot in height, by its incised pinnatifid leaves, by its urn-shaped capsule, and by the full, bright, scarlet color of its petals. It is a native of Europe, where it grown wild in great abundance, adorning especially the fields of grain with its brilliant flower. It has been naturalized in this country.

Its capsules contain the same kind of milky juice as that found in *P. somniferum*, and an extract has been prepared from them having the properties of opium; but the quantity is too small to repay the trouble of its preparation. Filhol has shown that the extract contains morphine, but in a proportion exceedingly minute compared with that in which it exists in opium. The petals are the official portion. They have a characteristic odor, and a mucilaginous, slightly bitter taste. By drying, they lose their odor, and assume a violet-red color. "Transversely elliptical, about five centimetres wide, bright scarlet, smooth and lustrous; margin entire. Characteristic, somewhat unpleasant odor; taste slightly bitter." *Br.*

Chevallier believed that he had detected a very minute proportion of morphine in an extract obtained from them; but Attfield seems to have determined satisfactorily the non-existence of morphine in the petals, having sought this alkaloid by three different processes, using a pound of the petals in each experiment, and failed to detect the least evidence of its presence. (*P. J.*, Oct., 1873, p. 291.) Their operation on the system is exceedingly feeble, and they are valued more for their beautiful scarlet color, which they communicate to water, than for their medicinal virtues. According to Leo Meier, the coloring principles of the flowers are

two acids, which he denominates *rhoeadic* and *papaveric acids*. (See *A. J. P.*, xviii, 211.) A syrup is prepared from them, which was formerly prescribed as an anodyne in catarrhal affections, but is now little esteemed except for its color.

An alkaloid was discovered in this species of poppy by O. Hesse, who proposed to name it *rhoeadine*. It seems to pervade all parts of the plant, from which, as the first step in its preparation, an aqueous extract is prepared. This is treated with sodium carbonate, and repeatedly agitated with ether; the ethereal liquid is shaken with a solution of sodium bitartrate, and the mixture is precipitated by ammonia. The precipitate is washed with cold water, dried, and boiled with alcohol, by which coloring matter and another alkaloid in small quantity, probably thebaine, are removed. The residue, consisting mainly of rhoeadine, is purified by combining it with acetic acid, treating with animal charcoal, and precipitating with ammonia. The alkaloid is in small white prismatic crystals, tasteless, fusible at 232.2° C. (450° F.), becoming brown at the same temperature and partially subliming. It is almost insoluble in water, alcohol, ether, chloroform, benzene, ammonia, solution of sodium carbonate, and lime water, but is dissolved by dilute acids, which produce colorless solutions. Its composition is represented by the formula $C_{21}H_{21}O_6N$. It does not appear to be poisonous. Hydrochloric and sulphuric acids, moderately concentrated, decompose and dissolve it, with the production of a purple color, which disappears under the action of the alkalis, but is restored by acids. One part of the alkaloid so treated produces a purple color with 10,000 parts of water, rose color with 20,000 parts, and a perceptible redness with 800,000 parts. This change is dependent upon the liberation from the rhoeadine of a red coloring matter, while the isomeric rhoeagenine remains. This forms small white tasteless prisms, which fuse at 223° C. (433.4° F.) and do not sublime, but are decomposed at higher temperatures. This is a very delicate test, by means of which the alkaloid may be detected in all parts of *Papaver Rhoeas*, in the ripe capsules of the opium poppy, and in opium itself. It is said also to exist in Merck's prophyroxine. (*A. J. P.*, 1867, p. 122.) According to Hesse, the milky juice also contains meconic acid.

Off. Prep.—Syrupus Rhoeados, Br,

Rhus.—The genus *Rhus* contains various species which have the property—probably even without direct contact—of so violently irritating susceptible skins as to produce severe dermatitis. Of these poisonous species there are six which are indigenous to the United States.

R. vernix L. (*R. venenata* DC.) — *Swamp Sumac, Poison Sumach, Poison Elder* is our most poisonous species. It is a handsome shrub or small tree, usually ten or fifteen feet high. The bark of the trunk is dark gray, of the branches lighter, of the extreme twigs and petioles pale to deep red. The leaves are pinnate, with three to six pairs of opposite leaflets, and an odd terminal one. These are oblong or oval, entire or slightly sinuate, acuminate, smooth, and, except the one at the end, nearly sessile. The flowers are polygamous, very small, greenish, and in loose or slender axillary panicles. The berries are small, roundish, and greenish white. The tree grows in swamps and low grounds from Canada to Carolina, and flowers in June and July. It was confounded by the older botanists with *R. vernicifera* DC., of Japan, the Japanese lacquer tree, which has similar poisonous properties. Its activity is said to depend upon *urushic acid*.

Rhus Michauxii Sargent (*R. pumila* Michx.) is a rare Southern species, growing in upper Carolina and Georgia, and not more than a foot in height. It is characterized by its pubescent branches and petioles, by its pinnate leaves, with many pairs of oval, nearly acuminate, incised- dentate leaflets, downy beneath, and by its silky fruit. According to Pursh, it is the most poisonous of the genus.

Rhus diversiloba Torrey and Gray (*R. Lobata* Hooker) is found on our Pacific border. It is there generally known as *Poison Oak*, and closely resembles the common poison ivy or poison oak- (*R. Toxicodendron* L.)

Rhus Metopium L. (*Metopium Linnaea*, Engelm.), *Mountain Manchineel, Coral Sumac*, is a West Indian species, growing also in the "hummock" lands of Southern Florida. It is a small tree, the bark, when wounded, exuding a gum-resin (*hog gum*) to which medicinal properties are ascribed. The leaves are pinnate with fine leaflets. To the acid red fruit is due the name Coral Sumac. It is exceedingly poisonous.

Rhus Toxicodendron (*R. radicans* L.), *Poison Oak, Poison Ivy*, whose fresh leaves were formerly official in the U. S. Pharmacopoeia under the name of *Rhus Toxicodendron*, U. S., 1890, is a woody vine climbing by numerous aerial rootlets to considerable heights and showing considerable variation. The leaves are 3-foliolate, the leaflets being ovate or rhombic, 2.5 to 15 cm. long, entire or sparingly dentate or sinuate, acute or short-acuminate, the lateral sessile or short-stalked, are inequilateral, the terminal ones stalked. The flowers are green, 3 mm. broad, in loose axillary panicles, 2 to 8 cm. long; the fruit globose-oblong, whitish or cream' colored, resembling that of *R. Vernix*.

The milky juice, of the poisonous species of *Rhus*, becomes black on exposure to the air, and leaves upon linen or other cloth a stain, which cannot afterwards be removed by washing with soap and water, or by alcohol either hot or cold, but deepens by age. It has been proposed as an indelible ink. Ether dissolves it; applied to the skin it frequently causes inflammation and vesication.

While there is a fairly general agreement that the toxic constituent of the poisonous species of *Rhus* is a non-volatile substance, there is much evidence that there is a volatile poison also in this plant. (Bessey, *A. J. P.*, 1914, p. 112.) Several authors are inclined to explain the poisoning which results to sensitive persons who pass near *Rhus* plants without touching them, by saying that the poison resides in the pollen and the plant hairs. The latter may be carried by air currents or may be transported on clothes, or tools, or animals, which after brushing against the plant are able to transfer the poison to susceptible persons. Warren (*A. J. P.*, 1913, p. 548) was unable to detect a poisonous principle in the pollen grains of *Rhus Vernix*. See also Tschirch and Stevens, *A. J. P.*, 1906, p. 63. Besides the unidentifiable poisonous principle of *rhus* there is present an iron greenening tannin, chlorophyll, wax, fixed oil, resin, sugar, albumen, pectin, gum, starch, and oxalic acid.

The poisonous *rhus* when taken internally appears to be possessed of narcotic besides irritant properties, vomiting, drowsiness, stupor, dilated pupils, convulsive movements, delirium, and fever having been present in poisoning by them. (*Am. J. M. S.*, April, 1866; also *M. Rep.*, Nov., 1867.) The tincture of *rhus* has been used especially by homeopathic practitioners in the treatment of *sub-acute* and *chronic rheumatism*, and the practice hastound imitation.

Some years ago H. C. Wood made extended trials of the remedy, using a homeopathic tincture obtained from a homeopathic pharmacy, in various doses (homeopathic, small, and large), upon a large number of cases of *subacute*, *chronic*, and *acute rheumatism*, in the Philadelphia Hospital, but he was not able to perceive that the patients progressed more rapidly when taking it than when they were simply nursed. The best preparation would undoubtedly be a concentrated alcoholic tincture, made from the green drug; strength of one to four. The dose, of a 25 per cent. tincture given by H. C. Wood was from one to five minims (0.06-0.3 mil), three times a day. The solid extract is an ineligible preparation, owing to the extreme volatility of the active principle of the crude drug.

Rhus canadensis Marsh. (*R. aromatica* Ait) (Fam. *Anacardiaceae*). —This indigenous plant, growing in dry soil from Maine and Southern Ontario to Florida and westward, has been highly recommended in the treatment of nocturnal incontinence of urine by a number of clinicians of repute. (See *G. H. M. C.*, 1889; also *Annals of Gyncaec.*, 1890.) For elaborate description of the bark, see *Newer Materia Medica*. The adult dose is twenty or thirty minims (1.3-1.8 mils) of the fluidextract of the bark, three times a day, given in aromatized solution.

Rhus Glabra. *N. F. IV (U. S. VIII). Rhus Glabrum. U. S. 1870. Sumac Berries. Sleek. Scarlet. White Sumach. Shoe-make. Vinegar Tree. Sumac, Fr. Sumach, Gr.*—"The dried, ripe fruit of *Rhus glabra* Linne (Fam. *Anacardiaceae*), without the presence of more than 5 per cent. of stems or other foreign matter." *N. F.*

Rhus glabra called variously *smooth sumach*, *Pennsylvania sumach*, and *upland sumach*, is an indigenous shrub from four to twelve feet or more in height. The leaves

are upon smooth petioles, and consist of numerous opposite leaflets, with an odd one at the extremity, all of which are lanceolate, acuminate, acutely serrate, glabrous, green on their upper surface, and whitish beneath. In the autumn their color changes to a beautiful red. The flowers are greenish red, and disposed in large, erect, terminal compound thryses. The fruit is in clusters of small crimson berries.

The shrub is found in Canada and almost all parts of the United States, growing in old neglected fields, along fences, and on the borders of woods. The flowers appear in July, and the fruit ripens in the early part of autumn. The bark and leaves are astringent, and are largely used, especially the leaves, in tanning leather and in dyeing. The sumach for the manufacture of extract for tanners' use is largely cultivated in Virginia, where the annual crop reaches from 7000 to 8000 tons, and is collected at any time between the first of July and the appearance of frost.

The berries have a sour, astringent, not unpleasant taste, and are often eaten by the country people with impunity. They are described in the National Formulary IV as follows:

"Nearly globular, ovoid, more or less reniform, somewhat compressed, about 5 mm. in length and 2 mm. in diameter; externally dark red, velvety with short hairs, summit with remains of the short style, base occasionally with the five-cleft calyx and a short pedicel; endocarp, smooth, shiny, light red; one-celled, one-seeded; seeds dark brown, smooth. Inodorous; taste acidulous and slightly astringent. The powder is brownish-red, and, when examined under the microscope, exhibits irregular fragments; non-glandular hairs, more or less elliptical or ovoid or spatulate, about 0.15 mm. in length and from 0.045 to 0.08 mm. in width, filled with a pink or red cell sap in which occasionally occur rod-shaped crystals; glandular hairs with a short one-celled stalk and multicellular head, from 0.045 to 0.075 mm. in length; fragments of endosperm numerous; fragments of endocarp showing very small stone cells with irregularly thickened walls, readily determined by the use of aniline sulphate T.S. and sulphuric acid; fragments of embryo with rather small cells containing a fixed oil; occasional reddish colored fragments of epidermis and underlying spiral tracheae of the mesocarp. Mix 1 Gm. of powdered *Rhus Glabra* with 10 mils of hot water, shake the mixture occasionally until cold, filter, and allow the filtrate to evaporate spontaneously in a watch crystal; numerous, feather-shaped crystals separate which polarize light strongly with a distinct play of colors. *Rhus Glabra* yields not more than 4 per cent. of ash." *N. F.*

W. J. Watson ascertained that free malic acid and acid calcium malate coexist in the berries, which contain also, upon the same authority, tan-nic and gallic acids, fixed oil, extractive, red coloring matter, and a little volatile oil. (*A. J. P.*, xxv, 194). A medicinal wine has been prepared from the fruit. (*M. S. R.*, Feb. 9, 1867.) For a paper on the relative proportion of the constituents found in the husk and seed portion of the fruit by Frankforter and Martin, see *A. J. P.*, 1904, 151.

Excrescences are produced under the leaves resembling Chinese galls in character, and containing large quantities of tannic and gallic acids. These have been used as a substitute for the imported galls by Walters of New York, who thought them in every

respect preferable. They may be collected at little expense, as they are produced very abundantly, especially in the Western States.

Henry Trimble collected some galls from the leaves of *R. glabra* and found that they contained 61.70 per cent. of tannin, reckoned on the weight of the air-dried galls, or 70.90 per cent. of the weight of absolutely dry material. (*A. J. P.* 1890, p. 564.)

From the experiments of Stenhouse (*A. J. P.*, xxxiv, 252), it appears that the tannic acid of sumach is identical with that of galls, being, like it, resolved, under the influence of sulphuric acid, into glucose and gallic acid, and this change is supposed to take place spontaneously in sumach when long kept.

The percentage of tannin in Virginia, sumach rises at times as high as 27 per cent., but falls a few per cent. below this as the season advances. Samples of leaves gathered along the Mississippi near Dubuque, Iowa, in July and August, yielded 16.36 per cent. and 15.75 per cent. respectively. (*A. J. P.*, 1888, p. 389.) The proportion of tannic acid in the European sumach falls from 6 to 8 per cent. below the percentage of the Virginia sumach, yet the European is much preferred by tanners and dyers. By using Sicilian sumach it is possible to make the finer white leathers so much used for gloves and fancy shoes, while by the employment of the American product the leather has a yellow color, apparently due to a coloring matter, which, according to Loewe, consists of quercitrin and quercetin, and exists in larger quantity in the American than in the Sicilian drug. Enormous quantities of a dark-red, semi-fluid, bitter, astringent extract are prepared in Virginia from sumach, and used both in America and in Europe. It is said to contain from 25 to 30 per cent. of tannin.

Recently the fruits of *Rhus glabra* have been replaced by those of the *Stag Horn Sumac* (*Rhus typhina* L.) This shrub is very abundant in the eastern United States. The fruits resemble those of *rhus glabra* both in form and size but are distinguished by being covered with needle-like crimson hairs which are frequently over 2 mm. long. For detailed description of the fruits of these two plants see Kraemer. (*A. J. P.*, 1913, p. 398.)

Sumach berries are astringent and refrigerant. A strong decoction, or the fluidextract diluted, affords a very effective and pleasant gargle in *angina*, especially in combination with potassium chlorate. *Fluidextractum Rhois Glabrae* was official in the U. S. VIII, but then deleted. It was admitted to the National Formulary IV with a slight alteration in the menstruum. The fluidextract affords an excellent astringent in relaxing *diarrheas* and other conditions where the tannin drugs are useful. The dose of the fluidextract is fifteen to thirty minims (1-2 mls).

Rimu Resin.—The resin of the *Dacrydium cupressinum* Solander, the New Zealand red pine or rimu, a large coniferous tree of New Zealand, is characterized by its rose color and its crystalline appearance. It is composed chiefly of a crystalline acid resin, *rimuic acid*. (*Chem. News*, Ixxxviii, 20.)

Robinia. *Robinia Pseudo-Acacia* L. *Locust Tree. False Acacia. Robinier*, Fr. *Falsche Akasie*, G. (Fam. *Leguminosae*.)—This well-known indigenous tree has a place in the materia medica of the eclectics. The bark of the root is the most active part, and is said to be tonic, and in large doses purgative and emetic. The root and inner bark are poisonous to cattle. The leaves, on the other hand, are said to offer a wholesome food for foraging animals. This would seem confirmed by the experiment of Paven, who failed to find in them any poisonous principles. (For an elaborate investigation of its histology, see *P. J.*, 67, 153.) F. B. Power and J. Cambier (*Ph. Rund.*, Feb., 1890) found an alkaloid identical with *choline*; also globulin and a phytalbumin, which produces purging and vomiting. It is precipitated by alkaloidal reagents. The bark also contains a poisonous albuminoid or enzyme, *robinabin*, which, according to Kobert (*M. Bull.*, April, 1891), is similar to, but not identical with, ricin. Power (*P. J.*, Aug. 17, 1901) summarizes the results of a more detailed investigation of this bark. He names the poisonous proteid *robin* and states that it belongs to the class of nucleo-proteids. He finds evidences of one or more alkaloids; by hydrolysis he obtained *syringic acid*, $C_9H_{10}O_5$, and a red amorphous substance, *syringenin*. These products indicate the glucoside *syringin*, $C_{17}H_{24}O_8$. He also considers that *gluco-syringic acid*, $C_{15}H_{20}O_{10}$, may pre-exist in the bark. Power subsequently reaffirmed the presence of the protein, robin, in robinia bark, and confirms its toxic properties and enzymic action. (*A. J. P.*, 1913, 339.) Robin has emetic and purgative properties. Three cases of the poisoning of children by the root have been recorded. (*Ann. Ther.*, 1860, 64.) Z. T. Emery (*N. Y. M. J.*, Jan. 22, 1887) reports the poisoning of thirty-two boys from chewing the inner bark of the tree. The symptoms in the mildest cases were vomiting and flushed face, dryness of the throat and mouth, and dilated pupils. In the severest cases, to these were added epigastric pain, extremely feeble, intermittent heart action, and stupor.

Robinia Nicou Aubl., now known as *Lonchocarpus Rufescens* Benth.—According to the researches of Geoffrey (*Annal. de l'Inst. botanico-geologique colon, de Marseille*, 1895), this leguminous plant, which is used in Guiana for the purpose of stupefying fish, contains an active principle, *nicoline* (C_3H_4O), which crystallizes in oblique, rhomboidal tables. It has been found by E. Boinet (*C. R. S. B.*, 1896, 10 s., iii) to produce in the lower animals a short primary stage of excitation, followed by one of stupor, great muscular relaxation, enfeeblement of sensibility, mydriasis, fall of temperature, cyanosis, and death through centric paralysis of the respiration, though there is also fall of arterial pressure. In the dog there was salivation and vomiting.

Rosa.—Of the genus *rosa* at least four species have been, and probably to some extent are still, use in medicine—namely, *Rosa canina* L., *Rosa centifolia* L., *Rosa damascena* Mill., and *Rosa gallica* L.

Rosa canina.—The *Dog Rose, Wild Brier, or Hip Tree*, of Europe, is distinguished by its prickly stem and petioles, and ovate, smooth, rigid leaves. It has white or pale red flowers, having usually five obcordate fragrant petals. The fruit consists of a fleshy, hollow receptacle, bearing on its inner surface a number of hairy achenes. The ripe fruit, which is usually employed in the fresh condition, is ovoid, smooth, shiny and of a reddish color. The summit is crowned with 5-calyx teeth. Rose hips possess a pleasant, sweet, acidulous taste. It was formerly official in the British

Pharmacopoeia under the name of *Rosae Caninae Fructus*. It contains about 30 per cent. of sugar, combined with citric and malic acids, also salts of these acids, and a trace of tannin. It was used for the preparation of an acidulous confection. Vanillin has also been found present in the petals.

Rosa centifolia has prickly stems and the leaves consist of two or three pairs of leaflets, with an odd one at the summit, closely attached to the common footstalk, which is rough, but without spines. The leaflets are ovate, broad, serrate, pointed, and hairy on the under surface. The flowers are large, with many petals, generally of a pale red color, and supported upon peduncles beset with short bristly hairs. The varieties of *R. centifolia*, produced by its almost universal cultivation, are very numerous, but the plant is said to grow with single flowers in the eastern part of the Caucasus. It is very closely allied to *R. gallica*, some botanists maintaining that the species are really one. The petals, which were recognized by the U. S. P., 1890, as *pale rose*, are roundish-obovate and reflex, or obcordate, pink, fragrant, sweetish, slightly bitter, and faintly astringent. They contain volatile oil, malic and tartaric acids, tannin, fat, resin, sugar, and a coloring matter which seems to be identical with that of the red rose. They should be collected when the flower is fully expanded but has not begun to fall. Their fragrance is impaired but not lost by drying. They may be preserved for a considerable time by compressing them with alternate layers of common salt in a well-closed vessel, or beating them with twice their weight of that substance. A rose water is often prepared from them by distillation.

Rosa damascena is not known in the wild state, and is thought by some botanists to have been produced by cultivation by hybridizing *R. gallica* with *R. canina*. It is the rose which is cultivated in Turkey and yields the commercial otto of rose. (See *Oleum Rosae*, p. 870.) It is a tall shrub with semi-double, light red to white flowers of moderate size, having several on a branch, though not clustered. Its volatile oil is the base of rose water.

ROSA GALLICA. U. S. (Br.)

RED ROSE Rosa Gall.

"The dried petals of *Rosa gallica* Linne (Fam. *Rosaceae*), collected just before the expansion of the flower. Preserve Red Rose in tightly-closed containers, protected from the light." *U. S.* "Red-Rose Petals are the fresh or dried unexpanded petals of *Rosa gallica*, Linn.; obtained from cultivated plants." *Br.*

Rosae Gallicae Petala, *Br.*, Red-rose Petals; Flores Rosarum Rubrarum; Rose rouge ou Rose de Provins, *Fr. Cod.*; Roses rouges, *Fr.*; Sammtrose, Zuckerrose, Französische Rose, Esaigrosenblätter, *G.*; Rosa rossa, *It.*; Rosa roja (Flore de), Rosa rubra, *Sp.*

At one time pale rose or *Rosa centifolia* was official in addition to red

rose or *Rosa gallica*. There is no uniformity on the subject in the several Pharmacopoeias. The Pharmacopoeia of the Netherlands and the French Codex still include both species. The German Pharmacopoeia, on the other hand, specifies only the petals of *Rosa centifolia*. The British and Austrian Pharmacopoeias are in unison with the U. S. Pharmacopoeia in restricting the drug to *R. gallica*.

Rosa gallica is smaller than *R. centifolia* L., but resembles it in the character of its foliage. The stem is beset with short bristly prickles. The flowers are very large, with obcordate widely spreading petals, which are of a rich crimson color, and less numerous than in the *R. centifolia*. The stamens on thread-like filaments, and the villose styles bearing papillary stigmas, are numerous. The fruit is oval, shining, and of a firm consistence. The red rose is a native of the south of Europe, and is cultivated in gardens throughout the United States.

The drug is officially described as "petals either separate or imbricated in small cones, broadly ovate, summit rounded and deeply notched, margin entire and somewhat recurved, base obtuse; externally of a purplish-red color except the light-brown claw; texture velvety; when dry, brittle; odor agreeable; taste astringent and slightly bitter. Under the microscope, transverse sections of the petals of Red Rose show the upper epidermal cells modified to conical papillae and containing a purplish-red cell sap; a loose mesophyll composed of from 2 to 10 rows of cells among which are the fibro-vascular bundles with spiral tracheae, and a lower epidermis of rectangular cells filled with a purple cell sap. Red Rose yields not more than 3.5 per cent. of ash." U. S.

"Usually in little cone-like masses, or sometimes separate and more or less crumpled. Petals velvety, deep purplish-red passing into brownish-yellow towards the base. Fragrant odor; taste slightly astringent." Br.

The petals should be gathered before the flower has blown, separated from their claws, dried in a warm sun or by the fire, and kept in a dry place. Their odor, which is less fragrant than that of *R. centifolia*, is improved by drying. They have a velvety appearance, a purplish-red color, and a pleasantly astringent and bitterish taste.

An illustrated article on the structural characteristics of rose petals, whole and powdered, has been published by Hans Kramer in *B. P. G.*, 1907, xvii, p. 354.

Their constituents, according to Cartier, are tannin, gallic acid, coloring matter, a volatile oil, a fixed oil, albumen, soluble salts of potassium, insoluble salts of lime, silica, and ferric oxide. (*J. P. C.*, vii, 531.) According to Filhol, the astringency of red roses is ascribable less to tannic acid, of which they contain but a trace, than to quercitrin, which he obtained in notable proportion, and with which their color is probably connected. Rochleder found that in red roses the gallic acid is accompanied by quercitannic acid. They also contain much uncrystallizable sugar. (*Repert de Pharm.*, Mai, 1863.) The sensible properties and medicinal virtues of the flowers are extracted by boiling water. Their coloring matter, according to Senior (*Y. B. P.*, 1877, p. 63), is an acid, which appears to form crystallizable salts with potassium and sodium, and amorphous ones with the heavy metals. Senior gives as the formula of the insoluble lead compound $Pb_2C_{21}H_{29}O_{30}$. Their infusion is of a pale reddish color, becoming bright red on the addition of sulphuric acid. As their color is impaired by exposure to light and air, they should be kept in opaque well-closed bottles or canisters.

Uses.—Bed rose is slightly astringent and tonic, and it was formerly thought to possess peculiar virtues. It is at present chiefly employed as affording an elegant vehicle for tonic and astringent medicines.

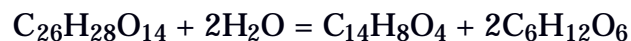
Off. Prep.—*Confectio Rosae Gallicae, Br.*; *Fluidextractum Rosae, U. S.*; *Infusum Rosae Acidum, Br. (N. F.)*; *Confectio Rosae, N. F.*; *Syrupus Rosae (from Fluidextract), N. F., Br.*

Rosemary. *Rosmarinus. Folia Rosmarini, s. RorisMarini. Folia Anthos. Feuilles de Romarin, Fr. Cod. Rosmarin, Rosmarinblatter, G. Rosmarino, It. Romero, Sp.*—"The leaves of *Rosmarinus officinalis* (Fam. *Labiatae*)." *U. S.*, 1880. Rosemary is a small evergreen shrub, with an erect stem, divided into many long, slender, ash-colored branches. The leaves are numerous, sessile, opposite, about 2.5 cm. long, rigid, linear, entire, obtuse at the summit, folded backward at the edges, of a firm consistence, smooth and green on the upper surface, whitish, woolly, and glandular beneath. The flowers are axillary, pale blue or white. The plant grows spontaneously in the countries which border on the Mediterranean, and is cultivated in the gardens of Europe and this country. The leaves, which have already been described, have a strong balsamic odor, which is possessed, but in a less degree, by all parts of the plant. Their taste is bitter and camphorous. These properties are imparted partially to water, completely to alcohol, and depend on the volatile oil. (See *Oleum Rosmarini*.) The tops lose a portion of their sensible properties by drying, and become inodorous by age. Rosemary is gently stimulant, and has been considered emmenagogue. In the practice of this country it is scarcely used; but in Europe, especially on the continent,

it enters into the composition of several syrups, tinctures, etc., to which it imparts its agreeable odor and excitant property. It is sometimes added to sternutatory powders, and is used externally in connection with other aromatics in the form of fomentation. In some countries it is employed as a condiment; and its flowers, which are much sought after by the bees, impart their peculiar flavor to the honey of the districts in which the plant abounds.

Rourea. *Rourea oblongifolia* Hook. and Am. (Fam. *Connaraceae*.)—This Mexican creeper is affirmed to contain an alkaloid, and to act as a violent convulsant poison. (*El Estudio*, 1890.)

Rubia. *Garance*, Fr. *Krappwurzel*, *Farberrothe*, G. *Robbia*, It. *Rubia de tintoreros*, *Granza*, Sp.—Under this name the U. S. P. formerly recognized madder, *Rubia tinctorum* L. (Fam. *Rubiaceae*.) The root of *dyer's madder* is perennial, and consists of numerous long, succulent fibers, varying in thickness from the size of a quill to that of the little finger, and uniting at the top in a common head, from which also proceed side-roots that run near the surface of the ground, and send up many annual stems. The quadrangular stems are furnished with short prickles by which they adhere to neighboring plants, upon which they climb. The leaves are arranged in whorls at the joints of the stem. The flowers are small, yellow and terminal. The plant is a native of Southern Europe. The root, which is dug up the third summer, enters commerce either in the form of the whole root deprived of its cuticle, or in the form of a reddish-brown powder. Madder has a weak, peculiar odor, and a bitterish, astringent taste, and imparts these properties, as well as a red color, to water and alcohol. It contains as its most important constituent *alizarin*, $C_{14}H_6(OH)_2O_2$, and with it as coloring matter of secondary importance *purpurin*, $C_{14}H_5(OH)_3O_2$. Besides these two technically important constituents there have been recognized *pseudopurpurin*, an orange dye color, and a yellow one (*xanthopurpurin*). These coloring matters, however, are probably decomposition products from glucosides existing in the fresh plant. Thus, alizarin is known to result along with glucose from the treatment with dilute acids of *rubianic* or *ruberythric* acid, $C_{26}H_{28}O_{14}$, according to the reaction:



The most interesting of the coloring substances is the *alizarin*, and this is now termed *dihydroxy-anthraquinone*, $C_{14}H_8O_4$. This occurs as orange-red crystals, almost insoluble in cold water, but readily soluble in alcohol, ether, the fixed oils, and alkaline solutions. The alcoholic and aqueous solutions are rose-colored; the ethereal, golden yellow; the alkaline, violet and blue when concentrated, but violet-red when sufficiently diluted. A beautiful rose-colored lake is produced by precipitating a mixture of the solutions of alizarin and alum. Alizarin was recognized by Graebe and Liebermann in 1868 as a derivative of anthracene, $C_{14}H_{10}$ —a hydrocarbon contained in coal tar—and in the same year they elaborated a method for preparing it commercially from anthracene. Upon this arose rapidly a great chemical industry, and the cultivation of madder, has, of course, decreased correspondingly.

Madder is used in *amenorrhoea* and *dropsy*, and when taken into the stomach imparts a red color to the milk and urine, and to the bones of animals, without sensibly affecting any other tissue. The effect is observable most quickly in the bones of young animals, and in those nearest the heart. Under the impression that it might effect some change in the osseous system, it has been prescribed in *rachitis*, but without favorable result. Dose, about half a drachm (2.0 Gm.), repeated three or four times a day.

Rubus. *N. F. IV. Blackberry Bark. Bramble. Finger Berry, Ecorce de Ronce Noir, Fr. Brambeeren, Brombeerrinde, G.*—"The dried bark of the rhizome of *Rubus villosus* Alton, *Rubus nigrobaccus* Bailey, or of *Rubus cuneifolius* Pursh (Fam. *Rosaceae*)." *N. F.* Of the genus *Rubus* a large number of species are indigenous in the United States, where they are called by the various names of *blackberry, dewberry, cloudberry*, etc. Most of them are shrubby or suffruticose briars, with astringent roots and edible berries; some have annual stems without prickles. They are naturally divided into the *raspberries*, in which the edible fruit is composed of pulpy, one-seeded, coherent little drupes, separate from the dry receptacle, and the *blackberries*, in which the receptacle is juicy and coheres with the drupes to form the fruit. The National Formulary recognizes as the source of rubus only three species, but it is probable that others contribute to the bark of the markets. In fact, the U. S. Pharmacopoeia of 1890 recognized officially *R. canadensis* L., and *R. trivialis* Michaux.

The blackberry root is branching, cylindrical from 0.5 to 2.5 cm. in thickness, and covered with a thin bark, which is externally of a light brownish or reddish-brown color, and in the dried root is wrinkled longitudinally. The dewberry root is usually smaller, without the longitudinal wrinkles, but with transverse fissures through the epidermis, and of a dark ash color, without any reddish tinge. Both are inodorous. The National Formulary IV describes blackberry bark as follows: "In elongated, tough, flexible quills or bands, from 3 to 6 mm. in diameter, the bark from 1 to 2 mm. in thickness; outer surface deep red-brown or dark gray-brown, occasionally blackish-brown, somewhat scaly; inner surface yellow or pale brown, strongly and coarsely long straight-striate; fracture tough-fibrous; readily splitting. Inodorous; taste strongly astringent and bitter. *Rubus* yields not more than 5 per cent. of ash." *N. F.* Blackberry bark was official in the U. S. VIII, but it was deleted, and the National Formulary IV admitted it under the name of *Rubus*. Its virtues are extracted by boiling water and by diluted alcohol, and depend chiefly upon tannin, which is an abundant constituent. The woody part of the roots is inert.

Dewberry and blackberry roots have long been a favorite domestic astringent remedy in *diarrheas*. Given in decoction, they are usually acceptable to the stomach, without being offensive to the taste. The decoction may be prepared by boiling an ounce of the smaller roots, or of the bark of the larger, in a pint and a half of water down to a pint, of which from one to two fluidounces (30 to 60 mls) may be given to an adult three or four times, or more frequently, during the twenty-four hours.

A fluidextract and compound elixir of rubus are in the *N. F.*

The fruit is official in the N. F. under the English title **Blackberries**, *N. F. IV. Rubi Fructus*. It is described by the N. F. as "The fresh, ripe fruit of varieties of *Rubus nigrobaccus* Bailey or *Rubus villosus* Alton (Fam. *Rosaceae*). An aggregate fruit, ovate to oblong, rounded or slightly pointed, composed of numerous, shining black drupelets attached to an esculent receptacle; pericarp externally smooth or with only a few hairs (*R. villosus*), mesocarps fleshy, juice purple-red, endocarps hard, black, surfaces deeply wrinkled." N. F.

The fruit of *Rubus Idaeus* is official in the N. F. under the English title **Raspberries**, *N. F. IV. Rubi Idaeus Fructus*. They are described as "The fresh, ripe fruit of varieties of *Rubus Idaeus* Linne or of *Rubus strigosus* Michaux (Fam. *Rosaceae*). An aggregate fruit, globular or hemispherical with a concave depression at the base where separated from the receptacle, composed of twenty or more small, rounded-polygonal, succulent drupelets; pericarps externally red, hairs numerous; mesocarps fleshy, juice red; endocarps small stones with wrinkled surfaces. Odor characteristic, aromatic; taste pleasant, sweet, acidulous. For pharmaceutical purposes, Black Raspberries, the fresh ripe fruit of varieties of *Rubus occidentalis* Linne (Fam. *Rosaceae*), may be substituted either in part or wholly for Red Raspberries." N. F. *Rubus strigosus* has yielded to cultivation certain superior raspberries, especially those which have been known commercially as the Cuthbert and Hansall raspberries. *Rubus neglectus* Peck, the purple wild raspberry, with a fruit which varies from dark red or purple to yellowish in cultivation, has also yielded a commercial raspberry.

Raspberries are employed for the production of the N. F. syrup.

The *Rubus occidentalis* L., *black raspberry* or *thimbleberry* of the Northern United States, which is also cultivated, is sometimes employed for the making of a raspberry syrup, but yields a very inferior product.

Rubus Chamoemorus L. *Cloud Berry*. *Baked-Apple Berry*. (Fam. *Rosaceae*.) —This plant, which inhabits the northern portions of both continents, is largely employed in Northern Russia, in the form of an infusion of the berries or leaves, as a diuretic in dropsy. The fruits are about 2 cm. in diameter, of an amber color, and very juicy when ripe.* Popoff found in it a crystallizable acid which is an essential diuretic, acting directly upon the renal secreting structures without affecting either cardiac action or arterial tension. (*Vrach.*, iv, 1886.)

Rumex. *N. F. IV. Yellow Dock. Curled Dock. Radix Lapathi*.—*Rumex* was official in the U. S., 1890, and has been admitted to the N. F. IV and is defined as "The roots of *Rumex crispus* Linne, or of *Rumex obtusifolius* Linne (Fam. *Polygonaceae*), without the presence of more than 5 per cent. of stem bases." N. IV. The roots of rumex are officially described as "Usually split longitudinally or cut into transverse pieces about 2 cm. in length. The entire root, nearly simple, slightly tapering, with few if any rootlets, somewhat twisted, up to 30 cm. in length and 7 cm. in diameter, externally reddish-brown or grayish from adhering soil, finely annulate above, deeply wrinkled longitudinally, marked with small indented root scars which are often transversely

elongated and with occasional stem scars or remains of stem, the latter being hollow and finely striated; leaf buds few, obconical; fracture short and dusty, somewhat fibrous. The transverse section exhibits a yellowish or brownish cortex and a whitish or yellowish wood which is finely radiate in the outer portion. When examined under the microscope, it exhibits a thick cortex with several layers of cork, beneath which is an interrupted row of stone cells; a distinct cambium; and vascular bundles with few fibers. The powder, when examined under the microscope, shows calcium oxalate crystals in rosette aggregates from 0.025 mm. to 0.06 mm. in diameter; numerous starch grains ellipsoidal or narrowly elongated, sometimes truncate, up to 0.025 mm. in length; stone cells from 0.04 mm. to 0.2 mm. in diameter, with walls somewhat lamellated, from 0.008 mm. to 0.025 mm. in thickness and with few simple pores; sclerenchymatous fibers few, thin-walled with simple pores; tracheae up to 0.1 mm. in width with scalariform or reticulate thickenings of the wall; cork cells light brown. Rumex yields not more than 10 per cent. of ash." *N. F. IV.*

Several species of rumex have sour leaves, and are distinguished by the common name of sorrel from the others, which are called dock. Of the former, *Rumex Acetosa* L., or *common English sorrel*, formerly held a place in the London and Dublin Pharmacopoeias. *R. Acetosella* L. is the common sorrel of our fields, though supposed to have been originally introduced from Europe. The leaves of both these plants are agreeably sour to the taste, and owe their acidity to acid potassium oxalate with a little tartaric acid. They quite lose this taste in drying. They are refrigerant and diuretic, and may be used advantageously as an article of diet in scurvy. For this purpose they are prepared in the form of salad. The juice of the leaves forms with water an agreeable acidulous drink, sometimes used in fevers. Taken very largely, the leaves are said to have produced poisonous effects. *R. scutatus* L., of Europe, Northern Africa, Asia Minor, and the Caucasus, also ranks among the sorrels (*French sorrel*).

Of the proper docks, the roots of *R. silvestris* Wallr., an European plant, and of *R. conglomeratus* Murr., *R. aquaticus*, *R. sanguineus* L., and *R. Patientia* L., belonging both to Europe and to the United States, may be employed indiscriminately with those of the *R. crispus* L., which was formerly recognized by the U. S. Pharmacopoeia. *R. Britannica* L., and *R. obtusifolius* L., were formerly official. *R. Hydrolapathum* Hudson, which is the *R. aquaticus* of the old Dublin Pharmacopoeia, is thought to be the *Herba Britannica* of the ancients, celebrated for the alleged cure of scurvy and diseases of the skin. The docks are herbaceous plants with perennial roots, and especially distinguished by the sheathing petioles of the leaves. The flowers are small, mostly green, and occur in terminal or axillary panicles.

Dock root, from whatever species derived, has an astringent, bitter taste, with little or no odor. The leaves of most of the species are edible when young, and are occasionally used like spinach. They are somewhat laxative, and form an excellent diet in scorbutic cases. The roots are used to dye a yellow color. According to J. H. Salisbury (*N. Y. Journ. Med.*, March, 1855), the petioles of the leaves contain nearly one per cent. of oxalic acid; the cortical part of the root, which is the most active, yielded, on analysis, starch, a little sugar, albuminous matter, gummy matter, bitter extractive, tannic acid of the kind which gives green precipitates with the salts of iron,

lignin, and various salts. The root yields its virtues to water and to alcohol, but is injured by long boiling.

Dock root is astringent, gently tonic, and has been supposed to have alterative properties, making it useful in skin diseases and even *syphilis*. From the root of *R. Nepalensis* Wall., which is largely used in Madras as an astringent for medicinal purposes and for dyeing, O. Hesse has separated three crystalline substances to which he gives the names of *rumicin*, *nepalin*, and *nepodin*. (*P. J.*, lvi; also *Proc. A. Ph. A.*, 1896, 551.) According to Tutin and Clewer (*Trans. Chem. Soc.*, 1910, xcvi) the *R. Eckolianus* Meissner, a South African herb, contains chrysophanic acid, emodin, and allied products, and is mildly purgative. Tschirch and Well found small quantities of *emodin* and *chrysophanic acid* with *lapathinic acid*, $C_{20}H_{18}O_{14}$, in the root of *R. obtusifolius*. (*A. de Pharm.*, 1912, No. 1, 20.) *R. aquaticus* and *R. Britannica* are the most astringent. The roots of some species unite a laxative with the tonic and astringent property, resembling rhubarb somewhat in their operation. Such are those of *R. crispus* and *R. obtusifolius*; and *R. alpinus* L., has in some parts of Europe the name of *mountain rhubarb*. This resemblance is not singular, as the two genera belong to the same natural family. A. Gilbert and P. Lereboullet have discovered a remarkable property of *Rumex crispus*. For the roots of this plant are said to possess the power of taking up the iron present in the soil, and fixing it in the form of organic compounds of iron. By watering the plants with a solution of iron carbonate, roots are said to be obtained which contain 1.5 per cent. of iron. *Rumex* is said to give good results in the treatment of *chlorosis* and *anemia*. The authors gave the dried and powdered root during meals in doses of fifteen to forty-five grains (1-3 Gm.), in view of their good results they regard it as a valuable iron medicine. Dock root is given in powder or in decoction. Two ounces (62 Gm.) of the fresh root bruised, or one ounce (31 Gm.) of the dried, may be boiled in a pint (480 mls) of water, of which two fluidounces (60 mls) may be given at a dose, and repeated as the stomach will bear it. George G. Flemyng (*L. L.*, i, 1896) reported the death of two sisters, aged respectively five and six and a half years, preceded by symptoms of oxalic acid poisoning as the result of the ingestion of sorrel leaves.

Ruta.—Under this name the U. S. Pharmacopoeia formerly recognized *Ruta graveolens* L.; *Rue*; *Rue odorante*, Fr.; *Garten-Raute*, G.; *Ruta*, It.; *Ruda*, Sp., (Fam. *Rutaceae*). It is a low, shrubby plant, with several shrubby branching stems, which, near the base, are woody and covered with a rough bark, but in their ultimate ramifications are smooth, green, and herbaceous. The leaves are fleshy, 2- to 3-pinnatifid, the ultimate lobes or divisions being obovate-cuneate. The flowers are yellow, and disposed in a terminal branched cyme. The plant is a native of the south of Europe, locally established in pastures in the United States and cultivated in our gardens. The whole herb is active, and yields its properties to water and alcohol. The leaves have a strong, disagreeable odor, especially when rubbed. Their taste is bitter, hot, and acrid. When recent, and in full vigor, they have so much acrimony as to inflame and even blister the skin, if much handled; but the acrimony is diminished by drying. Their virtues depend chiefly on a volatile oil, which is contained in glandular vesicles, apparent over the whole surface of the plant. They contain, also, according to Borntrager, a peculiar acid which he calls *rutinic acid*, $C_{25}H_{32}O_{15}$ (or $C_{27}H_{32}O_{16}$,

according to later writers). Rutinic acid is the coloring principle of rue, and has been found in various other plants; though, like quercitrin, yielding quercetin and sugar, it has been shown to be distinct. (J P. C., 1862, 165.)

Rue yields a very small proportion of a yellow or greenish volatile oil (*Oleum Rutae*, U. S; 1880), which becomes brown with age. According to Zeller, the yield from the fresh herb is 0.28 per cent., that from the seeds about 1 per cent. The oil has the strong unpleasant odor of the plant, and an acrid taste. Kane gives its sp. gr. at 0.837, its boiling point at 230° C. (446° P.). "A neutral reaction. Sp. gr. about 0.880. It is soluble in an equal weight of alcohol." U. S., 1880. It consists mainly of an oxidized constituent, which Strecker proved to be *methyl-nonyl-ketone*, $\text{CH}_3\text{CO.C}_9\text{H}_{19}$; that is, a ketone analogous to acetone, $\text{CH}_3\text{CO.CH}_3$. This accounts for its yielding under treatment with oxidizing agents, pelargonic acid, $\text{C}_9\text{H}_{18}\text{O}_2$. The methyl-nonyl-ketone, when pure, is a colorless liquid, fluorescing blue, boiling at 225° C. (437° F.), and crystallizing at about 15° C. (59° P.). Schimmel & Co. (*Schim. Rep.*, 1892, 31) state that pure oil of rue consists of 90 per cent. of methyl-nonyl-ketone, and solidifies even at a moderate temperature to a solid, crystalline mass, and has the sp. gr. 0.837.

According to von Soden and Henie, *Algerian oil* of rue differs from the ordinary oil in that it is chiefly composed of *methyl-heptyl-ketone*, with but small quantities of *methyl-nonyl-ketone*. Its specific gravity at 15° C. (59° P.) is 0.842; and it does not solidify at -15° C. (5° P.). (*Ph. Ztg.*, 46.) Frederick B. Power and Frederic H. Lees (*Trans. Chem. Soc.*, 1902) have since published an elaborate investigation of a similar Algerian oil. They find 80 per cent. of the two ketones, methyl-heptyl-ketone and methyl-nonyl-ketone, 10 per cent. of the corresponding carbinols (alcohols), pinene, 1-limonene, cineol, methyl salicylate, ethyl valerate, and some free fatty acids.

Rue is said to have been used by the ancients as a condiment. In modern times it has been employed in *hysteria*, *worms*, *colic*, and *atonic amenorrhea* and *menorrhagia*. Its medicinal activity depends upon its volatile oil, which is a powerful local irritant, causing, when applied to the skin persistently, burning, redness, and vesication, and when taken internally in large doses, violent gastric pains and vomiting, great prostration, confusion of mind, convulsive twitching, and in pregnant women, abortion. It has been considerably used in Europe for the production of criminal abortion, in a number of cases with fatal results. In a case of fatal poisoning in a man, reported by G. F. Cooper, there were vomiting, violent tormina and tenesmus, with bloody stools, great abdominal distention, with tenderness and severe strangury. (*Med. Exam.*, N. S., ix, 720.) The dose of the oil is from two to five minims (0.12-0.3 mil) every two or three hours. The rue itself is sometimes given in the dose of from ten to thirty grains (0.65-2.0 Gm.).

Rye. *Secale cereale* L. (Fam. *Gramineae*.) *Roggen*, G. *Leigle*, Fr. *Centeno*, Sp.—Rye is allied to wheat and barley. Its native country is somewhat doubtful, but is said to be found wild throughout the Mediterranean countries, extending to Central Asia. There are two prominent varieties known as "Winter" and "Spring" rye, the difference being due to cultivation mainly. Rye is now cultivated in all temperate latitudes. The average composition of rye as a cereal may be thus stated: fat, 1.43 per cent.; starch,

61.87 per cent.; sugar (as sucrose), 4.30 per cent.; albumen (insoluble in alcohol), 9.78 per cent.; nitrogenous matter (soluble in alcohol), 5.09 per cent.; cellulose, 3.23 per cent.; mineral matter, 1.85 per cent.; moisture, 12.45 per cent. (Sadtler, *Industrial Organic Chemistry*, 3d ed., p. 169.) Rye flour is used, in the dry state, as an external application to *erysipelalous inflammation* and other eruptive affections, the burning and unpleasant tingling of which it tends to allay, while it absorbs the irritating secretions. In the form of mush it is an excellent laxative article of diet, and, mixed with molasses, it may be given with great advantage in *hemorrhoids* and *prolapsus ani*, connected with *constipation*. Rye carbonized by heat, with exclusion of the air, has been highly recommended as a tooth powder.

The Dispensatory of the United States of America Twentieth Edition (1918)

Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Sabadilla. *Cevadilla*.—The dried ripe seeds of *Schoenocaulonofficinale* (Schlecht.) A. Gray [*Asagroea officinalis* (Chain. and Schlecht.) Lindl.], were recognized by the Br. Pharm. of 1885. At one time cevadilla was generally believed to be derived from *Veratrum Sabadilla* Schiede. The plant grows in the Andes of Mexico and in the mountains of Guatemala and Venezuela. It is also cultivated. The fruit is a capsule having three locules in each of which there are from three to four seeds. A resemblance, existing or supposed, between this fruit and that of barley is said to have given rise to the Spanish name cevadilla, which is a diminutive of barley. The seeds are elongated, pointed at each end, flat on one side and convex on the other, somewhat curved, 5 to 8 mm. long, wrinkled, slightly winged, black or dark brown on the outside, whitish within, hard, inodorous, and of an exceedingly acrid, burning, and durable taste.

Pellatier and Caventou first noted the presence of an alkaloid in cevadilla, which base they called *veratrine*; Meissner in the same year announced the presence of an alkaloid, *sabadilline*, $C_{34}H_{53}O_8N$, and Couerbe, Merck, and Weigelin all described what they considered as distinct bases; but its exact composition remained unsettled until Wright and Luff (*J. Chem. S.*, 33, 338) found in it three bases: (1) *cevadine*, $C_{32}H_{49}O_8N$, (agreeing with the base described by Merck as veratrine), crystallizing in needles or compact crystals, fusing at $205^{\circ} C.$ ($401^{\circ} F.$) ($202^{\circ} C.$ ($395.6^{\circ} F.$), according to Merck), insoluble in water, easily soluble in alcohol and ether, and decomposed by hot alcoholic potash into *cevine*, $C_{27}H_{43}O_8N$ ($C_{27}H_{45}O_9N$, Fluckiger), and *methyl-crotonic acid* (*cevadine acid* of Pelletier and Caventou), $C_5H_8O_2$; (2) *veratrine*, $C_{37}H_{53}O_{11}N$, obtained from the syrupy mother liquor from which the cevadine has crystallized; (3) *cevadilline* or *sabadilline*, $C_{34}H_{53}O_8N$, obtained after the extraction of the veratrine with ether; it is insoluble in ether, slightly soluble in boiling benzene, and readily soluble in fusel oil, uncrystallizable, and appears to yield methyl-crotonic acid on treatment with alcoholic soda. For method of extracting the alkaloids, see *U. S. D.*, 19th ed., p. 1636.

Merck has since (*M. R.*, Jan., 1891, 3-9) isolated two new alkaloids from cevadilla, which he names *sabadine* and *sabadinine* respectively. The former has the formula $C_{29}H_{51}NO_8$, crystallizes from ether in short needles, and fuses at from 238° to $249^{\circ} C.$ (460.4° - $464^{\circ} F.$). It dissolves in concentrated sulphuric acid with a yellow color and

a green fluorescence, which gradually disappears, while the liquid assumes a blood-red and then violet color. The alkaloid is sternutatory, although in a much less degree than veratrine. The second alkaloid crystallizes from ether in filiform needles, which begin to sinter at 160° C. (320° F.), but show no fixed fusing point. Concentrated sulphuric acid causes a permanent blood-red color. The formula is given as C₂₇H₄₅NO₈. This alkaloid is not sternutatory. Cevadilla yields about 0.3 per cent. of veratrine.

Cevadilla is an acrid, drastic emeto-cathartic, operating occasionally with great violence, and in overdoses capable of producing fatal effects. Known in Europe as early as 1752, and formerly used to some extent as a tsenicide, in doses of from five to twenty grains (0.32-1.3 Gm.), it was official solely as the source of veratrine. It is the principal ingredient of the *pulviscapucino-rum*, sometimes used in Europe for the destruction of vermin in the hair.

According to E. Falk, 0.001 Gm. of pure cevadine will paralyze the frog; 0.01 Gm. will cause death from cardiac paralysis in rabbits; 0.02 Gm. per kilogramme produces paralysis, interrupted by tetanic spasms. Cevine was found to be much less poisonous than cevadine, though producing similar symptoms.

SABAL. U. S.

SABAL [Saw Palmetto Saw Palmetto Berries]

"The partially dried, ripe fruit of *Serenoa serrulata* (Michaux) Hooker filius (Fam. *Palmae*). Preserve Sabal in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects." *U. S.*

The *Saw palmetto* flourishes on the Atlantic coast from South Carolina to Florida, where it forms the so-called "palmetto scrub." According to Schneider it is also found in southern portions of California. (*Pacific Pharm.*, ii, p. 466.) It was introduced into medicine in 1879. (*Bull. Lloyd Library*, 1911, No. 18, p. 71.) The stem of saw palmetto is from 6 to 10 feet high, has a crown of large leaves, long petioled, with a circular fan-shaped leaf blade split at the edge into from 15 to 30 divisions, which are slightly cleft at their apices. The fruit is a onesided blackish-brown drupe, from half an inch to one inch long; ovoid-oblong in shape, with a somewhat wrinkled exterior, and a sweetish, not agreeable taste. It occurs in a large panicle which in, some cases may weigh as much as nine pounds.

Properties.—Sabal is officially described as follows: "Ellipsoidal or ovoid, occasionally compressed, from 1.5 to 3 cm. in length and from 1 to

1.5 cm. in diameter; externally brownish-black to bluish-black, smooth and somewhat oily, with a few large, more or less angular depressions due to the contraction of the inner layer on drying, summit marked by the scar of the style, and the base either with a short stalk or stem-scar; epicarp and sarcocarp together forming a thin coriaceous shell enclosing a hard but thin endocarp, which is externally reddish-brown and somewhat fibrous as is also the inner layer of the sarcocarp; inner layer of endocarp smooth, enclosing a hard, ellipsoidal or ovoid, somewhat flattened, reddish-brown seed; odor pronounced, aromatic; taste sweetish, aromatic, slightly acrid. The powder is yellowish-brown; when examined under the microscope it exhibits large, irregular fragments; parenchyma cells of sarcocarp containing a yellowish-brown or brownish-red, amorphous substance; whitish fragments of endosperm; the walls being considerably thickened and with large pores; stone cells occasional, nearly colorless, more or less tabular or irregular in shape, about 0.125 mm. in length, walls about 0.015 mm. in thickness, and with numerous simple or branching pores." *U. S.*

Kraemer gives an illustrated article on the pharmacognosy of the saw palmetto in the *Practical Druggist*, 1910, xxviii, p. 97. In it Coblenz (*Proc. New Jersey Pharm. Assoc.*, 1895, 45) believes that he found, besides a volatile oil an alkaloid. In the studies of Sherman and Briggs (*Ph. Archiv.*, vol. 2) no alkaloid could be detected. Sieker (*Ph. Rev.*, 1897, 113) examined the fixed oil: the sp. gr. was 0.9138, and it was soluble in alcohol, ether, and petroleum benzin. By pressure the fruit yields about 1½ per cent. of a brownish-yellow to dark red oil, soluble in alcohol, ether, chloroform and benzene, and partly soluble in dilute solution of potassium hydroxide. It contains, according to Sherman and Briggs (*Ph. Archiv.*, 1899, 101; see also *Ph. Rev.*, 1900, 217), about 63 per cent. of free acids, and 37 per cent. of ethyl esters of these acids. The oil obtained exclusively from the nut was thick and of a greenish color, without fruity odor. It was a glyceride of fatty acids.

Yanderkleed and E'we (*Proc. P. Ph. A.*, 1916, p. 284) contribute formulas for syrup of sabal and elixir of sabal with terpin hydrate. The latter is made as follows:

Dissolve 1.75 Gm. of terpin hydrate in 40 mils of fluidextract of sabal and 10 mils of alcohol. Add 1 mil of tincture of sweet orange peel, 0.2 mil of solution of saccharin, 40 mils of glycerin, and 100 mils of syrup. This preparation will contain 8 grains of terpin hydrate and 184 grains of

sabal in each fluidounce.

Uses.—The oil of saw palmetto is probably eliminated through the kidneys unchanged, although we know of no actual experiments to prove this, and appears to exert a stimulant alterative action upon the mucous membrane of the genito-urinary tract, similar to that of other alterative diuretics. Saw palmetto is milder and less stimulant than is cubeb or copaiba, or even the oil of sandal-wood. Like these drugs it also has the power of affecting the respiratory mucous membrane, so that it has been used not only in *chronic* and *sub-acute cystitis*, but also in *chronic bronchitis*, *laryngitis*, and the catarrhs which accompany *asthma*, *phthisis*, and other more serious diseases of the lungs. It has been affirmed that saw palmetto is capable of increasing the nutrition of the testicles and of the mammae in functional atony of these organs, but this is very doubtful. It has been especially recommended in cases of *enlarged prostate* of old men; it is not probable that it has a direct influence upon the prostatic gland itself but there is much clinical testimony as to its value and it probably acts by reducing the catarrhal irritation and the relaxed condition of the mucous membrane of the bladder and urethra, which are almost universally present in prostatic hypertrophy.

Dose, ten to twenty grains (0.6i'5-1.3 Gm.).

Off. Prep.—Fluidextractum Sabal, *U. S.*; Tinctura Sabal et Santali, *N. F.*

Sabbatia. *American Centaury.* *Centauree Americaine*, Fr. *Sabbatie*, G.—The overground plant of *Sabatia* (*Sabbatia*) *angularis* (L.) Pursh. (Fam. *Gentianaceae*), an herb found in rich soil throughout the Eastern and Central United States and Ontario. The stems are much branched, distinctly 4-angled, and from 3 to 9 dm. high. The leaves are ovate, 5-nerved, having a heart-shaped clasping base. The flowers are rose-pink and on drying become pinkish-brown. The fruit is a 2-valved capsule, dark brown and covered with a resin. It is more or less used in popular medicine as a tonic and antiperiodic. It is a simple bitter of some activity, and may very well be substituted for the foreign remedies of its class. Rodney H. True found American centaury adulterated with *Rhexia mariana*, also known as *deer grass* or *meadow beauty*. (*A. J. P.*, 1905, 213.) John F. Huneker found in sabbatia a small proportion of *erythrocentaurin*, $C_{27}H_{24}O_8$, previously discovered by Mehu, a French chemist, in *Erythraea Centaurium* Pers., of Europe.

In the Southeastern United States, the *Sabbatia Elliottii* Steud., or *Quinine flower*, and in the Southwestern United States the *Sabbatia campestris* Nutt. have been

employed like the *S. angularis* in the North. According to Merck the *S. Elliottii* contains a glucoside, *sabbatin*, as its active principle. Of the *S. angularis* and the *S. campestris* the whole plant is used, the dose being a drachm (3.9 Gm.), given in the form of fluid-extract or in decoction. Of the quinine flower, the root is employed; dose, of the fluidextract, one fluidrachm (3.75 mls); in intermittent fever to be repeated at short intervals.

Sabina. U. S. VIII. *Savin. Sabinae Cacumina. Summitates (Herba) Sabinae. Savine Tops. Sabine, Fr. Cod. Sevenbaum. Sadebaumspitzen. Sevenkraut, G. Sabina, It., Sp.*—"The tops of *Juniperus Sabina* Linne (Fam. *Coniferae*)." U. S. VIII. *Juniperus Sabina* is an evergreen shrub from three to fifteen feet high, with numerous erect, pliant branches. The leaves, which completely invest the younger brandies, are numerous, small, erect, firm, smooth, pointed, dark green, glandular in the middle, opposite, and imbricated in four rows. The fruit is a blackish-purple berry of an ovoid shape, and containing three seeds. The savin is a native of the south of Europe and the Levant, and grows wild in the neighborhood of the northwestern lakes of the United States.

The ends of the branches, and the leaves by which they are invested, are collected for medicinal use in the spring. When dried they are very much faded in color. They were officially described as "short, thin, subquadrangular branchlets bearing leaves which are rather dark green, in four rows, opposite, scale-like, ovate-lanceolate, more or less acute, appressed, imbricated, having on the back a shallow groove containing an oblong or roundish gland; odor peculiar, terebinthinate; taste disagreeable, resinous and bitter." U. S. They have a strong, heavy, disagreeable odor, and a bitter, acrid taste. These properties, which are less striking in the dried than in the recent leaves, are owing to a volatile oil. The leaves impart their virtues to alcohol and to water. C. H. Needles found in them volatile oil, gum, tannic or gallic acid, resin, chlorophyll, fixed oil, bitter extractive, lime, and salts of potassium. (*A. J. P.*, xiii, 15.)

In America the tops of *Juniperus virginiana* L., or *common red cedar*, also commonly referred to as savin, are sometimes substituted in commerce for savin, which they resemble closely, but from which they can be distinguished by some of their leaves being obtuse or acutish and the fruits being smaller, purplish and containing fewer seeds. In Europe savin is said to be adulterated with the tops of *J. phoenicea* L., which contain volatile oil similar to that of *J. communis*. Such substitution is to be detected by the fact that in *J. phoenicea* the imbricated leaves occur in spirals of five, and the berries are large, shiny, and vary in color from yellow to reddish-yellow. In the mesophyll there occur large stone cells which are either single or in groups.

According to the more recent authorities, the proportion of volatile oil obtained from savin varies as much as from 1 to 2.5 per cent. The *oil of savine (Oleum Sabinae, U. S. VIII)* is "a colorless or yellowish liquid, having a peculiar terebinthinate odor, and a pungent, bitter, and camphoraceous taste. Specific gravity: 0.903 to 0.923 at 25° C. (77° F.). The Oil is dextrogyrate, the angle of rotation varying between +40° and +60° in a 100 Mm. tube, at a temperature of 25° C. (77° F.). Soluble in about one-half volume or more of 90 per cent. alcohol." U. S. According to Schimmel & Co. (*Schim.*

Rep., April, 1897), its specific gravity is from 0.91 to 0.925, optical rotation + 45° to + 60°, and it contains *pinene*, C₁₀H₁₆, *cadinene*, C₁₅H₂₄, and an alcohol, C₁₀H₁₆O, *sabinol*, which is present both in the free state and as acetic ester. With iodine it becomes heated, detonates, and gives off yellow and violet-red vapors. (Flaschoff.)

Savin is highly irritant, and is supposed to have a special direction to the uterus. It has been much used in *amenorrhoea* and *atonic menorrhagia*, and occasionally as a remedy for *worms*. Chapman strongly recommended it in *chronic rheumatism*, and it is employed in Germany, both internally and externally, in *chronic gout*. In overdoses it may produce dangerous gastro-intestinal inflammation, and it should therefore be used with caution. In no case should it be employed when much general or local excitement exists. In pregnancy it should always be given with great caution. As an external irritant, savin is useful, in the form of cerate, for maintaining a discharge from blistered surfaces; but as in this country savin ointment is often feeble, either from the age of the drug or from the substitution of red cedar, it has fallen into disrepute. In powder or infusion, savin is used in Europe as an application to *warts*, *indolent* or *gangrenous ulcers*, *psora*, and *tinea capitis*, and the expressed juice of the fresh leaves, diluted with water, is sometimes used for similar purposes. Powdered savin should not be used after it has lost the green color, characteristic of the fresh drug. The oil of savin is a powerful local irritant, producing, when persistently applied to the skin or the mucous membrane, violent inflammation. It has been much used for the purpose of producing criminal abortion, and in a number of such cases has caused death, the symptoms being violent abdominal pain, bloody vomiting and purging, diminution or suppression of urine, disordered respiration, unconsciousness, convulsions, and fatal collapse. Although Prochnow (*A. I. P. T.*, 1911, xxi, p. 316) has found that small doses of savin have a slight stimulating effect upon the uterus it is manifest that any abortifacient results must be due to general disturbance of the health rather than to any local action. The fluidextract is rarely used internally but the stated dose is from five to ten minims (0.3-0.6 mil). The dose of the oil of savin is from one to three minims (0.06-0.2 mil).

Fluidextract of Savin. Fluidextractum Sabinae. U. S. VIII—The U. S. VIII gave the following directions for the preparation of the fluid-extract: "Savin, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6½ fluidrachms]. Moisten the powder with two hundred and fifty mils [or 8 fluidounces, 218 minims] of Alcohol, and pack it firmly in a cylindrical percolator; then add enough Alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding Alcohol, until the Savin is exhausted. Reserve the first nine hundred mils [or 30 fluid-ounces, 208 minims] of the percolate, and evaporate the remainder, at a temperature not exceeding 50° G. (122° F.), to a soft extract; dissolve this in the reserved portion, and add enough Alcohol to make the Fluidextract measure one thousand mils [or 33 fluidounces, 6½ fluidrachms]." U. S. VIII

Sagapenum.—This gum-resin, formerly highly esteemed, but at present very rarely

met with even in Eastern commerce, is the concrete juice of a Persian plant. *Ferula Persica* Willd. (Fam. *Umbelliferae*), related to those that yield galbanum. It is in irregular masses, composed of agglutinated fragments, slightly translucent, of a brownish-yellow, olive, or reddish-yellow color externally, paler internally, brittle, of a consistence somewhat resembling that of wax, and often mixed with impurities, especially with seeds more or less entire. An inferior variety is soft, tough, and of uniform consistence. It has an alliaceous odor less disagreeable than that of asafetida, and a hot, nauseous, bitterish taste. It softens and becomes tenacious by the heat of the hand. The effect of time and exposure is to harden and render it darker. It is inflammable, burning with a white flame and much smoke, and leaving a light spongy charcoal. Pure alcohol and water dissolve it partially, diluted alcohol almost entirely. Distilled with water it affords a small quantity of volatile oil, and the water is strongly impregnated with its flavor. According to Tschirch (*Harze und Harzbehalter*, 229), it contains 23.3 per cent. of gum; 19.2 per cent. of essential oil, containing sulphur; and 57.5 per cent. of a resin which is free from sulphur and melts at 74° to 76° G. (165.2°-168.8° F.). The ether soluble resin of *sagapenum* can be separated by saponification into *umbelliferone* and *sagaresitannol*, C₂₄H₂₇O₄.OH. This latter yields on oxidation *oxypticric acid*. The oil is pale yellow, very fluid, lighter than water, and of a disagreeable alliaceous odor. *Sagapenum* was formerly used in doses of from ten to thirty grains (0.65-2.0 Gm.) in *amenorrhoea*, *hysteria*, etc.; also externally in plasters as a discutient.

Sage. *Salvia*. U. S. VIII. Garden Sage. Meadow Sage. Save. Picked Sage. *Sauge Officinale*, Fr. Cod. *Sauge*, Fr. *Folia Salviae*, P. G. *Salbei*, G.—"The dried leaves of *Salvia officinalis* Linne (Fam. *Labiatae*)." U. S. VIII. *Salvia officinalis*, or common *garden sage*, is a perennial plant, about two feet high, with a quadrangular, pubescent, branching, shrubby stem, furnished with opposite, petiolate, ovate-lanceolate, crenulate, wrinkled leaves, of a grayish-green color, sometimes tinged with red or purple. The flowers are blue, variegated with white and purple, and are disposed on long terminal spikes, in distant whorls, each composed of a few flowers, and provided with ovate, acute, deciduous bracts. The calyx is tubular and striated, with two lips, of which the upper has three acute teeth, the under two. The corolla is tubular, bilabiate, ringent, with the upper lip concave, and the lower divided into three rounded lobes, of which the middle is the largest. The filaments are supported upon short pedicels, to which they are affixed transversely at the middle.

Sage grows spontaneously in Southern Europe, and is cultivated abundantly in our gardens. There are several varieties, differing in the size and color of their flowers, but all possessing the same medicinal properties. The flowering period is in June, at which time the plant should be cut, and dried in a shady place. The leaves were officially described as "long and stoutly petiolate, the blade elliptical or ovate-oblong, 3 to 7 Cm. long, obtuse or subacute at the summit, rounded or subcordate at the base, finely crenulate, thick, grayish-green, very pubescent, especially on the under surface, conspicuously reticulate-veined; odor aromatic; taste aromatic, bitter, and somewhat astringent." U. S. VIII.

Both the leaves and the flowering summits have a strong, fragrant odor, and a warm,

bitterish, aromatic, somewhat astringent taste. They abound in a volatile oil, which may be obtained separate by distillation with water. Muir (*J. Chem. S.*, 37, p. 678) found it to contain a terpene boiling at 156° C. (312.8° F.), another boiling at 171° C. (339.8° F.), *thujone*, C₁₀H₁₆O, a liquid boiling at from 197° to 203° C. (386.6°-397.4° F.), and ordinary camphor, C₁₀H₁₆O. In the fresh oil the first terpene predominates. On standing, the amount of *thujone* increases, and then the camphor. The oil from English leaves contains also a sesquiterpene, C₁₅H₂₄, of the boiling point 260° C. (500° F.). Wallach (*Ann. Ch. Ph.*, 1889) states that the first portions contain pinene and cineol, but the greater portion consists of thujone, C₁₀H₁₆O (formerly called *salviol*). Ferrous sulphate strikes a black color with infusion of sage.

Sage unites slightly tonic, astringent, and aromatic properties. By the ancients it was highly esteemed; it is at present little used, except as a condiment, but has been given in *dyspepsia*, also for *colliquative sweats*. According to Cadeac and Meunier (*Lyons Med.*, May, 1891), the volatile oil of sage is a violent epileptiform convulsant, resembling in its action the oil of absinthe, but less powerful.

The dose of the powdered leaves is from twenty to sixty grains (1.3-3.9 Gm.). Dose, of the infusion (one oz. in one pint of boiling water), two fluidounces (60 mls).

Although the *Salvia officinalis* was the only species of this genus which was recognized by the U. S. P. VIII, many other species share the feeble medicinal properties of sage. *S. pratensis* L., *S. Æthiopis* L., *S. glutinosa* L., and *S. Sclarea* L., or *clarry*, have been officially recognized in Europe, but are less agreeable than is *S. officinalis* and are not much used; the leaves of *S. Sclarea* are said to be introduced into wine in order to impart to it a muscatel taste. The infusion of the Rocky Mountain sage, probably *S. lanceolata* Willd., is affirmed by A. Comstock (T. G., 1887, 660) to be valuable as a diaphoretic in malarial and rheumatic fevers, taken in the form of hot infusion, and when cold to be distinctly tonic and astringent. The dose of fluidextract is half a fluidrachm (1.8 mls).

The seeds of various sages contain enough farinaceous and mucilaginous material to make them useful as food. In the Western United States the ordinary sages of the plains are highly esteemed for fattening cattle, which eat their ripened tops freely (these sages must be distinguished from the so-called "sage brushes" of the West, which belong to the genus *Artemisia*). *Chia*, is the seeds of one or more species of *salvia* largely used in Mexico and Southern Arizona by the natives as food. It is affirmed that the variety known as *Chia pinoli* is yielded by *S. columbaria* (see *Report U. S. Geogr. Surveys, 100th Merid.*, vol. vi, 48). *S. Chia* was described in the *Farmacopea Mexicana* as a new species, yielding *chia*, but Mariano Bascena affirms (*La Naturaleza*, 1881) that the common chia-yielding sage of Mexico is *S. polystachya* Ort., while *Chia azul* is yielded by *S. patens* Cav. Guibourt is probably in error in ascribing chia to *S. hispanica* L. The chia seeds are used not only when crushed as food and for the making of mucilaginous poultices, but also for the preparation of a mucilaginous drink, prepared by adding a teaspoonful of the seed to a tumblerful of cold water, allowing it to stand for half an hour, sweetening and flavoring to taste. Chia seeds are described as follows: "The seed is oblong-ovate, somewhat flatfish,

from 1 to 8 mm. in length, at one end there is a small, dark line, forming a slight projection, which is the microphyle of the seed, and this, when exposed to moisture, opens in a star-shaped or scalloped manner, emitting the growing embryo. The seed is smooth and glossy, and is surrounded by a transparent epithelium, swelling very largely when in water. The testa is darkish-gray, striated with dark brown lines, running diagonally, and dotted, forming a very beautiful variegated surface; when pressed or crushed under a spatula it bursts at the hilum, exposing the cotyledons and the oil cells, leaving an oily stain upon paper. Internally the testa is dark, grayish-brown, perfectly smooth, glossy, and devoid of the external variegations or striae. It contains the embryo, with the radical pointing towards the hilum, and a white, mucilaginous substance much resembling unrendered fat." (A. J. P., May, 1882, 227-229.) The European species, *Salvia verticillata* L., *S. Verbenaca* L., *S. horminum* L. and *S. viridis* L., all indigenous to Central or Southern Europe, are also noted for the mucilaginous character of their seeds, and have on this account been employed to remove foreign substances from the eye. *S. Verbenaca* is sparingly naturalized in waste places in the Middle and Southern States.

Sago. *Sagou*, Fr. *Sago*, G., It. *Sagu*, Sp.— Under this name the U. S. P. formerly recognized the starch obtained from the *sago* palms. Numerous trees, inhabiting the islands and coasts of the Indian Ocean, contain a farinaceous pith from which is extracted the starch in enormous quantities. In India and the East Indies it is obtained from several palms, viz.: *Metroxylon Rumphii* Mart. and *M. laeve* Mart."

The fruit of the *Cycas circinalis*, according to J. van Donjen, contains a poisonous glucoside, *pakoeine*. (P. J., May, 1903.)

According to H. von Rosenberg (*Proc. A. Ph. A.*, xxvii, 140), pith cells of these palms consist mostly of starch when the large leaves have fallen off and the flowers are just taking their place. At this time the tree is felled, and the trunk cut into billets six or seven feet long, which are split in order to facilitate the extraction of the pith. This is obtained in the state of a coarse powder, which is mixed with water in a trough having a sieve at the end. The water, loaded with farina, passes through the sieve, and is received in convenient vessels, where it is allowed to stand till the insoluble matter has subsided. It is then strained off, and the farina which is left may be dried into a kind of meal or molded into whatever shape may be desired. For the consumption of the natives it is usually formed into cakes of various sizes, which are dried, and extensively sold in the islands. The commercial "Pearl" sago is prepared by forming the meal into a paste with water, and rubbing it into grains. It is produced in the greatest abundance in the Moluccas, but of the finest quality on the eastern coast of Sumatra. The Chinese of Malacca refine it so as to give the grains a fine pearly luster. Malcolm states that it is also refined in large quantities at Singapore.

Pearl sago is that which is now generally used. It is in small grains, 'about the size of a pin head, hard, whitish, of a light brown color, in some instances translucent, inodorous, and with little taste. It may be rendered perfectly white by a solution of chlorinated lime. *Common sago* is in larger and browner grains, of more unequal size, of a duller aspect, and frequently mixed with more or less of a dirty looking powder.

An average palm about fifteen years old will yield from 300 to 400 kg. of sago starch.

Sago meal is imported into England from the East Indies. It is in the form of a fine amylaceous powder, of a whitish color, with a yellowish or reddish tint, and of somewhat musty odor.

Sago starch grains are oval or ovate and often truncated. As the article of commerce is partially cooked the grains are more or less altered. The individual grains usually show a large central area around which are the narrow, distinct altered lamellae which are sometimes traversed by radiating fissures. The starch grains vary from 0.015 to 0.080 mm. in length. When examined by polarized light the grains show a distinct cross. At one time sago flour showed considerable amounts of stone cells, hairs and calcium oxalate crystals, but as the product is more highly refined in recent years, these impurities have been eliminated.

Common sago is insoluble in cold water, but by long boiling unites with that liquid, becoming at first soft and transparent, and ultimately forming a gelatinous solution.' Pearl sago is partially dissolved by cold water, probably owing to the heat used in its preparation. Chemically considered, it is a very pure natural starch, as the nitrogenous matter rarely amounts to more than one per cent., and the ash to one-half per cent., ' the remainder being starch and moisture.

Potato starch is sometimes prepared so as to resemble bleached pearl sago, for which it is sold. But, when examined under the microscope, it exhibits larger granules, which are also more regularly .oval or ovate, smoother, less broken, and more distinctly marked with lamellae than are those of sago, and the hilum often cracks with two slightly diverging slits. Imitation sago is now made in the United States from various kinds of starch.

Sago is used exclusively as an easily digestible, non-irritating food. It is given in the liquid state, and in its preparation care should be taken to boil it long in water, and stir it diligently, in order that the grains may be thoroughly dissolved. Should any portion remain undissolved, it should be separated by straining. A tablespoon-ful to the pint of water is usually sufficient.

Salep. *Tubera Salep*, P. G. *Salep*, Fr., G.— This name is given to the dried tubers of numerous species of the genus *Orchis*, and other allied genera of the *Orchidaceae*. At present the salep of European commerce is prepared chiefly in the Levant, but to some extent in Germany and other parts of Europe. The German salep is said to be more translucent than the Levant.

Salep is in small, oval, irregular, ovoid or oblong tubers, rarely palmate, hard, horny, semi-transparent, of a yellowish color, a feeble odor, and a mild mucilaginous taste. It is sometimes kept in the state of powder. In composition and relation to water it is closely analogous to tragacanth, consisting of a substance insoluble but swelling up in cold water (*bassorin*), of another in much smaller proportion, soluble in cold water, and

of minute quantities of saline matters. It also occasionally contains a little starch. It is highly nutritive, and may be employed for the same purposes as tapioca, sago, etc. Its medieval and Oriental reputation as an aphrodisiac is unfounded. On account of its hardness, salep, in its ordinary state, is of difficult pulverization; but the difficulty is removed by macerating it in cold water until it becomes soft, and then rapidly drying it. *Royal salep*, said to be much used as a food in Afghanistan, has been identified by J. E. T. Aitchison as the product of *Allium Macleanii* Baker. (Fam. *Liliaceae*.) (*P. J.*, Sept., 1889.)

E. Reeb stated that salep possesses, like diastase, the property of coagulating milk, which he attributes to *erythrodextrin*, but finds that this body, in distinction from diastase, will retain its coagulating property even after heating it to 100° C. (212° F.). (*Journ. der Pharm. v. Elsass-Loth-ringen*, 1912, No. 8.).

Salix. U. S. 1880.—*Willow-bark*. *Weidewinde*, G. *Ecorce de Saule*, Fr. Most of the species of the large genus *Salix* are possessed of similar medicinal properties. (For elaborate study of various willow barks see *Wellcome Chemical Research Laboratory Report*, No. 39.) *S. fragilis* L. or *Crack Willow*, which has been introduced into this country from Europe, is said by Sir James Smith to be the most valuable species. *S. purpurea* L., a European species, is stated by Lindley to be the most bitter, and *S. pentandra* L. is preferred by Nees von Esenbeck. Many native species are in all probability equally active with the foreign.

Salix alba L., the species formerly recognized by the U. S. Pharmacopoeia, is the common European or *white willow*. It has sparingly escaped from cultivation, growing from New Brunswick and Ontario southward to Pennsylvania. It is a large tree with a rough grayish bark, the twigs being brittle at the base, and in this respect somewhat resembling *S. fragilis*. The leaves are pubescent on both surfaces and finely serrulate. It hybridizes with other species of *Salix*. It flowers in April and May, and the bark is easily separable throughout the summer. That obtained from the branches rolls up when dried into the form of a quill, from 0.5 to 1 mm. thick, has a brown, more or less finely warty periderm, is flexible, fibrous, and of difficult pulverization. The inner surface is brownish-white, and smooth, separating in thin layers. Willow bark has a feebly aromatic odor and a peculiar bitter astringent taste. It yields its active properties to water, with which it forms a reddish-brown decoction. Pelletier and Caventou found among its ingredients, tannin, resin, a bitter yellow coloring matter, a green fatty matter, gum, wax, lignin, and an organic acid combined with magnesia. The proportion of tannin is so considerable that the bark has been used for tanning leather. The characteristic constituent of all species of willow, however, is *salicin*. Robert W. Beck (*A. J. P.*, 1891, 581) has determined the relative percentages of salicin and tannin as follows:

	Salicin.	Tannin.
Leaves of <i>S. lucida</i> Muhl	0.30 per cent.	6.48 per cent.
Bark of <i>S. lucida</i> Muhl	1.09 " "	3.58 " "
Bark of <i>S. alba</i> L	0.56 " "	4.26 " "
Bark of <i>S. nigra</i> Marsh	0.73 " "	3.29 " "

Jowett and Potter made an examination of thirty-three samples of willow and poplar,

and found in but one (*Salix discolor* Muhl.) the related glucoside *salinigrin*, which Jowett had previously discovered in an unknown sample of willow bark. This compound has the formula $C_{13}H_{16}O_7$, and on hydrolysis yields glucose and meta-hydroxybenzaldehyde. (*Wellcome Chem. Research Laboratory Report*, No. 28.) The bark of the willow is feebly tonic, but it is at present never employed in regular medicine.

Salix nigra Marsh. *Black Willow*.—This is a tree with a dark brown bark, and is noted for its rapid distribution along streams into which its brittle twigs fall, which strike root, forming new plants. It hybridizes with *Salix alba*. The younger Michaux states that this is a strong bitter, and according to various eclectic practitioners its greenaments or floral buds are a very active sexual depressant, useful in *spermatorrhoea*, in all forms of sexual excitement, and in the nervous disturbances of the menstrual period. From twenty to thirty minims (1.3-1.8 mils) of the fluidextract are to be given four times a day.

The *Pussy Willow* (*Salix discolor* Muhl.) is a shrub growing in swamps and on moist hillsides of the northern United States. It is well known because of its silky downy catkins which appear in early spring before the leaves.

Samandera Bark.—This is the inner bark of *Samandera indica* Gartn., a tree belonging to the family of *Simarubaceae*, growing in Ceylon and the East Indies. It is intensely bitter, and probably contains quassin. For further particulars, see *P. J.*, 1872, 541.

Sandal Wood. *Santalum Album*, *White Sandal Wood*.—"The heart wood of *Santalum, album*, Linne (Fam. *Santalaceae*)." *N. F. IV*.

White *sandal wood* was introduced into the *N. F. IV* to serve as an ingredient in *tincture of saw palmetto and santal* of the National Formulary. It is described as follows:

"In billets, pieces or chips of varying shapes and sizes, heavy, hard but splitting easily, color light yellow; transverse sections yellow to light reddish-brown, with alternating light and dark concentric zones nearly equal in diameter, with numerous pores and traversed by many very narrow medullary rays.

"When examined under the microscope, sections show the medullary rays from two to four rows wide, the cells thick-walled and radially marked; the wood wedges consisting largely of wood fibers with pointed ends, large parenchyma and thick-walled secretion vessels and cells containing single crystals of calcium oxalate; the oil in globules adhering to the walls of the ducts and parenchyma cells and especially rich in the medullary cells. Odor characteristic, aromatic, persistent; taste peculiar, strongly aromatic.

"Sandal Wood yields not more than 8 per cent. of ash." *N. F. IV*. For further information on sandalwood see *Oleum Santali*. It owes its therapeutic virtue entirely

to the volatile oil it contains.

Sandarac. *Sandaraca*. Gum Juniper. Sandaraque, Fr. Sandarak, G.—A resinous substance obtained from the *Callitris quadrivalvis* Vent. (*Thuja articulata*, Vahl), an evergreen tree (fam. *Pinaceae*) growing in the mountains of northwestern Africa.

Sandarac is a resinous exudation which occurs as a natural secretion in schizolysigenous reservoirs in the bark. It exudes naturally, but an increase in yield is obtained by cutting through the bark. The exuding resin hardens and is collected. It is sent by the natives to Mogador, Casablanca and Nazagan. From these points it is shipped to London, Trieste, Marseilles and Hamburg. It occurs in small, irregular, roundish oblong grains or tears, of a pale yellow color, sometimes inclining to brown, more or less transparent, dry and brittle, breaking into powder under the teeth, of a faint, agreeable odor increased by warmth, and of a resinous, slightly acrid taste. It melts with heat, diffusing a strong balsamic odor, and easily inflames. It is almost entirely soluble in ordinary alcohol, and entirely so in that liquid when anhydrous, and in ether. Heated oil of turpentine also dissolves the greater part of it, but very slowly. According to Unverdorben, it consists of three resins, varying in their relations to alcohol, ether, and oil of turpentine. The *sandaracin* of Geise, which remains after sandarac has been exposed to the action of ordinary alcohol, is a mixture of two of these resins. Tschirch (*Harze und Harzbehalter*, p. 276) has isolated and described an acid, *sandaracolic acid*, $C_{44}H_{64}O_4(OH)COOH$, making up 85 per cent. of the natural resin and *callitrollic acid*, $C_{64}H_{82}O_5(OH)COOH$, of which 10 per cent. is present. In Australia and Tasmania *Callitris* trees grow in vast numbers, and produce a sandarac which is almost colorless, having highly refractive power, and a pleasant aromatic odor, becoming dark by age, and sometimes assuming a superficial mealiness. This Australian sandarac softens easily, but does not melt in boiling water, is gritty to the touch, and can scarcely be distinguished from the African drug. (*P. J.*, Jan., 1890.) For an elaborate description of Australian sandarach, see also A. J. P., 1896, 215. Sandarach was formerly given internally, and entered into the composition of various ointments and plasters. At present it is used chiefly as a varnish and as incense; its powder, termed pounce, is rubbed upon paper to prevent ink from spreading after letters have been scratched out. It is sometimes adulterated with mastic, rosin and dammar. A false sandarach has been described by R. Haneke. It resembled the real article, being lemon-yellow in color, transparent, and the tears elongated and rounded at the tips. When chewed it broke into fine powder and stuck to the teeth, while it softened on the water bath and flowed together into a resinous mass. Examination showed it to consist largely of colophony. (*O. Z.*, liv.)

SANGUINARIA. U. S.

SANGUINARIA Sanguin. [Bloodroot]

The dried rhizome and roots of *Sanguinaria canadensis* Linne (Fam. *Papaveraceae*). U. S.

Blood-root, Red-root, Puccoon, Red Indian-plant, Puccoon-root. Coon-root, White puccoon, Pauson, Snakebite, Sweet-slumber, Tumeric, Red Puccoon, Tetterwort, Red Indian Paint; Sanguinaire, Fr.; Blutwurzel, G,

Bloodroot (*Sanguinaria canadensis*), or, as it is sometimes called, puccoon, is an herbaceous or perennial plant. The rhizome is horizontal, abrupt, often contorted, about as thick as the finger, two or three inches long, fleshy, of a reddish-brown color on the outside, and brighter red within. It is furnished with numerous slender roots, and makes offsets from the sides, which succeed the old plant. From the end of the rhizome arise the scape and leaf-stalks, surrounded by the large sheaths of the bud. These spring up together, the folded leaf enveloping the flower-bud, and rolling back as the latter expands. The leaf, which stands upon a long channelled petiole, is reniform, somewhat heart-shaped, deeply lobed, smooth, yellowish green on the upper surface, paler or glaucous on the under, and strongly marked by orange-colored veins. The scape is erect, round, and smooth, rising from a few inches to a foot, and terminating in a single flower. The calyx is two-leaved and deciduous. The petals, varying from seven to fourteen, but usually about eight in number, are spreading, ovate, obtuse, concave, mostly white, but sometimes slightly tinged with rose or purple. The stamens are numerous, with yellow filaments shorter than the corolla, and orange oblong anthers. The ovary is oblong and compressed, with a sessile, persistent stigma. The capsule is oblong, acute at both ends, one-celled, two-valved, and contains numerous oval, reddish-brown seeds. The whole plant is pervaded by an orange-colored sap, which flows from every part when broken, but is of the deepest color in the rhizome. The bloodroot is one of the earliest and most beautiful spring flowers of the Northern United States, growing abundantly in loose, rich soils and shady situations. After the fall of the flower the leaves continue to grow, and by the middle of summer have become so large as to give the plant an entirely different aspect. Except the seeds, all parts of the plant are active.

Properties.—The following is the official description of *sanguinaria*: "Of horizontal growth, occasionally branching, more or less cylindrical, somewhat flattened, from 2 to 7 cm. in length, and from 5 to 15 mm. in diameter; externally dark brown, slightly annulate, with a few stem-scars on the upper surface and numerous more or less broken filiform roots and root-scars on the lower surface; fracture short and somewhat waxy, brownish-red, occasionally yellowish-white, with numerous, small, circular, yellowish fibro-vascular bundles within about 1 mm. of

the epidermis, pith very large; odor slight; taste persistently acrid and bitter. Under the microscope, transverse sections of the rhizome of *Sanguinaria* show an outer layer of a single row of thin-walled epidermal cells; a cortex of from 10 to 15 rows of thin-walled parenchyma cells containing numerous starch grains, or a small amount of fixed oil; a zone of cambium, most of which is inter-fascicular; a narrow circular zone of small collateral fibro-vascular bundles, separated from each other by parenchyma; pith large, consisting of starch-bearing parenchyma cells; latex cells containing a red or orange colored secretion, either isolated or connected into irregular chains and distributed among the parenchymatous cells of the middle bark and pith; sections treated with glycerin show in the secretion cells, after twenty-four hours, spheroidal aggregates of crystals which strongly polarize light. The powder is brownish-red, sternutatory; when examined under the microscope it exhibits numerous starch grains, from 0.003 to 0.02 mm. in diameter, being mostly single, seldom 2- to 3-compound, the individual grains nearly spherical or ovoid, sometimes more or less plano-convex, somewhat resembling those of wheat starch in outline but polarizing light more strongly; numerous fragments of short latex cells with reddish-brown resinous masses; tracheal fragments few, having numerous slit-like pores." *U. S.*

For an interesting microscopical description of the rhizome by E. S. Bastin, see *Pharm.*, 1885, p. 201. *Sanguinaria* has a faint odor, and a bitterish very acrid taste, the pungency of which remains long in the mouth and fauces. Lloyd states that *sanguinaria* is both a contamination and an adulterant of *hydrastis*. (*Pharm. Rev.*, 1905, xxiii, p. 332.) It yields its virtues to water and alcohol.

Dana of New York, obtained from it an alkaloid, denominated by him *sanguinarine*. (*Ann. Lyc. of Nat. Hist.*, New lark, ii, 250.) It may also be conveniently procured by a process similar to that employed by Probst for obtaining chelerythrine from celandine. (*Chem. Gaz.*, i, 145.)

G. Konig (*A. J. P.*, 1891, p. 457) found *chelerythrine*, which is present in greatest quantity, *sanguinarine*, β - and γ -*homochelidonine*, and *protopine*. Chelerythrine crystallizes with a molecule of alcohol which is not separated at 150° C. (302° F.). Its formula is C₂₁H₁₇O₄N, and it is identical with the alkaloid extracted from *Chelidonium majus*. The salts are lemon-yellow. Sanguinarine has the formula C₂₀H₁₅O₄N (Schmidt,

$C_{91}H_{15}O_4N$), and is very similar to chelerythrine in its properties. It crystallizes with one-half molecule of H_2O , and melts at $211^{\circ} C.$ ($411.8^{\circ} F.$). Its salts are red. The base named γ -homochelidonine is probably identical with that separated by Selle from *Chelidonium majus*, and its formula is $C_{22}H_{21}O_5N$. The fourth alkaloid, protopine, has been prepared from *Chelidonium majus*, from *Sanguinaria canadensis*, and from opium, all three of the specimens being identical. Its formula is $C_{20}H_{17}O_5N$, and it melts at $204^{\circ} C.$ ($399.2^{\circ} F.$). The virtues of the root are said to be rapidly deteriorated by time. Thos M. Newbold extracted from sanguinaria a non-volatile liquid acid (*sanguinarinic acid*) (*A. J. P.*, 1866, p. 496), which L. C. Hopp has shown to be a solution of impure citric and malic acids. Schlotterbeck (*Ph. Rev.*, 1900, 358) examined sanguinarine nitrate of commerce and found it to consist mainly of chelerythrine, with some sanguinarine and traces of protopine and homo-chelidonine; he believes that chelerythrine should be called sanguinarine. For methods of assay of sanguinaria see *A. J. P.*, 1896, 305; *M. K.*, 1900, 451; *Proc. A. Ph. A.*, 1903, 284; *A. J. P.*, 1913, p. 395.

Uses.—*Sanguinaria* is an active local irritant, in large doses producing nausea and vomiting. When snuffed up the nostrils it excites much irritation and sneezing. According to the investigations of Meyer (*A. E. P. P.*, 1892, xxix, p. 397) sanguinarine is an active stimulant to the spinal cord producing in frogs strychnine-like convulsions followed, after very large doses, by complete paralysis. It also stimulates the respiratory center, increasing both the depth and rate of the breathing. By virtue of a stimulant action upon the vasomotor center it causes a rise in blood pressure which, with toxic doses, is followed by a fall in the blood pressure, due to weakening of the heart action. It also excites the flow of saliva and increases intestinal peristalsis. In toxic doses it acts as a poison to the voluntary muscles. When locally applied it causes at first pain, followed by a local anesthesia. Chelerythrine, although present in larger amounts in *sanguinaria*, is a much less poisonous alkaloid than sanguinarine and it is probable that it plays a role of relatively small importance in the action of the whole drug. It differs widely in its action from sanguinarine, acting chiefly as a paralyzant of the nerve centers, including the spinal cord, the respiratory and the vasomotor centers. It is also a poison to the voluntary muscles. It is locally irritant but has neither anesthetic nor narcotic properties. Beta-homochelidonine, the third most important alkaloid, has a feeble narcotic effect, produces cerebral convulsions, but does not increase reflex activity. It is an active

local anesthetic without the irritant effect of sanguinarine.

Sanguinaria is used chiefly as an expectorant, especially in the treatment of subacute or *chronic bronchitis*. Whether it possesses any beneficial action for this purpose except that which may be attributed to its nauseating effect, seems doubtful. It has also been recommended by Graber (*J. A. M. A.*, 1907, xlix, p. 705) as a local application in chronic *eczema*, especially when secondary to *varicose ulcers*.

In toxic quantities sanguinaria produces burning in the epigastrium with vomiting, tormenting thirst, faintness, vertigo, dimness of vision, and alarming prostration. Twenty grains (1.3 Gm.) are said to usually act as a violent emetic. (For fatal cases, see *Am. J. M. S.*, n.s., ii, p. 506.)

The alkaloid sanguinarine has been used in doses of from one-twelfth to one-sixth of a grain (0.005-0.01 Gm.). Sanguinaria is rarely given in substance.

Dose, U. S. P., two grains (0.13 Gm.).

Off. Prep.—Tinctura Sanguinariae, U. S.; Fluidextractum Sanguinariae, N. F.; Syrupus Pini Strobi Compositus, N. F.; Syrupus Pini Strobi Compositus cum Morphina, N. F.; Syrupus Sanguinariae, N. F.

Sanicula. *Sanicula marylandica* L. *Sanicle*, Fr. *Sanikel*, G.—The root of this indigenous umbellifer is popularly known in some parts of the country by the name of *black snake-root*. It is fibrous and of an aromatic taste, and, according to C. I. Houck (*A. J. P.*, vol. xiv, 463), contains a volatile oil and a resin. It has been used in *intermittent fever*, and also in *chorea* by Zabriskie. Dose of powder to children eight years old, half a drachm (2.0 Gm.) three times a day. (*Am. J. M. S.*, n. s., xii, 374.)

SANTALUM RUBRUM. U. S. (Br.)

RED SAUNDERS Santal. Rub.

"The heart-wood of *Pterocarpus santalinus* Linne filius (Fam. *Leguminosae*)." U. S. "Red Sanders Wood is the heart-wood of *Pterocarpus santalinus*, Linn. f." Br.

Pterocarpi Lignum, Br., Red Sanders Wood; Lignum Santalinum Rubrum, Rasura Santalum Ligni; Red Sandal Wood; Red Santal Wood; Ruby Wood; Santal rouge, Fr.

Cod.; Santelholz, Rothes Santelholz, *G.*; Sandalo rojo (Leno de), *Sp.*

Pterocarpus santalinus is a large tree, with alternate branches, and petiolate ternate leaves, each leaflet being ovate, blunt, somewhat notched at the apex, entire, veined, smooth on the upper surface, and hoary beneath. The flowers are yellow in axillary spikes, and have a papilionaceous corolla, of which the vexillum is obcordate, erect, somewhat reflexed at the sides, toothed and waved, the alae spreading with their edges apparently toothed, and the carina oblong, short, and somewhat inflated. The tree is a native of India, attaining the highest perfection in mountainous districts, and inhabiting especially the mountains of Coromandel and Ceylon. It is cultivated also in Southern India and in the Philippine Islands. Its wood is the official *red saunders*, though there is reason to believe that the products of other trees are also sold by the same name.

Properties.—The wood comes in heavy, irregular, roundish or angular billets of various size and thickness, externally brown from exposure, internally of a deep blood-red color, on transverse section variegated with zones of a lighter red. The structure is heavy, compact, and fibrous. In the pharmacies red saunders is usually kept in the shape of small chips, or raspings, or coarse powder, of a deep reddish-brown color, slightly astringent in taste, and when rubbed of a faint peculiar odor. It has little odor or taste. Red saunders is officially described as follows: "Usually in the form of a coarse powder, of a brownish-red or dark saffron color and nearly odorless and tasteless. Under the microscope, Red Saunders shows numerous wood-fibers which are mostly irregular in outline, with sharply pointed and occasionally forked ends, the individual fibers from 0.3 to 0.75 mm. in length, the walls being very thick, porous, yellowish, unevenly thickened, and strongly lignified, and the lumina being filled with a fine, granular, protoplasmic content; occasional trachea) with simple or bordered pores and filled with light lemon-yellow, resinous masses; occasionally fragments showing medullary rays in narrow elliptical groups 1 cell wide and 3 to 6 cells deep; also occasional groups of crystal fibers with calcium oxalate in the form of monoclinic prisms, from 0.01 to 0.02 mm. in diameter. Mounts in hydrated chloral T.S. are of a deep, rich red color. Add 0.5 Gm. of Red Saunders to 10 mls of alcohol; the solution becomes distinctly red. Add 0.5 Gm. of Red Saunders to 10 mls of ether, the solution assumes an orange-yellow color and when held in a bright light shows a distinct, greenish fluorescence. Add 0.005 Gm. of Red Saunders to 10 mls of

water; the liquid remains clear and colorless. Red Saunders yields not more than 3 per cent. of ash." *U. S.*

"Imported in irregular logs or billets, freed from the pale sapwood; reddish-brown or blackish-brown externally, deep blood-red internally; hard, but easily split longitudinally. In transverse section, narrow, closely approximated, reddish medullary rays traversing a nearly black wood with scattered, large, isolated vessels. Coloring matter readily soluble in alcohol (90 per cent.), but almost insoluble in water. Odor of the warmed Wood faintly aromatic; taste very slightly astringent." *Br.*

It imparts a red color to alcohol, ether, and alkaline solutions, but not to water, and a test is thus afforded by which it may be distinguished from some other coloring woods. The alcoholic tincture produces a deep violet precipitate with ferrous sulphate, a scarlet with mercuric chloride, and a violet with the soluble salts of lead. The coloring principle, which was separated by Pelletier and called by him *santalin*, is of a resinous character, scarcely soluble in cold water, more so in boiling water, very soluble in alcohol, ether, acetic acid, and alkaline solutions, but slightly in the fixed and volatile oils, with the exception of those of lavender and rosemary, which readily dissolve it. It is precipitated when acids are added to the infusion of the wood, prepared with an alkaline solution. Weyermann and Haeffely have found it to possess acid properties, and give it the formula $C_{15}H_{14}O_5$. (*Ann. Ch. Ph.*, 74, p. 226.) Weidel (*Wien. Akad. Ber.*, lx, p. 388), by extracting the red saunders with potassium hydroxide, precipitating with hydrochloric acid, and again extracting from the purified precipitate with ether, obtained a colorless crystalline principle, which he calls *santal*, $C_8H_6O_3 + \frac{1}{2}H_2O$.

Cazeneuve and Hugonneng (*C. R. A. S.*; 104, 1722, 1725) have described two crystalline principles which they have extracted from red saunders, *pterocarpin*, $C_{20}H_{16}O_6$ and *homo-pterocarpin*, $C_{24}H_{24}O_6$, of which the former fuses at $152^\circ C.$ ($305.6^\circ F.$) and the latter at from 82° to $86^\circ C.$ ($179.6^\circ - 186.8^\circ F.$). The wood has no medicinal virtues, and is employed solely for the purpose of imparting color.

Off. Prep.—Tinctura Lavandulas Composita, *U. S.*, *Br.*

Santolina.—A composite plant, commonly called *Holy herb*, *Heiligenpflanssen*, *Cypress herb*, *Cypressenkraut* (*Santolina Chamoeyparissus* L.), is stated to have long been used popularly against the round worm in Scotland. It has been analyzed by T.

Maben (*P. J.*, xvi, 301), who finds in it a volatile oil and a considerable percentage of resin, with a bitter principle, which he believes to be an alkaloid and the active principle of the drug. The decoction of the plant may be made by boiling half an ounce in a pint of water for half an hour, straining and making up to a pint. It is given in doses of five fluidounces (150 mils) to adults and half that quantity to children, repeated for four mornings, and then followed by a brisk cathartic.

Santonica. U. S. VIII. *Levant Wormseed. Turkestan, Aleppo, Alexandria, or European Wormseed. Santonici Semen. Semen cinae. Flores Artemisiae. Semen Sanctum. Semen-contra Dalep. Semencine ou Barbotine*, Fr. Cod. *Flores Cinae*, P. G. *Wurmsamen, Zitwersamen*, G. *Santonico*, It., Sp.—The dried unexpanded flowers of the *Artemisia Cina* Berg. (*A. pauciflora* (Ledebour) Weber) (Fam. *Compositae*). This plant is a small, semi-shrubby perennial, from whose oblique, knotted rootstalks arise numerous leafy shoots and flowering stems. The glabrous and woody stems bear on their many branches numerous small (one inch long) bi- to multi-pinnatifid leaves, while the leaves of the flowering stems are very minute, the upper ones simple. The flower heads are small, numerous, one-tenth of an inch long, with from twelve to eighteen involucre scales, and from three to five flowers; The plant varies very greatly, and several species have been made out of its varieties. The plant grows in Persia and Turkestan and the flower-buds are collected in July and August. The Levant wormseed was officially described as "heads 2 to 4 Mm. long, oblong-ovoid, slightly flattened, obtuse, consisting of an involucre of about 12 to 18 closely imbricated, glandular scales with broad midribs, enclosing 4 to 5 rudimentary florets. *Santonica* has the appearance of a granular, yellowish-green or greenish-brown, somewhat glossy powder; odor strong, peculiar, somewhat camphoraceous; taste aromatic and bitter." U. S. VIII. Astolfi (*Ph. Ztg.*, 1893, 333) gives the following test for recognizing adulteration of santonin. 1 Gm. of the suspected drug is finely pulverized and then agitated with 10 mils of absolute alcohol; the whole is heated to boiling, filtered, a piece of potassium hydroxide is added to the filtrate, which is then heated. If the drug is pure, the liquid will acquire a pronounced red color; if falsified, the color will be yellow; and if no santonin be present, the liquid will be colored but faintly, if at all.

Most of the wormseed of commerce comes from the steppes of the northern portion of Turkestan to the great Nizhni-Novgorod fair, whence it finds its way to Moscow and Western Europe. The export from this region has largely declined, because of the erection in Orenburg and Tschimkent of factories for the manufacture of santonin, which is now sent from there into commerce. The yearly consumption of santonin throughout the world is estimated 'at about twenty-five tons, and of this at least twelve tons are produced in the factories just spoken of. The santonin in the plants is said to reach its maximum proportion in July and August, and to disappear immediately after the flowering.

Attention was called by C. H. LaWall (*J. A. Ph. A.*, 1813, p. 596) to a variety of santonin that has appeared upon the market, which seems to be devoid of santonin or to contain not more than traces. He proposes a simple test which may be applied directly to the drug as a preliminary procedure and thus avoid the necessity of going

through the long assay process if the sample is valueless: Place 5 Gm. of santonica (whole or ground) in a test tube, add 5 mils of spirit of nitrous ether and boil gently. No more color should be developed or not more than a slight greenish yellow color due to the solvent action of the spirit on the resins of the drug. Now add 10 drops of alcoholic solution of potassium hydroxide. In an active drug a rose red color is developed in direct proportion to the amount of santonin present.

Wormseed contains a volatile oil, but it owes its efficiency to *santonin*. According to Merck, the mother liquors in the manufacture of santonin from the seeds of *Artemisia maritima* yield a crystalline principle, $C_{15}H_{18}O_4$, which has been named *artemisin*. It is freed from santonin by recrystallization from chloroform. It melts at $200^{\circ} C.$ ($392^{\circ} F.$), gradually turns yellow in the air, and is more readily soluble in water and in dilute alcohol than is santonin. It gives a fugitive carmine red color when heated with aqueous or alcoholic sodium hydroxide, and is apparently a *hydroxy-santonin*. (*P. J.*, 1896, 484.) Dose, of artemisin, one-six hundred and fortieth of a grain (0.0001 Gm.). The oil of santonica, according to Wallach (*Ann. Ch. Ph.*, ccxxv, 314; and ccxxvii, 277), consists chiefly of *cineol*, $C_{10}H_{18}O$, which is isomeric with borneol, and seems to be identical with the cajuputol of cajuput oil, together with some *dipentene*. Wormseed is rarely used in this country in substance. It is stated that artemisin is a powerful stimulant to the mucous membrane and muscles of the alimentary canal and that its addition to the simple bitters greatly increases their activity. Dose, of santonica, ten to thirty grains (0.65-2.0 Gm.). For a method of valuing santonica, by Dragendorff, see *Proc. A. Ph. A.*, xxvi, 229. For *Ehling's Process for Valuing Santonica*, see *U. S. D.*, 19th ed., page. 1085.

Sapindus.—Various tropical plants belonging to this genus of the *Sapindaceae* contain saponin, and are largely used for cleaning purposes. The berries are commonly used, being called "Soap berries" Thus, in India are employed the pulp of the fruit of *SapindusMukorossi* Gaertn., the capsules of *S. trifoliatu*s L., and in South America the oil and seed vessels of *S. Saponaria* L. (*P. J.*, 1871. 585.) For the properties of saponin, see *Saponaria officinalis*, below. The fruits of *S. rarak* DC., according to O. May, contain saponin and a fixed oil. (*A. Pharm.*, 1906, 25.)

Sapium. *Sapium sebiferum* (L.) Roxb. *Chinese Tallow Tree. Tankawang Fat.*—This is a species of the family *Euphorbiaceae*, cultivated in the Chinese provinces of Kiangse, Kiang-sou, and Chih-kiang for the sake of the fixed oil which covers the seeds and is extracted by methods detailed in *A. J. P.*, 1872, 264. (See *P. J.*, June, 1872.) The "tallow" occurs in hard, brittle, opaque, white masses of about eighty pounds' weight. It consists chiefly of palmitin with a little stearin and is said to be nearly pure stearin. The oil is largely used for lighting purposes. The remnants of the nut are employed as fuel and as manure. (See also *P. J.*, 1883, 401, and 1887, 901.)

Saponaria. *Saponaria officinalis* L. *Soapwort. Bouncing Bet. Fuller's Herb. Sheep Weed. Saponaire. Savonniere*, Fr. *Seifenwurzel*, G. (Fam. Caryophyllaceae.)—A perennial, herbaceous plant, having large rose-colored flowers, which are commonly double. It is common along roadsides and waste places in the United States. The rhizome and roots are employed. The rhizomes are cylindrical, from 5 to 12 cm. long

and 5 to 12 mm. thick, outer surface being reddish-brown. The fracture is short and even. They are inodorous, and of a taste at first bitterish and slightly sweetish, afterwards somewhat pungent, continuing long, and leaving a slight sense of numbness on the tongue. They impart to water the property of forming a lather when agitated, like a solution of soap, whence the name of the plant was derived. This property, as well as the medicinal virtues of the plant, resides in *saponin*, $C_{32}H_{54}O_{18}$. This principle constitutes, according to Bucholz, its discoverer, 34 per cent. of the dried root which contains also a considerable quantity of gum and a little bassorin, resin, and altered extractive, besides lignin and water. For description of saponin, see *Quillaja*. Saponin has been found in many other plants, among them some species of *Silene*, *Dianthus*, and *Lychnis*, in *Vaccaria vulgaris* Host., and in *Agrostemma Githago* L., all belonging to the fam. *Caryophyllaceae*. (*J. P. C.*, 3e ser., x, 339; also *P. J.*, 1871, 585; *Australian Jour. Pharm.*, 1887.) Serious poisonings by the mixture of the seeds of *Agrostemma Githago* with wheat have been reported. (*D. M. W.*, 1903.) According to Augustine Henry, there are at least eleven species of trees whose products are used in China for washing purposes and probably contain saponin, which is also found to the extent of 10 per cent. in the seeds of the Chinese tea oil tree, and is left in such large proportion in the refuse after the extraction of the oil that the "tea seed cake" is used as a fish poison. (*Am. Drug.*, 1896.) In California the *Indian Soap Root*, *Chlorogallum pomeridianum* (Ker.) Kunth., is much used for washing clothes; it probably contains saponin. The fruits of various species of *Sapindus* are also rich in saponin and are used as detergents accordingly.

SAPPAN. Br.

SAPPAN

"Sappan is the heart-wood of *Caesalpinia Sappan*, Linn." *Br.*

Sappan wood, Sampfen wood, Bakam, Tairi, Patang, Teri, Verzino, *It.*; False Sandalwood, Indian Redwood, Samfen.

Caesalpinia Sappan is a small thorny tree indigenous to the Eastern and Western Asiatic Peninsulas, Pegu and Tenasserim, and is also cultivated in Central India. The leaves are large and abruptly bipinnate; the flowers being yellow and in axillary racemes; and the pods are oblong, flattened, nearly smooth and dehiscent or indehiscent. The wood yields a valuable red dye which is also prepared from the pods and from the bark. The commercial samples vary considerably. There are two commercial varieties, viz., (1) Singapore or Dhansari, and (2) Ceylon sappan, the former being preferred. According to Dymock, the freshly cut wood is whitish, but becomes red on exposure to the air. He also states that the addition of alkalis increases the yield of coloring matter, turning it a reddish-violet. According to the British Pharmacopoeia, it

occurs in " hard, heavy pieces of variable size, or in orange-red chips. In transverse section, well-marked concentric rings, numerous narrow medullary rays, and large vessels. No odor; taste slightly astringent. It communicates to alcohol (90 per cent.) and to water a red color, which becomes carmine-red, but not purple, upon the addition of solution of sodium hydroxide (distinction from Logwood)." *Br.*

According to the investigations of Bolley, sappan wood contains *brasilin*, $C_{16}H_{14}O_5$, identical with that of Brazil wood.

Sappan, or samfen, as it is sometimes called, has been an article of commerce for at least five hundred years. It is employed in the arts as a substitute for logwood in dyeing. Medicinally it is used as an astringent in the treatment of *diarrhea*. It may be given in the form of a decoction.

Dose, from fifteen to forty-five grains (1-3 Gm.).

Off. Prep.—Decoctum Sappan, *Br.*

Sarcocolla. *Sarcocolle*, Fr. *Fleischleimgummi*, *Fischleimgummi*, G.—A peculiar vegetable product, exuding spontaneously from *Penoea Sarcocolla* L. (now *P. fulcata* L.), and *P. mucronata* L. (Fam. *Penceaceae*), small shrubs, growing at the Cape of Good Hope, in Ethiopia, Arabia, etc. *Sarcocolla* occurs in the form of small, roundish, irregular grains, somewhat spongy, sometimes agglutinated in masses, at times admixed with fine hairs, friable, opaque or semi-transparent, of a yellowish or brownish-red color, inodorous unless heated, when they have an agreeable odor, and of a peculiar, bitter, sweetish, and acrid taste. Sarcocolla, according to Pelletier, consists of 65.3 per cent. of a peculiar substance, considered by Thomson as holding an intermediate place between gum and sugar, and called sarcocollin, $C_{13}H_{23}O_6$, 4.6 of gum, 3.3 of a gelatinous matter having some analogy with bassorin, and 26.8 of lignin, etc. It is said to be purgative, but at the same time to produce serious inconvenience by its acrid properties. The Arabian physicians used it internally, and by the ancients it was employed as an external application to wounds and ulcers, under the idea that it possessed the property of agglutinating the flesh, whence its name.

Sarracenia. *Side-saddle Plant. Fly Trap. Pitcher Plant. Huntsman's Cup. Water Cup. Sarracenie*, Fr., G.—According to E. P. Porcher, the roots of *Sarracenia flava* L., and *S. variolaris* Michx., have long been used in the Southern United States in *dyspepsia*, and are tonic, laxative, and diuretic. Sheppard found them to contain lignin, coloring matter, resin, an acid salt of lime, and probably an alkaloid. Stan. Martin asserts that he has found in the root—(1) an alkaloid which he proposes to name *sarracenine*; (2) a resin; (3) a yellow coloring principle (probably identical with Schmidt's *sarracenic acid*); (4) extractive; (5) substances which constitute the framework of plants. Sarracenine is white, soluble in alcohol and ether, combines with acids to form salts,

and with sulphuric acid forms handsome needles, which are bitter, and communicate this taste to its menstrua. (*Ann. Ther.*, 1866, 73.) E. Schmidt, however, found no alkaloid but discovered sarracenic acid. (*A. J. P.*, 18.72, 213.) Dose, of tincture (two ounces in one pint), a fluidrachm (3.75 mils) ; of fluidextract, from ten to twenty minims (0.6-1.3 mils).

SARSAPARILLA. U. S.

SARSAPARILLA Sarsap.

"The dried root of *Smilax medica* Chamisso and Schlechtendal, known in commerce as Mexican Sarsaparilla; or *Smilax officinalis* Kunth, or an undetermined species of *Smilax*, known in commerce as Honduras Sarsaparilla; or *Smilax ornata* Hooker filius, known in commerce as Jamaica Sarsaparilla (Fam. *Liliaceae*)." U. S. "The dried root of *Smilax ornata*, Hook. f. Imported from Costa Rica and commonly known as Jamaica sarsaparilla" *Br.* 1898.

Sarsae Radix, *Br.* 1898; Jamaica Sarsaparilla; Salsepareille, *Fr. Cod.*; Radix Sarsaparillae, *P. G.*; Sarsaparille, Sarsaparilla, *G.*; Salsapariglia, *It.*; Zarzaparrilla (Raiz de), *Sp.*

The medicinal species of smilax grow in Mexico, Guatemala, and the warm latitudes of South America. The roots are very long and slender, and originate in great numbers from a common head or rhizome, from which the stems of the plant rise. The whole root with the rhizome is usually dug up, and as brought into market exhibits not unfrequently portions of the stems attached, sometimes several inches in length. The commercial sarsaparillas are conveniently divided into the mealy and non-mealy sarsapariilas. The first class comprises especially the Honduras, Guatemala, and Brazilian varieties; the second the Jamaica, Mexican and Guayaquil sarsapariilas. A very convenient key for distinguishing the commercial sarsapariilas by certain anatomical characters has been devised by Luerssen in his *Handbuch der Medicin-pharm. Botanik*, ii, 404.

All the species of *Smilax* are climbing or trailing plants, with prickly stems—a character expressed in the name of the medicine, which is derived from two Spanish words (*zarsa parilla*), signifying a small thorny vine.

The official species of smilax are as follows:

S. medica, has an angular stem, armed with straight prickles at the joints, and a few hooked ones in the intervals. The leaves are smooth, bright green on both sides, shortly acuminate, five-nerved, with the veins prominent beneath. They vary much in form, the lower being cordate^ auriculate-hastate, the upper cordate-ovate. In the old leaves the petiole and midrib are armed with straight subulate prickles. The inflorescence is an umbel of from eight to twelve flowers, with a smooth axillary peduncle and pedicels about three lines long.

The *Mexican* or *Vera Cruz sarsaparilla* is derived from this species. Although sometimes in bundles, it commonly comes in large, rather loose bales, weighing about two hundred pounds, bound with cords or leather thongs, and usually containing the roots folded upon themselves, and separately packed. These, as in the Honduras sarsaparilla, consist of a head or caudex with numerous long radicles, which, however, are somewhat smaller than in that variety, and have a thinner bark. They are often also much coiled with earth. It contains but little starch and has quadrangular endodermal cells, with thickened walls, and more or less oval lumen. It was formerly little esteemed; but, from the acrid taste which it possesses, it is probably of equal value to the other kinds.

S. officinalis.—In this species the stem is twining, angular, smooth, and prickly; the young shoots are unarmed; the leaves ovate-oblong, acute, cordiform, five- or seven-nerved, coriaceous, smooth, twelve inches long and four or five broad, with footstalks an inch long, smooth, and furnished with tendrils. The young leaves are lanceolate-oblong, acuminate, and three-nerved. Large quantities of the root are said to be sent down the Magdalena River to Mompox and Carthagena.

It is the source of *Honduras Sarsaparilla*. It is brought from the bay of Honduras and comes in bundles two or three feet long, composed of several roots folded lengthwise, and secured in a compact form by a few circular turns. These are packed in bales imperfectly covered with skins, each bale containing one hundred pounds or more. The roots are usually connected at one extremity in large numbers in a common head, to which portions of the stems are also attached. In some bundles are many small fibers, either lying- loose or still adhering to the roots. The roots externally are a dirty grayish or reddish-brown; the cortical

portion beneath the epidermis often appears amylaceous when broken.

S. ornata Hook.—This plant was recognized by both Fliickiger and Hanbury, and by Bentley and Trimen as *S. officinalis*, and was described by Lemaire with a query to it to express his doubtfulness of its specific distinctness. The species is, however, now generally accepted. The plant has large seven-nerved leaves resembling *S. officinalis*. It is especially distinguished by the young leaves being mottled with white. (See *Botanical Magazine*, 1889, cxv, 7054.)

This species yields *Jamaica* or *red sarsaparilla* of foreign writers, although but little known by the latter name in the United States. It is collected in Central America, especially in Costa Rica, and it owes its name to the fact that it has been largely exported to Europe through the island of Jamaica. As found in commerce it is in rolls from twelve to eighteen inches long by four or five in thickness, composed exclusively of long slender many-radiced roots very loosely held together by a few turns. Sometimes it is pressed into large bales. It is further to be distinguished from Honduras sarsaparilla by its dark color, the greater abundance of coarse rootlets, the less quantity of starch, its relatively thick cortex, and its less sharp taste. Externally it is also redder than is commonly the case with Honduras sarsaparilla. Kobert (*P. J.*, 1912, lxxxviii, p. 779), has found that the ornata has only one-eighth of the hemolytic power of the Vera Cruz sarsaparilla, which he takes as a test of its saponin content. He believes the plant is unfit for medical use.

Cultivated Jamaica Sarsaparilla (Roja Inglesa) occurs in thick short rolls and is especially characterized by its yellow-brown or orange color. According to W. B. Hemsley, Hooker's I. P. pl. 2589, it is the product of *S. utilis* Hemsley, a species related to *S. ornata*, from which it differs by its long pediculated simple umbels.

An investigation by Power and Salway (*Chem. News*, 1914, p. 56) showed the presence of the following constituents in Jamaica sarsaparilla: a glucoside, *sarsaponin*, $C_{44}H_{76}O_{20} \cdot 7H_2O$, which upon hydrolysis yields *sarsapogenin*, $C_{26}H_{42}O_3$, and dextrose; *sitosterol-d-glucoside*, $C_{27}H_{46}O$; *sitosterol*, $C_{27}H_{46}O$; *stigmasterol*, $C_{30}H_{50}O$; *sarsapic acid* (a new dicarboxylic acid), $C_6H_4O_6$, and a mixture of fatty acids, including palmitic, stearic, behenic, oleic and linolic acids. The alcoholic extract contained *acetyl-d-glucoside* and potassium nitrate was

also found.

Another variety is the *Caracas sarsaparilla*, brought in large quantities from La Guayra. It is in oblong packages, of about one hundred pounds, surrounded with broad strips of hide, which are connected laterally with thongs of the same material, leaving much of the root exposed. The roots, as in the last variety, are separately packed, but more closely and carefully. The radicles are often very amylaceous internally, in this respect resembling the following variety.

S. papyracea is said to have foliage like *S. officinalis*, with a multiangular stem, with squamiform thorns on the angles, and petioles which are vaginate for one-fourth their length. It is thought to be the source of Para sarsaparilla which is no longer found in commerce.

The *Brazilian*, or, as it is called in Europe, the *Lisbon* or *Para sarsaparilla*, is not very plentiful in commerce. It comes from the ports of Para and Maranham, in cylindrical bundles from three to five feet in length by about a foot in thickness, bound about by close circular turns of a very flexible stem, and consisting of unfolded roots, destitute of caudex (rhizome) and stems, and having a few radical fibers. It was also shown in the Brazilian exhibit in the Centennial Exhibition, neatly cut and tied into bundles about a foot long and eight inches in diameter. It is the variety of which Hancock speaks as celebrated throughout South America by the name of *Sarsa of the Rio Negro*, and was considered one of the most valuable varieties of the drug. It is distinguished by the thinness of its cortex, the large amount of starch that it contains and its large, radially elongated endodermal cells. It was said by Martius to be derived from *Smilax syphilitica*; but Hancock considers that portion of it which comes from the Rio Negro, and is shipped at Para, as the product of an undescribed species, certainly not *S. syphilitica*. As determined by Richard, it is the product of the *S. papyracea* of Poiret.

The variety described by Bentley under the name of *Guatemala sarsaparilla* was collected in the province of Sacatapéques, about ninety miles from the sea. It is in cylindrical bundles about two feet eight inches long by four inches in diameter, composed of separate roots, arranged in parallel order, without rootstalk, and bound together by a few turns of the flexible stem of a monocotyledonous plant. The bundles resemble the Brazilian in arrangement, but are much less compact. It is amylaceous, has considerable acidity, and is probably one of the most

efficient varieties. Bentley ascribes it to *S. papyracea*. For a particular description of the root, see *P. J.*, xii, 472.

Guayaquil sarsaparilla, according to Spruce, grows in valleys on the western slopes of the equatorial Andes. It is usually not in bundles, but carelessly packed in bales. "The rhizome and a portion of the stem are often present, the latter being round and prickly. The root is dark, large, and coarse-looking, with a good deal of fiber. The bark is furrowed, rather thick, and not mealy in the slenderer portions of the root, which is near the rootstalk; but, as the root becomes stout, so its bark becomes smoother, thicker, and amylaceous, exhibiting when cut a fawn-colored or pale yellow interior."

The root (rhizome) of *Smilax China*, a native of China and Japan, has been employed under the name of *China Root* for similar purposes with the official sarsaparilla. As it occurs in commerce, it is in pieces from three to eight inches long and an inch or two thick, usually somewhat flattened, more or less knotty, often branched, of a brownish or grayish-brown color externally, whitish or of a light flesh-color internally, without odor, and of a taste flat at first, but afterwards very slightly bitterish and somewhat acrid, like that of sarsaparilla. The root of *Smilax aspera* is said to be employed in the south of Europe as a substitute for sarsaparilla; but it has little reputation. The East India sarsaparilla, which was at one time referred to this species of smilax, is the product of *Hemidesmus indicus*. (See *Hemidesmus*.)

Under the name of *Raiz de china de Mexico*, the Mexican Pharmacopoeia recognizes the root of *S. rotundifolia* as diaphoretic and depurative, but, according to Maisch, this reference is incorrect. (See *A. J. P.*, 1879.)

Properties.—The several varieties of sarsaparilla are officially described as follows:

"MEXICAN SARSAPARILLA.—In loose bundles, or pressed into bales, single bundles attaining a length of 60 cm. and composed of from 20 to 35 folded roots attached to a crown with one or more stout stems; roots from 3.6 to 6 mm. in diameter; externally grayish-brown to dark brown, minutely hairy, longitudinally furrowed, the furrows containing more or less of a blackish earth; fracture tough, fibrous; internally light brown with a more or less shrunken, mealy or sometimes horny cortex

surrounding the porous central cylinder, pith distinct; nearly inodorous; taste mucilaginous, somewhat sweetish and acrid. Remove the woody, knotty crown with portions of the overground stems.

"HONDURAS SARSAPARILLA.—In more or less compact, cylindrical bundles, attaining a length of 55 cm. and a diameter from 8 to 15 cm., consisting of the long, folded roots bound together by roots of the same plant; roots from 2 to 6 mm. in diameter; externally dark- or reddish-brown, longitudinally furrowed, the furrows usually free from soil; fracture fibrous; internally consisting of a grayish-white or dark brown cortex, a light yellow and porous central cylinder and a whitish pith; taste mucilaginous and slightly acrid.

"JAMAICA SARSAPARILLA.—In more or less compact and somewhat flattened bundles, from 30 to 45 cm. in length and from 10 to 15 cm. in width, consisting of the folded roots loosely bound with roots of the same plant; roots from 2 to 5 mm. in diameter; externally grayish-brown to reddish-brown, longitudinally wrinkled, more or less furrowed and bearing numerous coarse fibrous rootlets; taste somewhat sweet and slightly bitter.

"Under the microscope, transverse sections of all of the commercial varieties of Sarsaparilla show an epidermal layer with basal portions of root hairs; a hypodermis composed of several layers of strongly lignified cells, the walls being uniformly thickened, except in Mexican Sarsaparilla in which the inner walls are only slightly thickened; a cortex composed of numerous parenchyma cells mostly containing starch, some containing resin or raphides of calcium oxalate; an endodermis of a single layer of strongly lignified cells, the walls being uniformly thickened except in Mexican Sarsaparilla in which the outer walls are only slightly thickened; a central cylinder composed of radial bundles connected with sclerenchymatous fibers, the tracheas being large and oval and the phloem in small groups at the periphery of the bundle; and a pith composed of starch-bearing parenchyma cells. Powdered Sarsaparilla is light grayish-brown to dark grayish-brown; when examined under the microscope it exhibits numerous starch grains, from 0.003 to 0.023 mm. in diameter, spherical, or biconvex or spherical-tetrahedral, single to 2- to 4-compound, and frequently with a central-elliptical cleft; calcium oxalate in raphides, from 0.006 to 0.035 mm. in diameter, occurring singly or in groups; cells of the hypodermis and endodermis with lemon-yellow or reddish-yellow porous walls and,

in the case of Mexican Sarsaparilla, showing an uneven or irregular thickening, the individual cells from 0.08 to 0.5 mm. in length; fragments of trachea) with simple and bordered pores or scalariform or reticulate thickenings associated with sclerenchymatous fibers having rather thin, very slightly lignified and porous walls. Sarsaparilla yields not more than 10 per cent. of ash." *U. S.*

According to Tunmann (*Apoth. Zeit.*, xxv, p. 475), the consumption of sarsaparilla in Europe has decreased materially, and the chief market for this drug at the present time appears to be the United States. While the U. S. Pharmacopoeia recognizes three commercial varieties, most of the drug which is used is the Mexican variety, a relatively small quantity of Honduras sarsaparilla being imported. The *red Jamaica*, *Orange* or *Native Jamaica* varieties are used chiefly in England. Hartwich has recently pointed out that the varieties of sarsaparilla on the market are more numerous than are generally supposed. He also states that the greatest emphasis should be placed on the structural characteristics in order to distinguish the several varieties, rather than the form of packing and the supposed botanical origin. He is the best authority on this subject and all of his articles, some of which are enumerated, should be consulted (*S. W. P.*, 1897, No. 44 and 45; 1898, No. 37, and 1909, p. 126; *Arch. d. Pharm.*, 1894, p. 37, and 1902, p. 325; *Ber. d. D. Pharm. Ges.*, 1907, p. 250). A recent article on the pharmacognosy of the several commercial sarsaparillas is by Fleury in *Bull. des Sc. Pharmacol.*, xii, p. 190. Rusby reports finding lots of Mexican sarsaparilla which consisted entirely of "butts" or rhizomes. (*Proc. A. Ph. A.*, 1908, lvi, p. 773.) Kraemer reports finding nineteen ounces of dirt in a bundle of Mexican sarsaparilla weighing four and a half pounds. (*Proc. A. Ph. A.*, 1906, liv, p. 345.) Rusby has reported the presence of a thick, blackish, woody and decidedly astringent root in several shipments of Vera Cruz sarsaparilla. (*Jour. A. Ph. A.*, 1913, p. 1104.)

Sarsaparilla is efficient in proportion as it is acrid to the taste, which is said by some authors to be confined to the cortical portion, while the ligneous fiber and medullary matter are insipid and inert. Hancock avers that all parts are equally acrid and efficacious. The truth is probably between the two extremes, and, as in most medicinal roots, it must be admitted that the bark is more powerful than the interior portions, while these are not wholly inactive. The virtues of the root are communicated to water, cold or hot, but are impaired by long boiling.

They are extracted also by diluted alcohol. According to Hancock, the whole of the active matter is not extracted by water. In South America it is the custom to prepare sarsaparilla by digestion in wine or spirit, or by infusion in water with additions which may produce the vinous fermentation and thus add alcohol to the menstruum. The same result, as to the superior efficacy of alcohol as a solvent of the acrid principle of sarsaparilla, has been obtained by the French experimentalists. It has been suggested that sarsaparilla, the virtues of which are admitted to be impaired by long boiling, might also be injured by the degree of heat applied in the water or steam bath. But the contrary appears to have been proved by J. F. Judge of Cincinnati. (*Proc. A. Ph. A.*, 1873, p. 595.)

Parillin. (*Smilacin.* *Pariglin.* *Salseparin.* *Parallinic acid.*)—The crystalline principle to which any activity of sarsaparilla is due is now called parillin. It was first discovered by Palotta, who described it in 1824 under the name of *pariglin*. Subsequently, Folchi supposed that he had found another principle, which he called *smilacin*. Fluckiger recommends the preparation of *parillin* by exhausting the crushed root with warm alcohol and distilling the tincture until the residue weighs one-sixth of the root. It is then gradually mixed with one and a half times its weight of water, and after several days the liquid is decanted from the light yellow precipitate, which is then mixed with about half its volume of alcohol, transferred to a filter, and washed with alcohol of 20 or 30 per cent. because parillin is less soluble in weak alcohol than in strong alcohol. The yield was 0.18 and 0.19 per cent. It is whiter inodorous, almost tasteless in the solid state, but bitter, acrid, and nauseous when dissolved in alcohol or water. It is very slightly soluble in cold water, but more readily in boiling water, without crystallizing on cooling. It is very soluble in alcohol, especially at the boiling temperature. Ether and the volatile oils also dissolve it. Its aqueous solution has the property of frothing very much on agitation. According to Fluckiger, concentrated sulphuric acid yields a yellow solution, which, on absorbing moisture, gradually turns cherry-red; warm diluted sulphuric acid colors parillin greenish, then red, and finally brown; phosphoric acid has a similar reaction, but the color is more greenish-yellow. The aqueous solution is precipitated by alcoholic solution of lead acetate, by lead subacetate, and by tannin, and when warmed reduces alkaline copper tartrate, but does not react with other tests for sugar until after it has been boiled with a dilute acid, when the solution acquires a green fluorescence. This is best observed if a trace of parillin is dissolved in warm concentrated sulphuric acid, and disappears on

dilution with water or on neutralizing with ammonia. Parillin is not sternutatory; its acrid taste is best observed in alcoholic solution. (See *A. J. P.*, xii, 245.) The solutions of parillin are without acid or alkaline reaction. By treatment with dilute mineral acids, it is resolved into *parigenin* and sugar. Poggiale found parillin both in the cortical and in the medullary part of the root, but most largely in the former. W. von Schuiz (*P. J.*, 1892, 6) has shown that Dragendorff's *smilacin*, *smila-saponin*, or *sarsaparill-saponin*, $C_{20}H_{32}O_{10}$, *sarsa-saponin*, $C_{22}H_{36}O_{10}$, discovered by himself, and Fluckiger's *parillin*, $C_{26}H_{44}O_{10}$; are three homologous compounds all belonging to the same series, having the general formula $C_nH_{2n-8}O_{10}$. These three all split up into *sarsapogenin* (parigenin of Fluckiger) and one or more molecules of glucose on boiling with dilute acids. Robert (*A. J. P.*, 1892, 465) comes to practically the same results, stating the constituents to be *parillin* ($C_{26}H_{44}O_{10} + 2\frac{1}{2}H_2O$), insoluble in water; saponin (*sarsaparill-saponin*), $5(C_{20}H_{32}O_{10} + 2\frac{1}{2}H_2O)$, soluble in water; and *sarsa-saponin*, $12(C_{22}H_{36}O_{10} + 2H_2O)$, easily soluble in water, and the most active of the constituents.

The sarsaparilla of commerce is apt to be nearly if not quite inert, either from age, or from having been obtained from inferior species of *Smilax*. This inequality of the medicine, with the improper modes of preparing it long in vogue, has probably contributed to its variable reputation. The only criterion of good sarsaparilla to be relied on is the taste. If it leave a decidedly acrid impression in the mouth after having been chewed for a short time, it may be considered efficient; if otherwise, it is probably inert. Various false sarsaparillas have been sent into commerce from South America. For description by C. Hartwich see *A. Pharm.*, July, 1902.

Uses.—The use of sarsaparilla in medicine is an interesting example of the power of superstition to survive the attacks of truth and reason. It was introduced into Europe about the middle of the 16th century as a remedy for *syphilis*, but soon fell into disrepute until revived by Fordyce in 1757. Subsequently it came to be used as an alterative in various other chronic diseases, especially *chronic rheumatism* and *scrofula*. There is, however, no reason to believe that it possesses any virtues except as a mild gastric irritant through its saponin content. Its most popular employment is in the form of its compound syrup which is used

as a vehicle especially for mercury and potassium iodide.

Sarsaparilla may be administered in the form of infusion, compound decoction, compound syrup, or fluidextract. A beer made by fermenting an infusion of the drug with molasses is said to be a popular remedy in South America. The smoke of sarsaparilla has been highly recommended in asthma, (*J. P. C.*, xviii, 221.)

Dose, thirty, to sixty grains (2-3.9 Gm.).

Off. Prep.—Fluidextractum Sarsaparillae, *U. S. (Br.)*; Fluidextractum Sarsaparillae Compositum, *U. S.*; Syrupus Sarsaparillae Compositus, *U. S.* (from fluidextract); Decoctum Sarsaparillae Compositum, *N. F.*

SASSAFRAS. U. S.

SASSAFRAS Sassaf.

"The bark of the root of *Sassafras variifolium* (Salisbury) O. Kuntze (Fam. *Lauraceae*), without the presence or admixture of more than 2 per cent. of adhering wood, collected in the early spring or autumn, deprived of the outer corky layer and dried." *U. S.*

Sassafras Radix, *Br.*; Sassafras Bark, Sassafrax; Sassafras, *Fr. Cod., G.*; Sasafrasso, *It.*; Sasafras (Leño de), *Sp.*

Sassafras is an indigenous tree, of medium size, rising in favorable situations to a height of 35 feet. The bark of the stem and large branches is rough, deeply furrowed, and grayish: that of the extreme branches or twigs is smooth and beautifully green. The leaves, which are alternate, petiolate, and downy when young, vary much in their form and size even upon the same tree. Some are oval and entire, others have a lobe on one side, but the greater number are three-lobed. The flowers, which appear before the leaves, are small, of a pale greenish-yellow color, and disposed in racemes which arise from the branches below the leaves and have linear bracts at their base. The fruit is an oval drupe, about as large as a pea, of a deep blue color when ripe, and supported on a red pedicel, enlarged at the extremity into a cup for its reception. For the microscopical character of the root and bark, see *E. S. Bastin, A. J. P.*, June, 1895. See also *Ph. Rev.*, 1899, 450.

The sassafras is common throughout the eastern United States, and extends into Mexico. The fresh flowers have a slightly fragrant odor, and almost all parts of the plant are more or less aromatic. The best time for collecting the pith is after the occurrence of frost in autumn, and the same is the case also with the bark of the root.

Bark of Sassafras Root.—As found in commerce, this is usually in small irregular fragments, sometimes invested with a brownish cork, sometimes partially or wholly freed from it, of a reddish or rusty cinnamon hue, very brittle, and presenting when freshly broken a lighter color than that of the exposed surfaces. The living bark is nearly white, but becomes colored, on exposure, immediately after collection. It is officially described as "in irregularly transversely curved or quilled pieces, from 1 to 15 cm. in length and from 1 to 4 mm. in thickness; outer surface orange-brown, nearly smooth and marked with more or less irregular ridges; inner surface light to dark reddish-brown, obscurely short-striate; fracture short with a thin reddish-brown corky layer and a yellowish-white inner bark; odor aromatic; taste slightly mucilaginous, astringent, aromatic and somewhat pungent. The powder is light reddish-brown; when examined under the microscope it exhibits numerous starch grains and prominent, characteristic bast-fibers; starch grains either single or 2- to 4-compound, the individual grains being more or less spherical or polygonal and frequently with a distinct cleft, from 0.003 to 0.02 mm. in diameter, some of the swollen or altered grains attaining a diameter of 0.03 mm.; bast-fibers spindle-shaped, occasionally very irregular in outline, with sharply pointed ends, from 0.15 to 0.4 mm. in length, about 0.025 mm. in diameter, and with very thick, strongly lignified walls, the lumina being frequently nearly obliterated; parenchyma cells containing either starch grains or irregular yellowish-red masses of tannin and becoming bluish-black upon the addition of ferric chloride T.S.; fragments of wood few, with large, thin-walled trachea? marked by simple pores and associated with rather thin-walled wood-fibers. Sassafras yields not more than 30 per cent. of ash." *U. S.*

According to Reinsch, the bark contains a heavy and light volatile oil, camphorous matter, fatty matter, resin, wax, a peculiar decomposition product of tannic acid called *sassafrid*, tannic acid, gum, albumen, starch, lignin, and salts. (See *Oleum Sassafras*) The sassafrid bears some analogy to cinchonic red, and, like it, appears to be a derivative of

the tannin, which exists in much larger proportion in the fresh bark than in that long kept. (Procter, *A. J. P.*, 1866, p. 490.) Owing to its volatile oil and tannic acid, the bark of sassafras root is an aromatic stimulant and astringent. It is used almost exclusively as an adjuvant to other more efficient medicines, the flavor of which it improves, while it renders them more acceptable to the stomach. The volatile oil may be used as an aromatic. In overdoses it is capable of producing marked narcotic poisoning, and it is said to act upon the lower animals as a narcotic. John Bartlett has reported several cases in which its use apparently caused abortion.

Sassafras Pith (*Sassafras medulla*) was recognized by the U. S. VIII, and is at present included in the N. F. IV. It occurs in "sub-cylindrical, often curved or coiled pieces, from 2 to 10 cm. in length and from 2 to 5 mm. in diameter; very light in weight; externally whitish, occasionally with small fragments of adhering wood; fracture short. Odor slight; sassafras-like; taste mucilaginous. When examined under the microscope, transverse sections of *Sassafras Pith*, mounted in phloroglucinol T.S. and hydrochloric acid, show nearly isodiametric cells with large intercellular spaces, the walls being more or less lignified and provided with numerous simple pores; mounts made in water show the separation of a thin layer of mucilage from the inner walls of the cells, characterized by the gradual disappearance of the pores. Macerate 0.5 Gm. of *Sassafras Pith* with 25 mils of cold distilled water for several hours and filter it through purified cotton; a mucilaginous solution is obtained which does not give a precipitate upon the addition of an equal volume of alcohol." *N. F.*

It abounds in a gummy matter, which it readily imparts to water, forming a limpid mucilage, which is not precipitated by alcohol, but has much less tenacity than that of gum arable and will not answer as a substitute in the suspension of insoluble substances. This mucilage is much employed as a soothing application in inflammation of the eyes, and forms an agreeable and useful drink in *dysenteric*, *catarrhal*, and *nephritic* diseases. It may be prepared by adding a drachm of the pith to a pint of boiling water.

Dose, of sassafras bark, one to two drachms (3.9-7.7 Gm.).

Sassy Bark. *Nkasa. Doom Bark. Casca Bark. Mancona Bark. Saucy Bark. Ecorce de Mangoine, Fr. Manconarinde, G.*—This bark is interesting chiefly from its employment by the natives of Western Africa as an ordeal in their trials for witchcraft or sorcery. (For details, see *P. J.*) lxxv, 2.) This bark was first studied by C. A. Santos (*A. J. P.*, 1849, xxi, 97), and subsequently by Procter (*Ibid.*, xxiii, 301; xxiv, 195). It is obtained from *Erythrophleum guineense* Don, and is a large tree with spreading branches, doubly pinnated leaves, flowers in spike-like racemes, and leguminous fruit. The bark is in pieces more or less curved, with or without epidermis, in the former case somewhat fissured externally, of a dull red color diversified by whitish spots, brittle, presenting when cut transversely numerous fawn-colored spots surrounded by reddish-brown tissue, nearly inodorous, and of an astringent taste. A comprehensive description of *sassy bark* is given in the *Commentar zur oesterreichischen Pharmacopoeia*, 1890, by Vogt; and in the *Resume de la Matiere Medicale et Toxicologique Coloniale*, by Corre and Lejuanne, the plant, fruit, seeds, etc., are carefully illustrated. Gallois and Hardy obtained the poisonous principle *erythrophleine* by making an alcoholic extract of the bark, exhausting this with water, evaporating, rendering this extract alkaline with ammonia, and treating with acetic ether. The alkaloid is a colorless, crystalline solid, soluble in water, acetic ether, alcohol, and amy alcohol, insoluble in chloroform, benzoin, and ether. In contact with sulphuric acid and black manganese oxide, a violet color (less intense, than that produced with strychnine) is developed. Harnack and Zabrocki (*A. E. P. P.*, xv, 404) also prepared *erythrophleine*, and by the action of hydrochloric acid upon it obtained an acid they call *erythrophleic acid*, and a volatile alkaloid they call *manconine*. The bark yields its virtues to water. Power and Salway examined sassy bark in 1912 and confirmed the presence of erythrophleine as described by Harnack. (*A. J. P.*, 1912, 337.)

According to the observations of Savage, made in Africa (*Charleston Med. Journ.*; 1859), sassy bark produces in the natives a feeling of constriction in the fauces, attended by prickling, and followed by numbness, with, after a toxic dose, stricture across the brow, severe pain in the head, coma, and death. The physiological action of erythrophleine has been studied by various observers, especially by E. Harnack and R. D. Zabrocki, Gallois and Hardy, and Lauder Brunton, with results which are fairly concordant. Erythrophleine exercises a digitalis-like action on the circulation causing a slow, strong pulse, with a rise in the arterial pressure. These changes are certainly in great part due to the direct action upon the heart, but are also seemingly in part produced by a stimulating influence upon the muscle fibers or nerves in the walls of the arteriole. Purging was also noted as the result of an increased peristalsis, thought to be due to the local action of the poison. Vomiting is believed by Lauder Brunton to be the result of an influence upon the nerve centers, because it occurs when the alkaloid is given hypodermically. In fatal poisoning in the lower animals, convulsions are pronounced, and the respiration is also markedly affected. In 1888 L. Lewin asserted erythrophleine to be a powerful local anesthetic, whose action is more pronounced than that of cocaine. His paper gave rise to an extraordinary controversy, the outcome of which appears to be that, although the alkaloid is possessed of not very active anesthetic powers, it is for various reasons practically not useful. (See 17th edition, *U. S. D.*, p. 1739.) A solution of the strength of one-tenth of one per cent. is used as an application to the cornea.

Germain See asserts (*Med.Mod.*, Dec., 1891) that, although sassy bark does not act well upon the heart, it gives great relief in *dyspnea*, the number of respirations being lessened and the inspirations being extraordinarily increased in depth. He gave of the alkaloid from one-fortieth to one-thirtieth of a grain (0.0016-0.002 Gm.) ; of the extract, from one-fourth to one-third of a grain (0.016-0.021 Gm.).

Satureja. *Satureja hortensis* L. *Summer Savory*. *S. Montana* L. *Winter Savory*. *Sarriette*, Fr. *Saturei*. *Bohnenkraut*, G.—An annual labiate plant resembling thyme in odor and flavor, growing spontaneously in the south of Europe, cultivated in our gardens as culinary herbs, and sparingly naturalized from New Brunswick to Michigan and southward.

Saururus. *Saururus cernuus* L. *Lizard's Tail*. (Fam. Saururaceae.)—D. L. Phares, of Newtonia, Miss., considers this indigenous swamp plant of the Eastern and Central United States "laxative, antispasmodic, sedative, and slightly astringent"; useful in irritation of the kidneys, bladder, prostate, and urinary passages generally. The dose of the strong infusion was, with the plant either fresh or dried, from one to four fluidounces (30-120 mils) every fifteen or thirty minutes, or three or four times a day. (*A. J. P.*, 1867, 468.)

Saxifraga.—Garreau and Machelast have isolated from *S. crassifolia* L. and other species of this genus a crystallizable bitter substance, *bergenin*. It is obtained by boiling the stems of the plants with absolute alcohol, after the tannin has been removed by ether. It crystallizes in alcohol, has a bitter taste, melts at 140° C. (284° F.), and burns up completely at 300° C. (572° P.). It is soluble in 167 parts of 90 per cent. alcohol and in 830 parts of water, but is more soluble in these liquids at a boiling temperature; it is faintly acid to litmus, and is not changed by treatment with dilute sulphuric or hydrochloric acid, but by diluted nitric acid is converted into oxalic acid. Concentrated sulphuric acid decomposes it. Its formula is given as C₆H₃O₃.H₂O. Bergenin is asserted to be intermediate in its action between salicylic acid and quinine. (*A. Pharm.*, 1881, 293.) The rhizome of *Saxifraga ligulata* Wall., which is used in India, in *dysentery*, has been found by David Hooper to contain about 16 per cent. of gallic and tannic acids, but no other active principles. (*P. J.*, Aug., 1888.)

SCAMMONIA RADIX. U. S., Br.

SCAMMONY ROOT Scam. Rad.

"The dried root of *Convolvulus Scammonia* Linne (Fam. *Convolvulaceae*), yielding not less than 8 per cent. of the total resins of Scammony Root." *U. S.* "Scammony Root is the dried root of *Convolvulus Scammonia*, Linn." *Br.*

As the resin of scammony is obtained in Oriental countries by a

somewhat tedious process, it has been very difficult to obtain sufficient quantities of the genuine article for use in medicine. The British Pharmacopoeia long ago solved the question by making official *scammony root* from which the resin is prepared. The U. S. P. IX following this precedent and for the same reason has introduced scammony root. There seems to be little doubt, however, that the natural exudation has properties which make it a more desirable medicine than the extracted resin. (*C. D.*, lxi, p. 864.) On the other hand, the therapeutic committee of the British Medical Association states that the natural exudation possesses no advantages over the resin. (*P. J.*, 1908, xxvii, p. 811.) Heusler states that the extracted resin of true scammony root as well as the resin obtained from Mexican scammony (*Ipomoea Orizabensis*) are sold for "virgin" scammony. (*Proc. Md. Ph. Assoc.*, 1908, p. 35.)

Scammony root is officially described as follows: "Cylindrical or somewhat tapering, from 10 to 25 cm. in length and from 1 to 4.5 cm. in thickness; externally grayish- to reddish-brown; usually distinctly twisted, deeply longitudinally furrowed, marked by distinct root-scars, otherwise nearly smooth except for the lenticels and abraded cork, the upper portion terminated usually by a number of short stem branches; hard and heavy; fracture tough, irregular with projecting wood-fibers; internally somewhat mottled, showing yellowish, porous wood-wedges separated by whitish parenchyma containing starch and resin, bark thin; odor slight, resembling that of jalap; taste very slightly sweet, becoming slightly acrid. Under the microscope, sections of Scammony Root show a corky layer consisting of from 2 to 10 rows of cells with thin, yellowish-brown lignified walls; an outer cortex with numerous stone cells occurring singly or in small groups, the walls being moderately thick, porous and not strongly lignified; parenchyma with numerous starch grains and mono-clinic prisms of calcium oxalate; fibro-vascular bundles numerous, circular or elliptical with a well developed wood consisting of large tracheae surrounded by slightly lignified wood-fibers; phloem or sieve prominent in which are included large resin ducts; the parenchyma, both in and surrounding the bundles, more or less collapsed and containing either starch or calcium oxalate crystals. The powder is light grayish-brown; when examined under the microscope it exhibits starch grains from 0.003 to 0.018 mm. in diameter, mostly single, occasionally 2- to 4-com-pound, the grains showing occasionally a central cleft; calcium oxalate crystals numerous, in monoclinic prisms from 0.01 to 0.045 mm. in length; fragments of

leptomes or sieve with accompanying yellowish-brown resin cells; tracheae mostly with reticulate thickenings and simple or bordered pores and associated with short wood-fibers having prominent oblique pores; stone cells of variable shape and varying from 0.04 to 0.11 mm. in length, the walls being from 0.006 to 0.012 mm. in thickness, slightly lignified and traversed with prominent, often branching pores; lignified cork cells relatively few.

"Assay.—Proceed as directed under *Jalapa*, using 10 G-m. of Scammony Root in No. 60 powder." *U. S.*

"Brownish-grey or yellowish-grey, tapering or nearly cylindrical, varying usually from two to eight centimetres, or more, in diameter. Frequently contorted and longitudinally furrowed; enlarged at the crown, and bearing the remains of slender aerial stems. Fracture very coarsely fibrous; internally light or dark grey. In transverse section, numerous rounded wood-bundles distributed throughout a paler ground-tissue in which dark resin cells can be distinguished with a lens; in the parenchymatous tissue abundant, characteristic starch grains. Characteristic odor; taste at first somewhat sweet, afterwards slightly acrid. Yields to alcohol (90 per cent.) a resin which has the properties described under (*Scammoniae Resina.*" *Br.*

The wood consists of compressed pale brown, coarsely porous, usually subdivided fibers in a parenchymatous tissue similar to the bark. For microscopic structure, see *Dragendorff's Jahresbericht*, 1875.

The root of the *male jalap* (*orizaba root*, *Mexican scammony*, *Purgo macho*) has recently largely replaced in commerce the scammony root on account of its containing a much larger percentage of resin chemically indistinguishable from that of scammony. The Levant or true scammony root, it is said, averages a little under 9 per cent. of resin, while the Mexican root usually yields over 15 per cent. Male jalap occurs in transverse pieces one-half to an inch in thickness and two to four inches in diameter or in the case of the smaller roots in pieces three or four inches long sometimes obliquely cut, the transverse slices show concentric rings with protruding coarse fibers which at once distinguishes it from the true scammony in which the vascular bundles are scattered.

Large quantities of a false scammony root of unknown botanical origin

have appeared in the London market. The root is 2 to 3 inches in diameter with a thin, brittle, blackish-brown bark, and on transverse section six or seven rings of wood. It is odorless and tasteless. (See *P. J.*, May, 1901, 596.)

Mexican Scammony Root.—Mexican scammony root has been identified by E. M. Holmes as being undoubtedly the root of *Ipomoea orizabensis*, and is described as follows: The appearance is quite characteristic and quite different from that of scammony root. It occurs mostly in transverse slices, showing concentric rings, from which coarse fibers protrude on both of the transverse surfaces. The sections are mostly those of the larger portion of the root, and vary from two to three inches or more in diameter, but are only about one-half to three-quarter inch in thickness. The smaller roots are about one inch or so in diameter, but are frequently three or four inches long^ a few pieces are obliquely cut. The concentric arrangement of the vascular bundles at once distinguishes it from the root of *Convolvulus Scammonia*, in which they are scattered and somewhat rounded, forming isolated strands, in the softer tissue. It appears that during 1903 there was an importation of over 3000 bags, which sold readily to the German makers of scammony resin. Analyses made showed from 6.4 to 22.2 per cent. of resin, but most of it yielded about 17 per cent. While chemically there appears to be no difference between scammony resin and the resin of *Ipomoea orizabensis*, it remains to be ascertained if they are identical in their physiological action. At the request of Holmes, Harold Dean determined the amount of resin in a specimen and, in a separate paper, gives the method employed and the results, as follows: The drug was powdered, exhausted by percolation with alcohol (90 per cent.), the greater part of the alcohol distilled off, and the resulting strong tincture poured into three times its volume of water. The resin separated as a mass of honey-like consistence. It was well washed with boiling water until the washings were free from sugar and from color, and then dried on a water bath until the weight was constant. The yield of resin amounted to 18.5 Gm. from 100 Gm. of the powdered drug; this is the highest percentage yet recorded from this source. The dried resin was pale brown, and almost entirely soluble in ether, the insoluble portion from 18.5 Gm. weighing less than 0.25 Gm. It had the general characteristics of scammony resin. The powdered drug, dried at 100° C. (212° F.), yielded 9.89 per cent. of ash. (*P. J.*, March 5, 1904, 226, 327.)

Uses.—Scammony root in substance is not used medicinally, but solely

for making resin of scammony.

Off. Prep.—Resina Scammoniae, *U. S. (.Br.)*; Tinctura Jalapae Composita (from Resin), *Br.*; Pilulae Aloes, Hydrargyri et Scammonii Composita (from Resin), *N. F.*; Pilulae Colocynthis Composites (from Resin), *N. F.*; Pilulae Colocynthis et Hyoscyami (from Resin), *N. F.*; Tinctura Jalapae Composita (from Resin), *N. F.*

Schinus. *Schinus molle* L. (Fam. *Anacardiaceae*.)—The *peppertree* of South America yields a berry the size of a pea, having a flavor similar to a mixture of pepper and fennel. It has been introduced as a shade tree in Southern California. (*A. J. P.*, 1896, 215.) The leaves contain a volatile oil which is readily discharged, as after a rain when the air is filled with fragrance. Schimmel & Co. examined the volatile oil distilled from the berries; it had the sp. gr. 0.850, the odor of phellandrene, and was soluble in alcohol. (*Ph. Rev.*, 1897, 114.) It has been used successfully in *gonorrhoea* as a substitute for cubeb. The leaves, bark, and gum resin have been employed medicinally. (See *A. J. P.*, 1866, 1885, 1890; also *P. J.*, 1887.)

SCILLA. U. S., Br.

SQUILL Scill.

"The fleshy, inner scales of the bulb of the white variety of *Urginea maritima* (Linne) Baker (Fam. *Liliaceae*), cut into pieces and carefully dried. Preserve Squill in tightly-closed containers, in a dry place. If made into the official tincture and assayed biologically, the minimum lethal dose should not be greater than 0.006 mil of tincture, or the equivalent in tincture of 0.0000005 Gm. of ouabain, for each gramme of body-weight of frog." *U. S.* "Squill is the bulb of *Urginea Scilla*, Steinh., divested of its dry membranous outer scales, cut into slices, and dried. When powdered should be kept quite dry over quicklime." *Br.*

Squills; Scille, *Fr. Cod.*; Bulbus Scillae, *P. G.*; Meerzwiebel, *G.*; Scilla, *It.*; Escila (Bulbo de), Cebolla albarrana, *Sp.*

Urginea maritima (*Urginea Scilla* Steinh.) is a perennial plant, with fibrous roots proceeding from the bottom of a large bulb, which sends forth several long, lanceolate, pointed, somewhat undulated, shining, deep-green leaves. From the midst of the leaves a round, smooth, succulent flower-stem rises, from one to three feet high, terminating in a long, close spike of whitish flowers. These are destitute of calyx, and stand on purplish peduncles, at the base of each of which is a linear, twisted, deciduous floral leaf. The squill grows on the sea coast of Spain,

France, Italy, Greece, and the other countries bordering on the Mediterranean. The bulb is the official portion. It is generally dried for use, but is sometimes imported in the recent state packed in sand.

Properties.—The fresh bulb is pear-shaped, from 15 to 30 cm. in diameter, weighing as much as 5 or 6 pounds, and consists of fleshy scales attenuated at their edges, closely applied over each other, and invested by exterior scales so thin and dry as to appear to constitute a membranous coat. There are two varieties, distinguished as the *red* and the *white squill*. In the former the exterior coating is of a deep reddish-brown color, and the inner scales have a whitish rosy or very light pink epidermis, with a yellowish-white parenchyma; in the latter the whole bulb is white. They do not differ in medicinal virtue. The bulb abounds in a viscid, very acrid juice, which causes it to inflame and even excoriate the skin when much handled. By drying, this acrimony is very much diminished, with little loss of medicinal power. The bulb loses about four-fifths of its weight in the process. Vogel found 100 parts of fresh squill to be reduced to 18 by desiccation. The process is somewhat difficult, in consequence of the mucilaginous character of the juice. The bulb is cut into thin transverse slices, and the pieces dried separately by artificial or solar heat. The outer and central scales are rejected, the former being dry and destitute of activity, the latter too fleshy and mucilaginous.

Dried squill, as found in commerce, is "in irregular, more or less curved, somewhat flattened pieces, from 0.5 to 5 cm. in length, yellowish-white, somewhat translucent, nearly smooth and lustrous with slight projections of fibro-vascular bundles; brittle when dry and somewhat flexible when damp; odor slight; taste bitter and acrid. Under the microscope, sections of the scales of Squill show on the upper and lower surface a thin-walled epidermal layer, a mesophyll of nearly isodiametric or slightly elongated thin-walled cells and occasionally show in alcoholic or glycerin mounts spheroidal aggregates of a carbohydrate; numerous more or less rectangular cells containing mucilage and bundles of raphides of calcium oxalate, the latter from 0.075 to 1.0 mm. in length; fibro-vascular bundles few and isolated, with spiral or reticulate tracheae. Occasionally some of the parenchyma cells contain a few somewhat spherical starch grains. The powder is light yellow, with a tendency to cake in moist atmosphere and consisting of very irregular fragments; when examined under the microscope it exhibits numerous single crystals and bundles of long raphides of

calcium oxalate; fragments of thin-walled, colorless parenchyma, frequently with dark intercellular spaces due to the inclusion of air; fragments with spiral or reticulate tracheae are occasionally found. Squill yields not more than 8 per cent. of ash.

Examined by the microscope, the bulb is seen to be pervaded by innumerable minute acicular crystals of calcium oxalate. According to Hartwich, the mucilage occurs either in the form of large drops, filling the parenchymatous cells, or as masses enclosing the raphides. For an elaborate microscopic study, with plates, see *A. Pharm.*, July, 1889. Water distilled from it had neither taste nor odor, and was drunk by Vogel to the amount of six ounces without effect. When kept in a dry place, squill retains its virtues for a long time; but if exposed to moisture it soon becomes mouldy.

"Assay. In curved, yellowish-white, somewhat translucent strips, from about two and a half to five centimetres long, frequently tapering towards both ends; tough and slightly flexible while moist, but brittle and easily pulverisable when dry. Almost inodorous; taste disagreeably bitter. Ash not more than 5 per cent." *Br.*

The virtues of squill are extracted by alcohol, but apparently only in part by water. It has been analyzed by Vogel, J. H. Marais, Lebour-dais, Tilloy, Merck, and by Schmiedeberg (*Zeit. Physiol. Chem.*, 111, 112) with varying results. The bitter principle, not yet obtained pure, is *scillitin*. Merck, however, obtained three compounds of this class—*scillipicrin*, *scillitoxin*, and *scillin*. Jarmersted (*A. E. P. P.*, 11, 22) obtained a glucoside which he called *scillain*, but which seems to be identical with scillitoxin.

Ewins (*J. P. and Ex. T.*, 1912, ii, p. 155) separated from the squill two active principles, although neither of them in crystallizable form. The first is water soluble glucoside, which is fatal to the frog in doses of 0.03 Gm. for a 25 gramme frog. The second is a resinous body, very slightly soluble in water, but readily so in alcohol. Fatal dose for a frog is 0.06. Besides these they found a trace of caffeine. These authors state and it is generally acknowledged that the so-called active principles of squill which are found upon the market are not true principles but are impure bodies.

Schmiedeberg found a peculiar mucilage, analogous to dextrin, which

he calls *sinistrin*, (C₆H₁₀O₅). It is white, easily soluble in water, insoluble in alcohol, laevo-rotatory; on boiling with dilute sulphuric acid it yields levulose and an inactive sugar of reducing properties. The 'mucilage is not affected by saliva or diastase. This last statement, however, was contradicted by F. Kurtz (*A. J. P.*, 1894, 246), who says that diastase acts upon it, producing a reducing sugar. Kurtz also obtained a reducing sugar (probably dextrose) along with the gum direct by extracting the bulb with hot alcohol. S. Wanizewski (*A. J. P.*, 1893, 498) found *scillinine*, soluble in alcohol, but insoluble in water and in chloroform; *scillapicrine*, soluble in both water and alcohol, and *scillamarine*, soluble in both chloroform and alcohol. The bulbs of *Scilla maritima* also yield a slightly colored liquid oil of unpleasant odor when distilled in a current of steam. (*Husemann's Pflanzenstoffe*, 2d ed., p. 406.)

Uses.—Squill belongs to that series of drugs, commonly known as the digitalis group, which have for their characteristic properties the power of slowing and strengthening the pulse, of contracting the blood vessels, and in toxic doses causing systolic spasm of the frog's heart. While it in many regards closely resembles digitalis in its physiological action, it is notable for the strong degree of vasomotor action and for its local irritant effect. Probably by virtue of its effects on the circulation, but also largely because of its local irritant action upon the renal epithelium, squill is one of the most active diuretics among this group of drugs. Indeed it is so stimulating to the kidney that in overdose it is capable of causing an acute inflammation of this organ. When given in large dose, partly because of the central emetic effect which is characteristic of the digitalis group, but largely because of its local irritant influence upon the stomach, it produces severe nausea and even vomiting. In overdoses it has been known to cause hypercatharsis, strangury, bloody urine, and fatal inflammation of the stomach and bowels.

While squill is capable of exercising all the beneficial effects of digitalis in chronic *heart disease*, because of its action upon the alimentary canal it is rarely employed for this condition unless associated with *dropsy*. Because of its stimulant action upon the kidney as well as upon the heart, it is peculiarly useful for the evacuation of edematous infusions due to weakness of the heart, and is also sometimes of service in the ascites of *hepatic cirrhosis*. When, however, there is active inflammation of the kidney it must be used with great caution if at all. Like other emetic drugs, if given in sufficient doses to nauseate it tends to increase

in the bronchial secretions and is occasionally used as an expectorant in *bronchitis* and *spasmodic croup*. Because of its potent action upon the circulation its use for this purpose, however, is not to be encouraged.

Neither water nor dilute acetic acid entirely extract the activity of squill. The only liquid preparations, therefore, which thoroughly represent the drug are those made with alcohol, of which the tincture is probably the better.

When given in substance it is most conveniently administered in the form of pill.

Dose, of squill, from one to two grains (0.065-0.13 Gm.).

Off. Prep.—Acetum Scillae, U. S., Br.; Fluid-extractum Scillae, U. S.; Oxymel Scillae, Br.;

Pilula Ipecacuanha cum Scillae, Br.; Pilula Scillae Composita, Br.; Syrupus Scillae, U. S., Br. (from vinegar); Syrupus Scilla Compositus, U. S. (from fluidextract); Tinctura Scillae, U. S., Br.; Mistura Pectoralis Stokes (from Fluidextract), N. F.; Oxymel Scillee (from Vinegar), N. F.; Pilulas Digitalis, "Scillae et Hydrargyri, N. F.

SCOPARII CACUMINA. Br.

BROOM TOPS

"Broom Tops are the fresh and the dried tops of *Cytisus scoparius*, Link." Br. " The dried top of *Cytisus Scoparius* (Linne) Link (Fam. *Leguminosae*)." N. F.

Scoparius, N. F.; Herba Scoparii, Spartium; Irish or Scotch Broom, Besom, Genet & balais, Fr.; Gemeine Besenginster, Besenginster, Besenkraut, Pfriemenkraut, G.

Cytisus scoparius is a common European shrub, cultivated as a sand-binder and locally naturalized on the Atlantic Coast from Nan-tucket to Virginia. It is a low, densely branched shrub, from three to eight feet high, with numerous straight, pentangular, bright green, very flexible branches, and small, oblong, glabrous leaves, usually ternate, but on the upper part of the plant sometimes simple. The flowers are numerous, papilionaceous, large, showy, of a golden-yellow color, and solitary upon

short axillary peduncles. The seeds are contained in a compressed legume, which is hairy at the sutures. It is essential that true broom be carefully distinguished from Spanish broom (*Spartium Junceum*), since a number of cases of poisoning have occurred from the substitution of the dried flowers of *Spartium* for those of broom.

The whole plant has a bitter, nauseous taste, and, when bruised, a strong, peculiar odor. The tops of the branches are used in medicine. They are in "thin, flexible, branched twigs, from 2 to 3 mm. in thickness, five-angled; externally dark green, nearly glabrous, with numerous reddish-brown cork patches; internally yellowish, fracture short-fibrous, that of thicker pieces tough and splintery, upper leaves sessile, with often only one obovate leaflet present in small amount or absent. Odor slight, on bruising more distinct and peculiar; taste disagreeable, bitter. Scoparius yields not more than 5 per cent. of ash." *N. F. IV.*

"Stem dark green, with long, straight, slender, alternate branches; the latter, like the upper part of the stem, winged, tough, flexible, and glabrous. Leaves, when present, small, sessile, and simple above, stalked and trifoliate below. Odor of the fresh tops, especially when bruised,, characteristic; the dry tops almost inodorous." *Br.*

The seeds are reported to be used sometimes, and to be as active as the tops. Water and alcohol extract their active properties. According to Cadet de Gassicourt, the flowers contain volatile oil, fatty matter, wax, chlorophyll, yellow coloring matter, tannin, a sweet substance, mucilage, albumen, and lignin. Stenhouse has separated from them two principles, scoparin, $C_{21}H_{22}O_{10}$ (Goldschmidt and Himmelmayer (*Ap. Ztg.*, 1893, 566) give the following formula of scoparin: $C_{10}H_{16}O_8(OH)(OCH_3)$), and an alkaloid, *sparteine*, $C_{15}H_{26}N_2$. The former is in stellate crystals, easily dissolved by boiling water and alcohol, and is obtained by purifying a yellow gelatinous substance deposited upon the evaporation of the decoction. It is only slightly soluble in cold water, more readily in hot water with greenish light yellow color, easily soluble in aqueous ammonia and caustic and carbonated alkalies. It is decomposed by heat. When fused with potassium hydroxide it yields, according to Hlasiwetz, phloroglucin and protocatechuic acid. Sparteine was obtained by distillation from the mother waters of the scoparin. It is a colorless liquid, having a peculiar bitter taste, and all the properties of a volatile alkaloid. It is heavier than water, and boils at $288^{\circ} C.$ ($550.4^{\circ} F.$) if distilled in a current of

hydrogen gas. It dissolves only slightly in water, but takes up some water itself. In contact with water it becomes opalescent. It turns yellowish on distillation in air, but can be distilled colorless in an atmosphere of carbon dioxide. It is colorless, but becomes brown by exposure to light; it has at first an odor of aniline, but this is altered by rectification. It readily neutralizes acids and forms crystallizable salts, which are extremely bitter. Its sulphate occurs in colorless crystals, and is freely soluble in water. (See *P. J.*, June 28, 1879; also *Sparteinae Sulphas.*) By the action of potassium dichromate and sulphuric acid, *oxysparteine*, $C_{15}H_{24}N_2O$, is formed, and by the action of hydrogen dioxide upon this, a deliquescent *trioxysparteine*, $C_{15}H_{24}N_2O_3$, is obtained; if the hydrogen dioxide acts upon sparteine itself, *dioxysparteine*, $C_{15}H_{24}N_2O_2$, is formed as a solid, crystallizing in prisms melting at $128.5^{\circ} C.$ ($263.3^{\circ} F.$). Zinc and hydrochloric acid reduce sparteine to *hydrosparteine*, $C_{15}H_{28}N_2$, a thick liquid boiling at from 281° to $284^{\circ} C.$ (537.8° - $543.2^{\circ} F.$). (Schmidt, *Pharmaceutische Chemie*, 3te Auf., Bd. ii, 1276.)

Uses.—*Scoparius* is diuretic and cathartic, and in large doses emetic, and has been employed with advantage in *dropsy*. Cullen prescribed it in the form of decoction, made by boiling half an ounce of the fresh tops in a pint of water down to half a pint, of which he gave a fluidounce (30 mils) every hour until it operated by stool or urine. The seeds may be given in powder, in the dose of from ten to fifteen grains (0.65-1.0 Gm.). A fluidextract is official in the N. F. IV.

Scoparin probably represents the diuretic and purgative influences of *scoparius*, although its physiological and therapeutic properties have not as yet been sufficiently investigated. For description of the effects of *sparteine*, see *Sparteinae Sulphas*.

Oxysparteine, $C_{15}H_{24}N_2O$.—This is an alkaloidal oxidation product of sparteine, originally described by F. Ahrens (*Ber. d. Chem. Ges.*, 1891). It occurs in white, somewhat hygroscopic needles, melting at about $84^{\circ} C.$ ($183.2^{\circ} F.$), soluble in water, alcohol, ether, and chloroform. It has been found by Hurthle (*A. E. P. P.*, 1892) to be a cardiac stimulant, decreasing the pulse rate, but markedly increasing the arterial pressure and heart work. The hydrochloride, which occurs in large needles (often consolidated together) and is very soluble in water, has been used hypodermically by von Oefele in cases of *heart failure*. The dose is half a

grain (0.032 Gm.), rapidly increased to one and a half grains (0.096 Gm.). The system is said soon to become accustomed to it.

Dose, of scoparius, ten to fifteen grains (0.65-1.0 Gm.).

Off. Prep.—Infusum Scoparii, Br.; Succus Scoparii, Br.

Scolopendrium. *Scolopendrium Scolopodendrium* (L.) Karst. *Asplenium Scolopendrium* L. *Phyllitis Scolopendrium* (L.) Newman. *Hart's Tongue*.—The fronds of this fern, which is indigenous both in Europe and America, have a sweetish, mucilaginous, and slightly astringent taste, and, when rubbed, a disagreeable oily odor. They were used as a deobstruent in visceral affections, as an astringent in *hemorrhages* and fluxes, and as a demulcent in pectoral complaints.

Scopola. *Scopolia. Belladonna Scopola. Scopola Belladonna. Japanese Belladonna*, (incorrectly).—"The dried rhizome of *Scopola Carniolica* Jacquin (Fam. *Solanaceae*), yielding, when assayed as directed below, not less than 0.5 per cent. of its alkaloids." *U. S. VIII*. The genus *Scopola* is the connecting link between *Atropa* and *Hyoscyamus*, resembling *Atropa* in leaf and flower and in the microscopical character of its rhizome, but differing in that its fruit is not a berry but is a pyxis resembling that of *Hyoscyamus*. For description of drug and its histological study, see Kraemer, *A. J. P.*, 1908, p. 459. The Japanese plant, *S. japonica*, is so closely allied to *S. carniolica* that its specific distinction is very doubtful; it has been separated upon the characters of the style being curved, the calyx-teeth unequal and the leaves less obovate and having much longer petioles than *S. Carniolica*; but Holmes has shown that the curved style occurs in *S. Carniolica*. *S. Carniolica* is a common plant in Bavaria, Austro-Hungary, and Southwestern Russia, usually in the hilly districts, where it grows in damp, stony places. Its general appearance is that of the belladonna, but it is much shorter, rarely growing above a foot in height, has thinner leaves, and is especially distinguished by its fruit being a transversely dehiscent capsule and by the presence of a distinct rhizome.

The rhizome was officially described as "of horizontal growth, more or less curved and shortly and sharply flexuous, cylindraceous and somewhat flattened vertically, occurring mostly in pieces from 2.5 to 7.5 Cm. long and 0.8 to 1.6 Cm. broad, often split before drying; upper surface marked with closely set, large, cup-shaped stem scars, margins irregularly contracted; externally varying from yellowish-brown to dark brownish-gray, finely and irregularly wrinkled longitudinally, obscurely annulate and more or less nodular-roughened; fracture short and sharp, exhibiting a yellowish-white bark, its corky layer dark brown, or pale brown, wood indistinctly radiate, and central pith rather horny; nearly inodorous; taste sweetish, afterwards bitterish and strongly acrid." *U. S. VIII*.

The Japanese rhizome is from 5 to 15 cm. long, about 1 cm. in diameter, rarely branched, cylindrical or slightly compressed, knotty, bent, with circular disk-like

scars, of a pale brown color, not whitish when abraded, with a slightly mousy, narcotic odor, and a taste nearly free from bitterness. According to Thos. Greenish, the microscopical characteristics of the rhizome of *S. Carniolica* are very similar to those of belladonna root, the chief differences being that the bark is less thick, the dark line under the epidermis narrower, the vascular bundles neither so large nor so numerous, and the bundles of raphides less pronounced; the starch grains are also smaller and their shape less distinct. The structure of the rhizome of *S. japonica* was found to be the same as that of the European species. Kraemer (*loc. cit.*) has since shown that *scopola* possesses only reticulate tracheae while in belladonna root the tracheae possess both simple and bordered pores.

The alkaloid *scopolamine* (or *scopoleine*), $C_{17}H_{21}O_4N$, has been found to be the characteristic constituent of the root. (See p. 985.) Inactive scopolamine, $C_{17}H_{21}O_4N$, also known as atropine, is present. It melts at $82^{\circ} C.$ ($179.6^{\circ} F.$), and yields by hydrolysis tropic acid and scopoline. Seward W. Williams states, as the result of the assay of many tons of the root of *Atropa belladonna* and of the rhizome of *scopola*, each of the best qualities occurring in the American market, that while the belladonna root yields on an average 0.50 per cent. of alkaloid, the *scopola* yields 0.58 per cent. See also *Proc. A. Ph. A.*, 1899, 285.

Fluidextract of Scopola, U. S. VIII, was made as follows: "Scopola, in No. 40 powder, one thousand grammes [or 35 ounces av., 120 grains]; Alcohol, Water, each, a sufficient quantity, to make about one thousand mils [or 33 fluidounces, $6\frac{1}{2}$ fluidrachms] Mix eight hundred mils [or 27 fluidounces, 24 minims] of Alcohol with two hundred mils [or 6 fluidounces, 366 minims] of Water, and, having moistened the powder with three hundred and fifty mils [or 11 fluidounces, 401 minims] of the mixture, pack it firmly in a cylindrical percolator; then add enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for forty-eight hours. Then allow the percolation to proceed slowly, gradually adding menstruum, using the same proportions of Alcohol and Water as before, until the *Scopola* is exhausted. Reserve the first eight hundred mils [or 27 fluidounces, 24 minims] of the percolate, and evaporate the remainder, at a temperature not exceeding $50^{\circ} C.$ ($122^{\circ} F.$), to a soft extract; dissolve this in the reserved portion, and mix thoroughly. Assay ten mils of this liquid as directed below; from the result thus obtained, ascertain by calculation the amount of mydriatic alkaloids in the remainder of the liquid, and add to this enough menstruum to make each one hundred mils of the finished Fluidextract contain 0.5 Gm. of the mydriatic alkaloids from *Scopola*." *U. S. VIII.*

Extract of Scopola, U. S. VIII, was made by evaporating the fluidextract and assaying it so that it contains 2 per cent. of mydriatic alkaloids. Dose, one-eighth to one-fourth of a grain (0.008-0.016 Gm.).

The physiological and medicinal properties of *scopola* are very similar to those of belladonna, but the crude drug has been scarcely used at all in internal medicine. It has been largely employed in America in the manufacture of belladonna plaster and

much of the hyoscine of commerce in the last decade has been obtained from it. Its alkaloid *Scopolamine hydrobromide* is recognized in the United States Pharmacopoeia. Dose, of the drug, one to two grains (0.65-0.13 Gm.) ; of the fluidextract, one-half to three minims (0.03-0.2 mil).

Scrophularia. *Scrophularia marilandica* L. (*S. nodosa* L.). *Figwort. Scrofula Plant. Scrofulaire*, Fr. *Kropfwurz. Kontenwurz*, G. (Fam. *Scrophulariaceae*).—This rather tall herb, having a square stem, opposite leaves and slender panicles of small, greenish-purple flowers, grows in rich open woods from New York to North Carolina and west to Kansas. Its leaves have when fresh a rank fetid odor, and a bitter, somewhat acrid taste; but these properties are diminished by drying. Water extracts their virtues, forming a reddish infusion, which is blackened by ferric sulphate. For histological study of root, see *P. J.*, 1896. Walz has obtained from it two proximate principles, which he names respectively *scrophularin* and *scrophularosmin*. (Mayer, *A. J. P.*, 1863, p. 295.) Figwort leaves were formerly considered. tonic, diuretic, diaphoretic, discutient, anthelmintic, etc.; useful in *scrofula* and as a local application in *hemorrhoids*. Van de Moer (*P. J.*, 1896) affirms that the seeds are toxic, belonging to the digitalis group.

Scutellaria. *N. F. IV. Skullcap. Scullcap. Hoodwort. Madweed. Mad-dog or Sideflowering Scullcap. Blue Pimpernel. Hooded Willow-herb. Scutellaire*, Fr. *Helmkraut, Schildkraut*, G.—"The dried plant of *Scutellaria lateriflora* Linne (Fam. *Labiatae*)." *N. F. Scutellaria* was official in the U. S. P. VIII, but was introduced into the *N. F. IV*.

Several species of scutellaria have attracted attention. *Scutellaria galericulata* L., which grows in wet places from Newfoundland to North Carolina and west to Nebraska, has a feeble, somewhat alliaceous odor, and a bitterish taste. It has been employed in intermittents, and externally in old *ulcers*. *S. integrifolia* L. is intensely bitter, and might probably be found useful as a tonic.

Scutellaria lateriflora is an indigenous, perennial herb, with a stem erect, much branched, quadrangular, smooth, and one or two feet high. The leaves are ovate, acute, dentate, subcordate upon the stem, opposite, and supported upon long petioles. The flowers are small, of a pale blue color, and disposed in long, lateral, 1-sided, leafy racemes. The plant grows in wet shaded places in the United States and Canada.

The dried tops are described as "about 50 cm. in length, smooth; stem quadrangular, branched; leaves opposite, petiolate, about 5 cm. in length, ovate-lanceolate or ovate-oblong, serrate; flowers about 6 mm. in length, in axillary one-sided racemes, with a pale blue corolla and bilabiate calyx, closed in fruit, the upper lip helmet-shaped. Odor slight; taste slightly bitter. *Scutellaria* yields not more than 12 per cent. of ash." *N. F. H. Molisch* and *G. Goldschmidt* (*Ph. Ztg*; Dec. 4, 1901, 965) obtained from scutellaria and a number of other labiates an identical body, to which they gave the name *scutellarin*. It is present in all of the different scutellarias, being most abundant in the upper epidermis of the leaf, but found also in the roots, stems and flowers of the plant. It was further obtained from the leaves of *Galeopsis Tetrahit* L., and of *Teucrium*

Chamaedrys L. In *Scutellaria altissima* L., the presence of cinnamic and fumaric acids were also established. Scutellarin is obtained by boiling freshly gathered leaves for fifteen minutes in ten times their weight of water, filtering the decoction and adding from 1 to 2 per cent. of hydrochloric acid, which causes an abundant precipitate of scutellarin. If precipitation is effected from the hot solution, the scutellarin separates in the form of light yellow crystals. The formula $C_{10}H_8O_3$ has been assigned to scutellarin. Its alcoholic solution gives a red precipitate with lead acetate and an intense green color with ferric chloride, changing on heating to a red color if the reagent is not present in great excess; alcoholic potassium or sodium hydroxides, as also alkali acetates, produce reddish-yellow precipitates, which change to green on exposure to the air. Solution of barium hydroxide has the same effect. The green color is produced immediately if an oxidizing agent, such as chlorine or bromine water, is added.

Scullcap is as destitute of medicinal properties as a plant may well be¹, not even being aromatic. When taken internally, it produces no very obvious effects, and probably is of no remedial value, although at one time it was esteemed as a remedy in hydrophobia. It has also been used in neuralgia and convulsive affections, chorea, delirium tremens, and nervous exhaustion from fatigue or over-excitement. (*A. J. P.*, xxiii, 370; *N. J. M. R.*, v; *M. S. Rep.*, 1870.) Dose, thirty to ninety grains (2.0-5.8 Gm.)

Sedum. *Sedum acre* L. *Biting Stonecrop*. *Wall Pepper*. *Small Houseleek*. *Mossy Stonecrop*. *Joubarbe acre*, *Poivre des Murailles*, Fr. *Mauerpfeffer*, *Steinkraut*, G. (Fam. *Crassulaceae*.)—This European plant has escaped to some extent from the gardens and grows wild in New England. It is spreading moss-like, possesses small, very thick leaves and yellow flowers. It causes vomiting and purging, and applied to the skin produces inflammation and vesication. The fresh herb and the expressed juice have been used as an antiscorbutic, emetic, cathartic, and diuretic, and have been applied locally to old *ulcers*, *warts*, and other excrescences. Other species are less acrid, and are even eaten as salad in some parts of Europe. Such are *Sedum rupestre* L., and *S. album* L. *S. Telephium* L. was formerly employed externally to cicatrize wounds, and internally as an astringent in *dysentery* and *hemoptysis*, and is still esteemed by the common people in France as a vulnerary. Ernst Mylius found in 100 parts of *Sedum acre* 2.2 parts of a soft, not acid resin, 12.80 parts of uncrystallizable sugar, and 12.40 parts of a soft acid resin, besides an alkaloid and inert substance. (*J. P. C.*, 4e ser., xvii, 81.)

Semecarpus. *Semecarpus venosa* (Fam. *Anacardiaceae*), the *Tschongott Tree*.—The highly poisonous nature of the bark of this tree, which is a native of the Caroline Islands, is, according to Thorns and Mannich [*Ph. Ztg.*, 1902), due to the presence of *cardol* (*anacardic acid*).

Sempervivum. *Sempervivum tectorum* L. *Common Houseleek*. *Hen-and-Chickens*. *Grande Joubarbe*, Fr. *Hauswurz*, *Hauslauch*, *Dachwurss*, G. (Fam. *Crassulaceae*.)—A succulent, perennial plant with imbricated leaves and cymes of rose-purple flowers. It is extensively cultivated. In Europe the bruised recent leaves of this plant are

¹ Every so often Remington's anti-botanical elitism gets SOOO tiresome....MM

employed as a cooling application to burns and other external inflammations. The juice is said to cure *warts*.

Senecio. *N. F. IV. Life Root.*—*Senecio* was introduced into the N. F. IV. It is defined as follows: "The dried overground portions of *Senecioaureus* Linne (Fam. *Compositae*), gathered when flowering." *N. F.* Various species of this composite genus have been domestically used in the treatment of *amenorrhoea* both in Europe and America, and their value has been confirmed by various practitioners. (See *P. J.*, Dec., 1897.) The species specially used have been *Senecio vulgaris* L., *Common Groundsel*, *Senecion*, Fr., *Kreutzkraut*, *Jacobskraut*, G.; an annual European plant introduced into this country and growing quite commonly in waste grounds, and the North American species, *S. aureus* L., commonly called golden ragwort or liferoot and growing in wet meadows in the Northern United States. It is described as follows: "Stems from 3 to 6 dm. in length, if entire bearing a basal rosette of leaves; sparingly clothed with successively smaller leaves and bearing at the summit several yellow heads in a loose corymb, white floccose when young, but mostly glabrous when expanded, radical leaves on long, slender petioles, mostly of rounded form from 5 to 7 cm. in breadth, the base often cordate, the summit rounded, the margin crenate-dentate; stem-leaves gradually changing from the shape of the radical leaves to lyrate-pinnate, then pinnatifid and sessile, and at length clasping, oblong, and incised; heads slender peduncled, from 12 to 25 mm. in breadth, the lance-linear involucreal scales in about two series, closely appressed, rays about ten, bright-yellow, disk flowers very numerous, small, bearing a glabrous akene and a white pappus. Odor characteristically aromatic; taste bitter, slightly astringent and distinctly acrid and pungent. *Senecio* yields not more than 10 per cent. of ash." *N. F. IV.* The fluidextract is official in the N. F. IV and made from a menstruum of two volumes of alcohol and one volume of water. It is used in the dose of one fluidrachm (3.75 mils) three times a day.

In *S. vulgaris*, and in lesser amount also in *S. Jacoboea* L., Grandval and Lajoux (*Union Medicale du Nord-est*, xix, 1895) have found two alkaloids, *senecionine*, $C_{18}H_{26}NO_6$, which is slightly, and *senecine*, which is readily, soluble in ether. According to Wiet, *senecionine* is a paralyxant of the peripheral motor and sensory nerves, while Bunch has found that the alcoholic extract of *Senecio Jacoboea* is capable of producing a rise of the arterial pressure due to contraction of the arterioles, followed, if the dose has been large enough, by arterial dilatation with fall of pressure. (*B. M. J.*, 1900, ii, 212.) *Senecin* of the eclectic practitioners is made by precipitating the tincture with water and is not therefore a pure active principle.

The rhizomes of the Mexican species, *Seneciograyanus* Hemsl. and *S. cervariaefolius* Sell., constitute *maturin*, the plants being known as *matarique*, *maturin*, or *guerena*. They produce rise of temperature, dilatation of the pupil, and violent tetanic spasms. Henckel states that they contain a glucoside resembling digitalin. (*A. J. P.*, Jan., 1891; also *Nouv. Rem.*, 1888, and *P. J.*, March, 1889.) Several species of *senecio*, especially the *S. Jacoboea*, have been accused of causing poisoning in cattle which have eaten them. Cushny has found in the *S. Gladifolium* Watt two alkaloids, *senecifoline* and *senecifolidine*, which are actively poisonous, causing symptoms

similar to those which have occurred in animals after eating the compound. The most characteristic pathological lesion was cirrhosis of the liver. The fluid extract of *S. vulgaris* has been recommended by Dalche and others in dysmenorrhea and amenorrhea. (*Bull. Med.*, 1904.)

SENEGA. U. S. (Br.)

SENEGA Seneg. [Senega Snakeroot, Seneca Snakeroot]

"The dried roots of *Polygala Senega* Linne (Fam. *Polygalaceae*), without the presence or admixture of more than 5 per cent. of stems and other foreign matter." U. S. "Senega Root is the dried root of *Polygala Senega*, Linn." *Br.*

Senegae Radix, *Br.*; Rattlesnake Root, Mountain Flax, Senega or Seneca Root, Radix Polygalae Virginianae; Polygala de Virginie, *Fr. Cod.*; Radix Senegae, *P. G.*; Senegawurzel, Klapper-Schlangenwurzel, *G.*; Poligala Virginiana, *It.*; Poligala de Virginia (Raiz de), *Sp.*

Besides *P. Senega*, two other species have attracted some attention in Europe—*P. amara* and *P. vulgaris*—as remedies in chronic pectoral affections; but, as they are not natives of this country, and are never used by practitioners here, they do not merit particular notice.

A senega which was first used in Japan, and which has been referred by some writers to *P. japonica*, by others to *P. tenuifolia*, has been examined by Renter, who finds in it 0.8 per cent. of resin, traces of methyl salicylate, and 8.8 per cent. of an oil which has somewhat the odor of patchouli. For description of other species see *Polygala*.

Polygala Senega has a perennial branching root, from which several erect, simple, smooth, round, leafy stems annually rise, from nine inches to a foot in height. The stems are occasionally tinged with red or purple below, but are green near the top. The leaves are alternate or scattered, lanceolate, pointed, smooth, bright green on the upper surface, paler beneath, and sessile or short petiolate. The flowers are small and white, and form a close spike at the summit of the stem. The calyx is their most conspicuous part. It consists of five sepals, two of which are wing-shaped, white, and larger than the others. The corolla is small and closed. The capsules are small, much compressed, obcordate, two-valved and two-locular, with two oblong-ovate, blackish, hairy seeds, slightly longer than the lobes of the caruncle. In *P. alba* Nutt, the seeds are silky

and about twice the length of the caruncle lobes.

Polygala Senega extends over most of the United States and Southern Canada, east of the Rocky Mountains. At one time it was largely collected in Canada and the Northeastern Atlantic states; when this supply was exhausted, Kentucky and the States West and Southwest of it were invaded; then Wisconsin and the Northwestern States, from which with Western Canada the commerce at present derives its chief supply. There are two varieties of the plant, the typical *P. Senega*, the form found in the Northeastern United States, and the variety *latifolia* (T. and G.) which extends from Maryland and Pennsylvania to Michigan and Tennessee. This variety is distinguished by its height (from ten to twenty inches) and its very large, ovate or ovate-lanceolate leaves, which taper towards each end and attain a length of four inches. The root of commerce seems to be obtained from both varieties. It is brought into market in bales weighing from fifty to four hundred pounds. See True (*Ph. Era*, 1913, xlvi, p. 68).

Owing to the extensive use of senega considerable interest is manifested in the cultivation of the plant. Hood reports to have demonstrated that it can be successfully cultivated. (*Vermont Sta. Rept.*, 1907, p. 371.) It has also been grown by the Bureau of Plant Industry, U. S. Dept. of Agriculture.

Properties.—Senega is officially described as " usually in broken pieces; when entire slenderly conical, more or less tortuous, somewhat branched, from 3 to 15 cm. in length and from 2 to 10 mm. in thickness and bearing a few rootlets; crown knotty with numerous buds and short stem-bases; externally brownish-yellow, the crown rose-tinted, longitudinally wrinkled, frequently marked by a keel; fracture short, wood pale yellow, usually eccentrically developed; odor peculiar, penetrating; taste sweetish, afterwards acrid. Under the microscope, transverse sections of Senega usually show a characteristic eccentric development of wood, the central cylinder varying in outline from elliptical or ovate to irregularly fan-shaped, and being surrounded by an unevenly developed cortex which is thickest next to the broadest strands of wood and where the wood-wedges are narrow and the medullary rays very broad, the cortical parenchyma occupies a very narrow zone of the cross-section; in older roots a corky layer of from 4 to 5 rows of tangentially elongated, light yellowish or yellowish-brown cells; outer bark of about 20 rows of cells on one side of the root and only

10 or less on the other, the cells having slightly thickened walls and containing a colorless or pale yellow, amorphous substance, which is liberated in the form of large globules on the addition of a drop of potassium hydroxide T.S.; inner bark, the cells in radial rows, consisting of parenchyma, small groups of sieve tissue and medullary rays, the latter from 1 to 3 cells wide; all the cells in this zone show a collenchymatous thickening of the walls and contain an amorphous substance similar to that found in cells of the outer bark; woody layer of tracheas with bordered pores, wood-fibers with oblique simple pores, tracheids, and medullary rays, the latter being rather indistinct and resembling the wood-fibers; tissues of the central layer of wood colored yellowish-or reddish-brown on the addition of a drop of potassium hydroxide T.S. The powder is yellowish-gray to light yellowish-brown, odor penetrating, slightly sternutatory; when examined under the microscope it exhibits a mixture of fragments of parenchyma containing oily globules and wood-fibers with tracheae; wood-fibers, non-lignified and with oblique simple pores, from 0.175 to 0.25 mm. in length; trachea? with simple and bordered pores and about 0.175 mm. in length; medullary ray cells somewhat lignified and with large simple pores. Extract 10 Gm. of powdered Senega by means of a Soxhlet apparatus, using 50 mls of ether containing 2 drops of hydrochloric acid. Continue the extraction during four or five hours and then add sufficient ether to make the liquid measure 50 mls. Take 25 mls of this solution and evaporate it on a water bath to dryness; the residue weighs not less than 0.3 Gm., and upon dissolving it in 10 mls of chloroform, transferring the solution to a test tube and adding 5 mls of sulphuric acid to form an underlying layer, a reddish-brown color is produced at the zone of contact, and the sulphuric acid shows a slightly green fluorescence after the mixture has stood for twenty-four hours. Pour 10 mls of the original ethereal solution into a beaker containing 10 mls of water and warm the mixture on a water bath until the ether has evaporated; the aqueous solution, upon filtering and adding a few drops of ferric chloride T.S., becomes a bright pinkish purple. Senega yields not more than 5 per cent. of ash." *U. S.*

"Greyish or brownish-yellow, slender, usually from five to ten centimetres long, with a knotty crown bearing the bases of numerous, slender, aerial stems; frequently curved or contorted, sparingly branched, keeled, sometimes transversely wrinkled. Fracture short. In transverse section, a horny translucent cortex free from starch grains and a white, often irregularly developed, wood. Characteristic odor;

taste at first sweet, afterwards acrid." *Br.*

Holm describes the pharmacognosy of senega root and the morphology of the plant in *M. R.*, 1907, xvi, p. 155. Hartwich has made a very interesting observation in that he has found starch occasionally present in official senega. (*Apoth.-Ztg.*, xxvi, p. 84.) Hartwich has also described two false senegas. (*S. W. P.*, xlvi, pp. 537 and 749.) The pharmacognosy of the drug has been well elaborated by Tunmann in *Ph. Zentralh.*, xlix, p. 61. Muller describes and figures senega and a number of the drugs that have been used as adulterants of this drug or as occasional contaminations. (*Pharm. Praxis.*, vii, p. 309.)

Senega root varies somewhat in appearance according to the locality from which it is derived, and local varieties are recognized in commerce. In *Southern senega* the roots are very small, while in *Manitoba senega* they are large and thick, dark in color, and often have purple markings about the crown. The official senega is often known in commerce as *Southern senega*, or *small senega*, the roots seldom attaining the size of an ordinary lead-pencil, and four to five hundred of the dried roots being required to make a pound.

Since 1870 the so-called *Northern, White, False, or Large senega* has been sent into the American market from Wisconsin, Minnesota, and further west. It is much larger than true senega, probably eighty to one hundred to the pound. The knot at the top of the root is from one to three inches in diameter; below it the root abruptly contracts to from half an inch to an inch in diameter; it is usually from eight to ten inches long, more fleshy and much less contorted than true senega, nearly free from small rootlets, but breaking-up below into from four to eight descending branches; very light-colored, with the ligneous portion thick and regular, and in the circular outlines of the section, with the keel rudimental or not rarely altogether absent. The taste is similar to that of true senega, but somewhat more mucilaginous and less rapidly acrid. In structure, false senega root is very -similar to the true root; it has, indeed, been asserted that there are anatomical differences between the two senegas, but O. Linde (*P. J.*, xvi, 724) has been unable to make out any such differences. According to L. E. Sayre (*A. J. P.*, Sept., 1897), it is not possible to distinguish the two drugs when powdered. For description of the roots of a number of species of *Polygala* see *Flora*, Jan., 1886, and *D. C.*, 1901, 26. False Senega was thought to be the product of *Polygala Boykinii* Nuttall, or of *P. alba* Nuttall, whose

habitat extends from the mountains of Texas to western British America, but Farwell (*M. R.*, 1907, xvi, 221) believes it is from the *P. Senega*, as it has the characteristic keel-like ridge of the official drug. The properties of senega as well as the medicinal virtues of the root, are extracted by boiling water and by alcohol. Diluted alcohol is an excellent solvent.

Senega root was analyzed by Gehlen, Peschier of Geneva, Feneulle of Cambray, Dulong d'Astafort, Folchi, and Trommsdorff, and subsequently by Quevenne. The virtues of senega appear to reside chiefly, if not exclusively, in the acrid principles called *senegin*, $C_{17}H_{26}O_{10}$, and *polygalic acid*, $C_{19}H_{30}O_{10}$. These principles resemble saponin very closely and are recognized as distinct. Quevenne obtained polygalic acid by the following process: Powdered senega is exhausted by alcohol of 33°, and so much of the alcohol is distilled off as to bring the resulting tincture to the consistence of syrup. The residue is treated with ether in order to remove the fatty matter. The liquid upon standing deposits a precipitate, which is separated by filtration and is then mixed with water. To the turbid solution thus formed alcohol is added, which facilitates the production of a white precipitate, consisting chiefly of polygalic acid. The liquid is allowed to stand for several days, that the precipitate may be fully formed. The supernatant liquid being decanted, the precipitate is drained upon a filter, and, being removed while yet moist, is dissolved by the aid of heat in alcohol of 36°. The solution is boiled with purified animal charcoal, and filtered while hot. Upon cooling, it deposits the principle in question in a state of purity. Thus obtained, polygalic acid is a white powder, inodorous, and of a taste at first slight, but soon becoming pungent and acrid, and producing a very painful sensation in the throat. It is fixed, unalterable in the air, inflammable, soluble in water slowly when cold and rapidly with the aid of heat, soluble in all proportions in boiling absolute alcohol, which deposits most of it on cooling, quite insoluble in ether and in the fixed and volatile oils, and possessed of the properties of reddening litmus and neutralizing the alkalis. Quevenne found it, when given to dogs, to occasion vomiting, and much embarrassment in respiration, and in large quantities to destroy life. Dissection exhibited evidences of inflammation of the lungs, and frothy mucus was found in the stomach, esophagus, and superior portion of the trachea, showing the tendency of this substance to increase the mucous secretion, and explaining in part the beneficial influence of senega in croup. (*J. P. C.*, xxii, 449, and xxiii, 227.) Bolley showed that this active principle was resolvable by

hydrochloric acid into glucose and a peculiar substance called saponin. Rochleder (*Chem. Cb.*, 1867, p. 925) confirmed this view of the identity of polygalic acid and saponin.

Christophson (J. P. C., 1874) and Schneider (A. Pharm., [3], 7, 394) have thoroughly established the existence of saponin in senega root. According to the researches of Trommsdorff and Schneider, saponin is contained solely in the bark, the woody tissues being inert. (See *Quillaja*.) L. Renter (A. Pharm., 1889, 309 and 452) finds that the constituents of senega root are fixed oil and resin, traces of volatile oil (a mixture of valeric ether and methyl salicylate), sugar (7 per cent.), which seems to develop to a greater extent upon standing, senegin or saponin (from 2 to 5 per cent.), yellow coloring matter, and malates. The quantity of methyl salicylate varied in different samples from 0.25 to 0.33 per cent. See also Schroeder's analysis. (A. J. P., 1896, 178.) Methyl salicylate occurs in very many, if not all, of the species of the genus *Polygala*. (See paper by Kremers and James, *Ph. Rev.*, xvi.) Kain (*Ph. Ztg.*, 1898, 562) states that he has discovered a laevorotatory glucoside distinguished from saponin by its mild taste, solubility in absolute alcohol, and in its not giving a precipitate with barium hydroxide.

Senega yields its virtues to water, cold or hot, and to boiling alcohol, and the extracts obtained by means of these liquids have the sensible properties of the root. But under the influence of heat a portion of the acrid principle unites with the coloring matter and coagulated albumen, and thus becomes insoluble in water. In forming an aqueous extract, the infusion should be prepared by percolation, as it is thus most concentrated, and consequently requires less heat in its evaporation. In preparing the infusion, the temperature of the water should not exceed 40° C. (104° F.). Experience has thoroughly proved the value of the use of an alkali in small proportion in making galenical preparations of senega, it prevents gelatinization and combines with the active principles. (See *Fluidextractum Senega*)

The roots of *Panax quinquefolius* L., or ginseng, were at one period frequently mixed with those of senega, but are easily distinguishable by their shape and taste. The roots of *Gillenia trifoliata* (L.), Moench., and *Asclepias Vincetoxicum* L. (*P. J.*, ix, 411), and of *Triosteum perfoliatum* L., are noted as occurring in commercial senega; they are readily detected by the absence of the keel-like line.

Uses.—Senega owes what therapeutic virtues it possesses to its saponins. (See *Quillaia*.) These by their local irritant action upon the mucous membrane of the stomach tend to cause nausea, thereby increasing the secretions of the sweat glands and especially of the bronchial glands. For this reason the drug has been used as an expectorant in various forms of *bronchitis* and in *asthma*. In overdose it is capable of acting as an irritant poison producing violent vomiting and purging. Polygalic acid may be employed in doses of from one-fourth to one grain (0.016-0.065 Gm.), administered in the form of either pill or capsule.

For a formula for its preparation, see also *A. J. P.*, 1860, 150.

Dose, from fifteen to twenty grains (1.0-1.3 Gm.).

Off. Prep.—*Infusum Senegae*, *Br.*; *Fluidextractum Senegae*, *U. S.*; *Syrupus Senegae* (from Fluidextract), *U. S.*; *Tinctura Senegae*, *Br.*; *Syrupus Scillae Compositus* (from Fluidextract), *U. S.*; *Mistura Pectoralis*, Stokes (from Fluidextract), *N. F.*; *Syrupus Cimicifugae Compositus* (from Fluidextract), *N.F.*

SENNA. U. S. (Br.)

SENNA Senn.

"The dried leaflets of *Cassia acutifolia* Delile, known in commerce as Alexandria Senna, or of *Cassia angustifolia* Vahl, known in commerce as India Senna (Fam. *Leguminosae*), without the presence or admixture of more than 10 per cent. of stem tissues, pods, seeds and other impurities." *U. S.* "Senna Leaves are the dried leaflets of *Cassia acutifolia*, Delile, and of *Cassia angustifolia*, Vahl. Known in commerce as Alexandria senna, and Tinnevelly senna." *Br.*

Sennae Folia, *Br.*; Senna Leaves; Sene, *Fr. Cod.*; Feuillea de Sene, *Fr.*; Folia Senna; *P. G.*; Sennesblatter, *G.*; Sena, *It.*; Sen, *Sp.*

The plants which yield *senna* belong to the genus *Cassia*, of which several species contribute to furnish the drug. These were confounded by Linneus and comprised in a single species, which he named *Cassia Senna*. Since his time the subject has been more thoroughly investigated, especially by Delile, who accompanied the French

expedition to Egypt and had an opportunity of examining the plant in its native country. Besides the official species, it is probable that *C. lanceolata* of Forskhal and *C. aethiopica* of Guibourt contribute towards commercial senna. The leaves of a number of species of Cassia are utilized like senna leaves in the respective countries in which they grow, among which may be mentioned *C. marilandica* L.; *C. cathartica* Mart.; *C. rugosa* Don.; *C. splendida* Vog.; *C. laevigata* Willd.; *C. multijuga* Rich.; *C. Chamaecrista* L.; and *C. montana* Hayne. Farwell asserts that *Cassia marilandica* and other American species of Cassia have been offered in large lots and sold as senna. (*M. R.*, xvii, p. 35.)

Cassia acutifolia is a small undershrub, two or three feet high, with a straight, woody, branching, whitish stem; but, according to Landerer, the senna plant attains the height of eight or ten feet in the African deserts. The leaves are alternate and pinnate, with glandless petioles, and two small narrow pointed stipules at the base. The leaflets, of which from four to six pairs belong to each leaf, are almost sessile, oval-lanceolate, acute, oblique at their base, nerved, from half an inch to an inch long, and of a yellowish-green color. The flowers are yellow, and in axillary spikes. The fruit is a flat, elliptical, obtuse, membranous, smooth, grayish-brown, bivalvular legume, about an inch long and half an inch broad, scarcely if at all curved, and divided into six or seven cells, each containing a hard, heart-shaped, ash-colored seed. *C. acutifolia* grows wild in great abundance in Upper Egypt, Nubia, Sennaar, and other parts of Africa. This species furnishes the greater part of the variety known in commerce by the name of Alexandria senna.

Cassia angustifolia, as usually grown is annual, but with care it may be made to live through the year, and then assumes the character of an undershrub. It has an erect, smooth stem, and pinnate leaves, with from four to eight pairs of leaflets. These are nearly sessile, lanceolate, obscurely mucronate, oblique at the base, smooth above and somewhat downy beneath, with the veins turned inward so as to form a wavy line immediately within the edge of the leaflet. The most striking character of the leaflet is its length, which varies from 2 to 5 cm. The petioles are without glands; the stipules minute, spreading and semi-hastate. The flowers are bright yellow, and arranged in axillary and terminal racemes rather longer than the leaves. The legume is oblong, membranous, tapering abruptly at the base, rounded at the summit, and 4 to 5 cm. long by about 1.5 cm. broad. This plant is found in Southern Arabia and on the coast of East Africa from Mozambique to

the Somali land. It has been said to grow in the interior of India, and is cultivated at Tinnevely for medicinal use.

Cassia obovata Colladon, possesses a rather shorter stem than that of *C. acutifolia*, rising to the height of only a foot and a half. The leaves have from five to seven pairs of leaflets, which are obovate, very obtuse, sometimes mucronate. The flowers are in axillary spikes, of which the peduncles are longer than the leaves of the plant. The legumes are very much compressed, curved almost into the kidney form, of a greenish-brown color, and covered with a very short down, which is perceptible only by the aid of a magnifying glass. They contain from eight to ten seeds. This species grows wild in Syria, Egypt, Senegambia, and Jamaica. (*P. J.*, Sept., 1867.) It has been cultivated successfully in Italy, Spain, and the West Indies. It is said to be no longer gathered for senna, although its leaflets and pods have been found in Alexandria senna.

C. lanceolata of Forskhal, found by that author growing in the deserts of Arabia, is admitted by Lindley and others as a distinct species. Some difference of opinion, however, exists upon this point. De Candolle considered it a variety of the *C. acutifolia* of Delile, from which it differs chiefly in having leaflets with glandular petioles, and, as Forskhal's description preceded that of Delile, he designated the species by the name of *C. lanceolata*. Forskhal's plant has been supposed by some to be the source of the India or Mocha senna, but the leaflets in this variety are much longer than those of *C. lanceolata*, from which the plant differs also in having no gland on the petiole. Niebuhr informs us that he found the Alexandria senna growing in the Arabian territory of Abu-Arisch, whence it is taken by the Arabs to Mecca and Jedda. This is probably the *C. lanceolata* of Forskhal. It is highly probable that this species is the source of a variety of senna which has been brought to this market under the name of Mecca senna.

Cassia aethiopica of Guibourt (*C. ovata* of Merat), formerly confounded with *C. acutifolia*, is considered by Lindley to be a distinct species. It grows in Nubia, Fezzan, to the south of Tripoli, and probably, according to Guibourt, throughout Ethiopia. It is from this plant that the *Tripoli senna* of commerce is derived.

Several varieties of this valuable drug are known in commerce. Of these, four have been received in America—the Alexandria, the Tripoli,

the India, and the Mecca senna—but only two are recognized by the Pharmacopoeia, which are officially described as follows:

"Alexandria Senna.—Usually unbroken, occasionally in fragments, leaflets inequilaterally lanceolate or lance-ovate, from 2 to 3.5 cm. in length and from 6 to 10 mm. in breadth, having extremely short, stout petiolules; acutely cuspidate, entire, subcoriaceous, brittle, pale green or grayish-green, sparsely and obscurely hairy, especially beneath, the hairs appressed; odor characteristic, taste somewhat mucilaginous and bitter. Pods few, broadly elliptical, somewhat rent-form, dark green, thin and membranous.

"India Senna.—Leaflets usually unbroken, from 2 to 5 cm. in length and from 6 to 14 mm. in breadth, usually more abruptly pointed than those of Alexandria Senna, yellowish-green and smooth above, paler beneath; in odor and taste closely resembling Alexandria Senna. Pods few, elliptical, more or less reniform and from 4 to 5 cm. in length. Powdered Alexandria Senna is light green; when examined under the microscope it exhibits non-glandular hairs, 1-celled, conical, often curved, from 0.1 to 0.35 mm. in length, walls thick and papillose; calcium oxalate in rosette aggregates, from 0.009 to 0.01 mm. in diameter, and in 4- to 6-sided prisms, about 0.015 mm. in length, usually in crystal fibers; stomata broadly elliptical, about 0.02 mm. in long diameter. In India Senna the powder is slightly darker green than that of Alexandria Senna and the hairs are similar but relatively fewer. Mix 0.5 Gm. of powdered Senna with 10 mils of an alcoholic solution of potassium hydroxide (1 in 10), boil the mixture for about two minutes, dilute it with 10 mils of water and filter. Now acidify the filtrate with hydrochloric acid, shake it with ether; remove the ethereal layer and shake it with 5 mils of ammonia water; the latter is colored pinkish-red or bluish-red. Senna yields not more than 12 per cent. of ash, The yield of ash insoluble in hydrochloric acid is not more than 3 per cent. of the Senna taken." *U. S.*

"Pale greyish-green or yellowish-green, thin, brittle; usually from two to four centimetres long, the leaflets of Alexandrian senna being usually smaller than those of Tinnevelly senna; lanceolate, or oval-lanceolate, acute, entire, and unequal at the base. Surface finely pubescent or nearly glabrous, veins on the under surface distinct. Epidermis of both surfaces consisting of polygonal cells and bearing one-celled, thick-walled, warty hairs together with stomata, each stoma being enclosed

between two cells with their long axes parallel to the ostiole. The powdered Leaves greenish-yellow, exhibiting, in addition to the characteristic epidermis, stomata, and hairs, elongated palisade cells and grouped sclerenchymatous fibres accompanied by prismatic crystals of calcium oxalate. Ash not more than 12 per cent." *Br.*

1. ALEXANDRIA SENNA.—This variety of senna is gathered in extreme Upper Egypt and the Soudan, and thence sent to Assouan at the First Cataract of the Nile, whence it finds its way into commerce through Cairo, Suakim, Suez and Alexandria. Two crops are produced annually, one in the spring and one in the autumn. The plants are first cut, then dried, and then the stripped-off leaves and pods are packed in crude bales, in which several species of senna are represented in varying proportion, the predominating species being *C. acutifolia*. Formerly there was an intentional mixture of the product of *Cassia acutifolia* with the leaflets of *C. obovata*, brought from other parts of Egypt, and even from Syria, with the leaves of *Cynanchum oleaefolium* (*C. Argel* of Delile, *Solenastemma Argel* Hayne), known commonly by the name of *argel* or *arguel*, and sometimes with those of *Tephrosia apollinea* of De Candolle, a leguminous plant growing in Egypt and Nubia. According to M. Royer, the proportions in which the three chief constituents of this mixture were added together were five parts of *C. acutifolia*, three of *C. obovata*, and two of *Cynanchum*. Thus prepared, the senna was again packed in bales, and transmitted to Alexandria. But at present there is much more uniformity in the constitution of Alexandria senna. This variety of senna is often called in French pharmaceutical works *sene de la palthe*, a name derived from an impost formerly laid upon it by the Ottoman Porte. A parcel of Alexandria senna, as it was formerly brought to market, consisted of the following ingredients: (1) the leaflets of *C. acutifolia*, characterized by their acute form, and their length, almost always less than an inch; (2) the leaflets of *C. obovata*, known by their rounded very obtuse summit, which is sometimes furnished with a small projecting point, and by their gradual diminution in breadth towards their base; (3) the pods, broken leafstalks, flowers, and fine fragments of other parts of one or both of these species; (4) the leaves of *Cynanchum oleaefolium*, which are distinguishable by their length, almost always more than an inch, their greater thickness and firmness, the absence of any visible lateral nerves on their under surface, their somewhat lighter color, and the regularity of their base. In this last character they strikingly differ from the genuine senna leaflets, which, from whatever species derived, are

always marked by obliquity at their base, one side being inserted in the petiole at a point somewhat lower than the other, and at a different angle. Discrimination between this and the other ingredients is of some importance, as the *Cynanchum* must be considered an adulteration. It is said by the French writers to produce hypercatharsis and much irritation of the bowels, but was found by Christison and Mayer to occasion griping and protracted nausea, with little purgation. The flowers and fruit of the *Cynanchum* were also often present, the former white and in small corymbs, the latter an ovoid follicle rather larger than an orange-seed. Besides the above constituents of Alexandria senna, it occasionally contained leaflets of genuine senna, much longer than those of the *acutifolia* or *obovata*, equalling in this respect the *Cynanchum*, which they also somewhat resembled in form. They were distinguishable, however, by their greater thinness, the distinctness of their lateral nerves, and the irregularity of their bases. The leaflets and fruit of *Tephrosia apollinea*, which have been an occasional impurity in this variety of senna, may be distinguished, the former by their downy surface, their obovate-oblong, emarginate shape, their parallel unbranched lateral nerves, and by being usually folded longitudinally; the latter, by its dimensions, being from an inch to an inch and a half long, and only two lines broad. In Europe, Alexandria senna was formerly adulterated with the leaflets of *Colutea arborescens* L., or bladder senna, and the leaves of *Coriaria myrtifolia* L., a poisonous plant of Southern Europe..

The leaflets of the *Coriaria* are ovate-lanceolate, grayish-green with a bluish tint, and are readily known, when not too much broken up, by their strongly-marked midrib and two lateral nerves running from the base nearly to the summit. They are free from hairs and do not contain crystals of calcium oxalate. Another addition to Alexandria senna has been detected by Lacroix of Macon, France, in the leaves of the *Globularia Turbith* (*Globularia Alypum* Linn.), which seem to have taken the place of the *Colutea arborescens*, because more closely resembling the senna leaflet. The leaves of the *Globularia* are spatulate, much enlarged towards the upper end, rounded at the extremity, but always terminating in a short sharp point. . Besides, they are brown, thick, firm, and hard to the touch, while those of the *Colutea* are green, very thin, and soft. They have an acrid, very bitter taste, but are without nauseous odor. They are asserted to be cathartic, but milder than senna, and capable of being substituted for it in twice the dose. (*J. P. C.*, 4e ser., i, 413.)

The so-called *Aden senna* which Holmes states to be active, is composed of small, broad, not very acute, hairy leaves, and is believed to be obtained from *C. holosericea* Fres. A false senna from Madras has been identified by E. M. Holmes as the product of *Cassia montana* Hayne. The leaflets are about the size of the Tinnevelly senna, but are distinguishable by obtuse or rounded ends which are with distinct mucronate, the tip is, however, often broken off and absent from individual leaves; by the obtuse angles of the lateral veins and by the presence of a well marked network of veins of the under surface; further, the color of the upper surface is distinctly browner than of the Tinnevelly leaflet. The whole leaves of *Cassia montana* have from 10 to 15 pairs of leaflets, while the Tinnevelly senna has only from 6 to 8 pairs. In the drug this character can usually be made out by noticing the number of scars on the rachis. For a microscopic description of powder, see H. G-. Greenish, *P. J.*, lvi, 694. In detecting the adulteration of senna, the apothecary may avail himself not only of the general physical characteristics of the leaves, but also of the fact that while the senna leaf, containing no tannic acid, does not precipitate ferric chloride, most leaves used in adulteration do alter the ferric solution. The microscopic characteristics of the false leaves, though varying greatly, are almost always very different from those of senna. In the senna leaflets the epidermis from the upper and under surface is very similar. The stomata are numerous; the epidermal hairs are unicellular and deciduous, leaving, when detached, a base which has the appearance of an annular pad, around which the neighboring cells seem to radiate. The parenchyma of the cell has a thick epidermis, and is divided into three layers, the uppermost and lowest of which consist of palisade tissue, and are separated by a zone of very small, rounded, parenchymatous cells. Rosette aggregate crystals of calcium oxalate are scattered throughout the parenchyma, and prismatic crystals, one in each cell, occur (clustered around the bast tissue of the principal veins).

For a microscopical description of Alexandria senna, see *Proc. A. Ph. A.*, 1882, p. 238.

2. INDIA SENNA.—This variety is in Europe sometimes called Mocha senna, probably because obtained originally from that port. It derives its name of India senna from the route by which it reaches us. Though produced in Arabia, it is brought to this country and Europe from Calcutta, Bombay, and possibly other ports of Hindostan. It consists of

the leaflets of *Cassia elongata*, with some of the leafstalks and pods intermixed. The eye is at once struck by the great length (about two inches) and comparative narrowness of the leaflets, so that the variety may be readily distinguished. The pike-like shape of the leaflet has given rise to the French name of *sene de la pique*. Many of the leaflets have a yellowish, dark-brown, or blackish color, probably from exposure after collection, and the variety has commonly in mass a characteristic dull tawny hue. It is generally considered inferior in purgative power. Leaflets of a senna resembling the Indian were brought by Livingstone from Southern Africa, where the plant grows abundantly. (*P. J.*, xvii, 499.)

A variety of India senna has reached this country which is a product of Hindostan, being cultivated at Tinnevelly, and probably other places in the south of the Peninsula. The plant was originally raised from seeds obtained, from the Red Sea, and is the same as that from which the common Indian senna is derived. The drug is exported from Madras to England, where it is known by the name of *Tinnevelly senna*. It is a fine unmixed variety, consisting of unbroken leaflets, from one to two or more inches long, and sometimes half an inch in their greatest breadth, thin, flexible, and of a fine green color. T. B. Groves, however, states as the result of his experiments that Tinnevelly senna contains only two-thirds as much of the active principle as does the Alexandrian. (*P. J.*, Oct., 1868, p. 292.)

Much study has been given to the question of distinguishing the powder of Alexandria and India senna by means of the microscope. (See papers by Sayre, *A. J. P.*, 1896, 1897; Schneider, *Am. Drug.*, 1897; Denniston, *Ph. Rev.*, vol. xvi.) As a result of these studies it is asserted that it is possible to take advantage of the greater hairiness of the Alexandria senna as a practical distinction, it being alleged that a fragment of the epidermis of Alexandria leaf contains twice as many hairs as does a similar sized shred of epidermis from the India senna. It is especially proposed to count the number of epidermal cells between two hairs or their scars, the average distance of the hairs from one another being in the Alexandria senna three epidermal cells, and in the India six cells. Advantage may also be taken of the difference in the neighboring cells of the stomata; in the majority of stomata, in each case, there are two of the neighbor-cells, but in India senna the proportion is one having three neighbor-cells to seven having two, and in the Alexandria the proportion is one having three to two having two.

3. TRIPOLI SENNA.—Genuine Tripoli senna consists in general exclusively of the leaflets of one species of Cassia, formerly considered to be a variety of *C. acutifolia*, but now admitted to be distinct, and named *C. aethiopica*. The leaflets, however, are much broken up, and it is probably on this account that the variety is usually less esteemed than the Alexandrian. The aspect given to it by this state of comminution, and by the uniformity of its constitution, enables the eye at once to distinguish it from the other varieties of senna. The leaflets, moreover, are shorter, less acute, thinner, and more fragile than those of *C. acutifolia* or Alexandria senna, and their nerves are much less distinct. The general opinion at one time was that it was brought from Sennaar and Nubia to Tripoli in caravans; but, it is reasonably asked by Fee, how could it be afforded at a cheaper price than the Alexandrian, if thus brought on the backs of camels a distance of eight hundred leagues through the desert. It is probably collected at Fezzan, immediately south of Tripoli.

4. MECCA SENNA is still imported under the name of *Arabian* or *Bombay Senna*, and is obtained from both wild and cultivated plants of *Cassia angustifolia*. The best drug is obtained from British India, great care being taken in its garbling. Much of the commercial article is of a dark brown color. The leaflets are oblong-lanceolate, on the average longer and narrower than those of *C. acutifolia*, and shorter than those of *C. elongata*. The variety in mass sometimes has a yellowish or tawny hue, more like that of India than like that of Alexandria senna and may be the product of the *C. lanceolata* of Forskhal. Landerer speaks of a valuable variety of senna, characterized by the large size of the leaflets, and sold under the name of Mecca senna, which he says comes from the interior of Africa.

Commercial senna is prepared for use by *garbling*, or picking out the leaflets, and rejecting the leafstalks, the impurities, and the leaves of other plants. The pods are also rejected by some apothecaries. (See *Senna Fructus*.)

The market for senna is gradually changing. For years the drug used in the United States was imported from London or European ports. At the present time, the importations into the United States are largely direct from Egypt. The amount of senna annually exported is about 8000 bales of each of the varieties. Owing to the failure of the crops at certain

seasons, the price of senna is very high, and what is known as "broken" senna is found upon the market and sold for the genuine article. This is done with the sanction of the government. In addition, what is known as "senna sittings," which contain large amounts of sand and other foreign matter, have been offered, and these have caused the government inspectors a large amount of trouble. There is considerable difference in the actual constituents of the two sennas, and it would seem advisable for the Pharmacopoeia to restrict the drug to one species or else to include them under two separate titles. This principle has been followed by the German Pharmacopoeia, as well as the Swiss Pharmacopoeia, which restrict the official drug to the Indian senna, or that derived from *Cassia angustifolia*. Indian senna is known commercially as Tinnevelly senna, and this name should probably have been used in the Pharmacopoeia. Alexandria senna is occasionally admixed with the leaflets of *C. obovata* Coll. (*Bull. Soc. roy. d. pharm. Brux.*, liii, p. 169). In addition to admixture of senna with the leaflets of *Cassia marilandica* it is stated that the leaves of *Ailanthus glandulosa* have been found admixed. A very interesting and characteristic test for genuine senna depends upon the sublimation of its oxymethyl-anthraquinone, which is always a constituent, and this may be further confirmed by testing the sublimed material with a drop of one of the solutions of the alkalies which will show a red-colored test. (*Pharm. Prax.*, v, p. 435.)

Constituents.—The odor of senna is faint and sickly; the taste slightly bitter, sweetish, and nauseous. Water and diluted alcohol extract its active principles. Pure alcohol extracts them but imperfectly. (Bley and Diesel, *Ph. Cb.*, Feb., 1849, p. 126.) The leaves are said to yield about one-third of their weight to boiling water. The infusion is of a deep reddish-brown color, and has the odor and taste of the leaves. When exposed to the air for a short time, it deposits a yellowish insoluble precipitate, supposed to result from the union of extractive matter with oxygen. The nature of this precipitate, however, is not well understood. Decoction also produces some change in the principles of senna, by which its medicinal virtues have been supposed to be impaired, but some experiments of B. Heerlein would seem to show that this opinion is incorrect. An extract prepared by boiling down an infusion, redissolving the residue, and again boiling down to a solid consistence, was found to operate actively in a dose equivalent to a drachm of the leaves. (*Ph. Cb.*, 1851, p. 909.) To diluted alcohol it imparts the same reddish-brown color as to water, but rectified alcohol and ether, digested upon the powdered

leaves, become of a deep olive-green.

Lassaigue and Feneulle first isolated a substance to which they gave the name of *cathartin*, but it proved to be a mixture; Bley and Diesel (*Ph. Cb.*, 1849, p. 126) isolated a yellow coloring matter, which they called *chrysoletin*, but which Martins identified as *chrysophan*; Ludwig (*A. Pharm.* (2), cix, p. 42, and cxc, p. 69) obtained two bitter principles, *sennapicrin* and *sennacrol*, the first insoluble, the second soluble in ether; but the active purgative principle was first discovered in 1866 by Dragendorff and Kubly (*Viertelj. f. Prakt. Pharm.*, 16, pp. 96 and 337), who found it to be a glucoside of weak acid character, and named it *cathartic acid*. Thos. B. Groves, in 1868 (*P. J.*, 1869, p. 196), unaware of Dragendorff and Kubly's discovery, isolated the same principle, and found for it the same reactions. For a method of preparing cathartic acid, by Ralph Stockman, see *P. J.*, 1885, p. 740. Its formula is given as $C_{180}H_{96}N_2SO_{82}$, and by boiling its alcoholic solution with acids it yields *cathartogenic acid* and sugar. Gensz (*A. J. P.*, 1893, 334), who prepared it later by the method of Kubly and Stockman, gave the formula $C_{30}H_{36}NO_{15}$. It is amorphous, difficultly soluble in cold water, readily soluble in boiling water. The best solvent is a 30 to 40 per cent. alcohol; ether, benzene, chloroform, and petroleum ether are without solvent action. Alkalies with heat decompose it. It is prepared by partially precipitating with alcohol infusion of senna, concentrating to a syrupy consistence in vacua, filtering, treating the filtrate with a large proportion of absolute alcohol, and repeatedly dissolving in water, and precipitating by alcohol the precipitate thus obtained. It is purified by submitting it (dissolved in moderately strong hydrochloric acid) to dialysis on a diaphragm of parchment paper, cathartic acid having strong colloidal properties. Groves found that ammonium cathartate purged moderately in the dose of three and three-quarters grains, with considerable griping, and that of certain mixed cathartates seven and a half grains purged violently, with much griping and sickness, and continued to act through most of a day. He considers four grains a fair dose. It should be given in connection with an aromatic and a saline cathartic. *Magnesium cathartate* is soluble. The salts of this acid in aqueous solution are decomposed and rendered inert by long exposure to heat in contact with the air. (Groves, *P. J.*, Oct., 1868, 200-1.) Dragendorff and Kubly also found chrysophanic acid in small proportions, the two substances, *sennacrol* and *sennapicrin*, previously mentioned, and a peculiar non-fermentable saccharine principle, with

the formula $C_{21}H_{44}O_{19}$, which they named *catharto-mannite*. (*J. P. C.*, 4e ser., v.) A. Seidel proposes the name of *sennit* for catharto-mannite, and gives a process for its preparation in *A. J. P.*, 1885. In 1900 Tschirch and Hiepe made a comprehensive investigation of the chemical constituents of senna in which they found that the active principles belonged to the oxymethylan-thraquinone group of glucosides, yielding emodin upon decomposition. From the aqueous percolate they extracted, besides *cathartic acid*, a crystalline body, giving the same reactions as *sennanigrin* and having the composition $C_{14}H_{10}O_5$. From the weak ammoniacal percolate they obtained *anthraglucosennin*, which, however, is composed of several distinct substances, for on treating it with ether, a portion enters solution and another remains undissolved; then the ether-soluble portion, if boiled with toluene and the solution poured on petroleum benzin, precipitates *sennaemodin*, while *sennachrysophanic acid* remains in solution and may be obtained on evaporation; the portion insoluble in toluene is a body which the authors have named *glucosennin*. Its composition agrees with the formula $C_{22}H_{18}O_8$, and it is possibly an emodin glucoside. From the portion of anthraglucosennin insoluble in ether, *sennaisoemodin* is obtained by treatment with acetone and shaking the resultant solution with petroleum benzin. The acetone solution retains a substance which the authors have named *sennarhamnetin*. Finally, the portion of anthraglucosennin remaining undissolved after treatment with ether and acetone is a black body which resembles in this and other respects aloë-nigrin. *Sennanigrin*, however, yields on treatment with alcoholic potassium hydroxide, sennaemodin and sennachrysophanic acid. (*A. Pharm.*, Aug. 31, 1900, 427, 448.)

Some results of experiments on the properties of senna which more particularly concern the pharmacist are noted in a paper contained in the *J. P. C.* (Janv., 1874, p. 80), and require to be mentioned here, because they tend to fix certain points which are left undetermined in the above statement. An extract made by evaporating in the air an aqueous infusion of senna possesses but partially the purgative properties of the leaves. If the extract be redissolved in a large quantity of water, and the solution be again evaporated, the extract now obtained will be quite inert. It follows that a prolonged decoction of senna destroys its cathartic powers. The presence of an alkali in the decoction increases the rapidity of the destruction. An infusion of senna in lime water, heated to the boiling point, and then deprived of lime by

a stream of carbon dioxide, becomes inert. An infusion of senna, made to boil after the addition of potassium hydroxide, and then neutralized by an acid, is also inert. The mineral acids destroy the purgative powers of senna, but less energetically than the alkalies; the vegetable acids exercise the same power but feebly. Concentrated alcohol does not dissolve the active principle, which is soluble in cold water. It was Heerlein who first determined the complete want of purgative power in the pure alcoholic extract of senna. Nevertheless, this extract possesses in a high degree the odor and taste of senna, and, taken internally, without purging, imparts a deep-yellow color to the urine, which the alkalies change to red. The leaves exhausted by alcohol have all their purgative effect, but lose the power of affecting the urine so that an alkaline solution shall color it red. These facts prove that chrysophanic acid is not the purgative principle of senna. The fact that alcohol removes the odor and taste of senna without affecting its purgative action may sometimes be advantageously applied in cases in which the taste of senna is extremely offensive. L. Siebold, after experimenting with senna leaves washed with alcohol, arrived at the following conclusions: (1) Strong spirit does not remove any of the active principle from senna leaves; (2) the therapeutic action of cathartic acid is assisted by one or more of the constituents yielded by senna to strong alcohol, though these constituents produce no purgative effect when taken alone; (3) senna exhausted by alcohol is a reliable and pleasant purgative, but somewhat weaker in its action than the unexhausted leaves. Tutin reports the analysis of the water soluble portion of an alcoholic extract of Tinnevely senna as containing (1) salicylic acid, (2) rhein ($C_{15}H_8O_6$), (3) kaempferol (1:3:4 trihydroxyflavonol), (4) aloemodin ($C_{15}H_{10}O_5$), (5) kaempferin ($C_{23}H_{30}O_6$), a glucoside of kaempferol, (6) glucosides of rhein and aloemodin, (7) a magnesium salt of an unidentified organic acid, (8) a sugar. The water insoluble portion contained (1) myricyl alcohol, (2) a phytosterol ($C_{27}H_{46}O$), (3) a phytosterolin ($C_{33}H_{56}O_6$), (4) palmitic and stearic acids, besides a small amount of essential oil.

Incompatibles.—Many substances produce precipitates with the infusion of senna, but it does not follow that they are all medically incompatible, as they may remove only inert ingredients. Cathartic acid is precipitated by infusion of galls and solution of lead sub acetate. Lead acetate and tartar emetic which disturb the infusion, have no effect upon the solution of this substance.

Uses.—Senna was first used as a medicine by the Arabians. It was noticed in their writings as early as the ninth century, and the name itself is Arabic. Like the other cathartics of the anthraquinone series, its action is chiefly upon the lower bowel, and is therefore especially suitable in *habitual costiveness*. It increases the peristaltic movements of the colon by its local action upon the intestinal wall. The tendency to gripe may be obviated by combining it with aromatics or with a saline laxative. The coloring matter of senna is absorbable, and twenty or thirty minutes after the ingestion of the drug it appears in the urine and may be recognized by a red color on the addition of ammonia. It is asserted also that the milk of nursing women acquires purgative properties after the administration of senna. Under the name of *cathartin* there is upon the market a mixture of the salts of cathartic acid which may be used in doses of from three to six grains (0.2-0.4 Gm.). *Sennax* is the name applied to the water-soluble glucoside of senna, and is marketed in tablets each one of which contains 0.075 Gm.

Dose, of senna, one-half to two drachms (2.0-7.7 Gm.).

Off. Prep.—*Confectio Sennae, Br., N. F.*; *Fluidextractum Sennae, U. S.*; *Infusum Sennae, Br.*; *Infusum Sennae Compositum, U. S.*; *Pulvis Glycyrrhizae Compositus, U. S., Br.*; *Syrupus Sennae* (from Fluidextract), *U. S., Br.*; *Tinctura Sennae Composita, Br.*; *Mistura Sennae Composita* (from Infusion), *Br.*; *Syrupus Sarsaparillae Compositus* (from Fluidextract), *U. S.*; *Elixir Cascarae Sagradae Compositum* (from Fluidextract), *N. F.*; *Elixir Catharticum Compositum* (from Fluidextract), *N. F.*; *Species Laxativae, N. F.*; *Syrupus Ficorum Compositus, N. F.*; *Syrupus Sennae Aromaticus, N. F.*; *Syrupus Sennae Compositus, N. F.*

SENNÆ FRUCTUS. Br.

SENNÆ PODS

" Senna Pods are the dried ripe fruits of *Cassia acutifolia*, Delile, and of *Cassia angustifolia*, Vahl." *Br.*

Senna pods, while regarded as an adulterant in the U. S. P. IX in that the quantity is restricted, are official in the Br. Pharm. They are described as follows: " About five centimetres long, and from two to two

and a half centimetres wide; broadly oblong or somewhat rent-form; pale green; brownish in the centre above the seeds; very flat; rounded at the base, slightly mucronate at the apex. Pericarp papery. Seeds obovate-cuneate, flattened. Odor and taste slight." *Br.*

Uses.—They were preferred by the Arabian and mediasval physicians of Europe to the leaves, while Pereira states that they are much milder in their operation than the leaflets. This has been explained by the researches of E. F. Salmon, who has found that they contain about 25 per cent. more cathartic acid and emodin than the leaves, but no resinous principle or volatile oil. (*P. J.*, Oct., 1889.) The griping of senna being largely due to the resin, it is a priori to be expected that the pods would act more kindly than the leaves. A. W. Macfarlane has found this to be actually the case. From six to twelve pods for the adult, or from three to six for the young or very aged, infused in a claret-glass of cold water, in his experience, act very mildly but very thoroughly upon the whole intestine.

Dose, from one-half to one drachm (2.0-3.9 Gm.).

SERPENTARIA. U. S. (Br.)

SERPENTARIA Serpent. [Virginia Snakeroot, Texas Snakeroot]

"The dried rhizome and roots of *Aristolochia Serpentaria* Linne, known in commerce as Virginia Snakeroot, or of *Aristolochia reticulata* Nuttall, known in commerce as Texas Snakeroot (Fam. *Aristolochiaceae*), without the presence or admixture of more than 10 per cent. of the stems or other foreign matter." *U. S.* "Serpentary Rhizome is the dried rhizome and roots of *Aristolochia Serpentaria*, Linn., and of *Aristolochia reticulata*, Nutt." *Br.*

Serpentaria Rhizoma, *Br.*, Serpentry Rhizome; Virginia Serpentaria, Virginia Snakeroot, Snakeweed, Pelican-flower, Snagrel, Sangrel, Radix Colubrina, Radix Viperina; Serpentry, Sangree; Serpentaire de Virginie, *Fr. Cod.*; Couleuvre de Virginie, *Fr.*; Virginische Schlangenzwurzel, *G.*

Many species of *Aristolochia* have been employed in medicine. Their supposed possession of emmenagogue properties has given origin to the name of the genus.

Aristolochia Serpentaria is an herbaceous plant, with a short rhizome and numerous slender roots. Several stems often rise from the same rhizome. They are about eight or ten inches in height, slender, round, flexuose, jointed at irregular distances, and frequently reddish or purple at the base. The leaves are oblong-cordate, acuminate, entire, of a pale yellowish-green color, and supported on short petioles. The flowers proceed from the joints near the root, and stand singly on long, slender, round, jointed peduncles, which are sometimes furnished with one or two small scales, and bend downward so as nearly to bury the flower in the earth or decayed leaves. The tube of the calyx is curved like the letter S, enlarged at the base (ovary) and at its throat, the short limb being obtusely three-lobed. The anthers—six or twelve in number—are sessile, attached to the under part of the stigma, which is fleshy and from three to six-lobed. The fruit is an hexangular, six-celled capsule, containing several small flat seeds. The plant grows in rich shady woods from Connecticut west to Michigan and Missouri and south to Florida and Louisiana, abounding in the valley of the Ohio and in the mountainous regions of our interior. It flowers in May and June. The root is collected in Western Pennsylvania, West Virginia, Ohio, Indiana, and Kentucky. It is usually in bales containing about one hundred pounds, and is often mixed with the leaves and stems of the plant, and with adhering dirt. For an account of *A. hirsuta*, see 18th ed., *U. S. D.*, p. 1222. On account of the rather large use of *Serpentaria* the drug is becoming scarcer and some attempts at cultivation have been made. (See *Proc. A. Ph. A.*, 1905, liii, p. 275, and *West. Drug.*, xxvii, p. 775.)

A. hastata (Nuttall.) Duchartre.—This is now considered to be nothing more than a variety of *A. Serpentaria*, from which it differs in having hastate, acute, somewhat cordate leaves, and the lip of the corolla ovate. It flourishes on the banks of the Mississippi, in the Carolinas, and elsewhere. Its root scarcely differs from that of the official plant, and is frequently mixed with it, as is proved by the presence of the characteristic hastate leaves in the parcels brought into market.

A. reticulata was probably first observed by Nuttall, as a specimen labelled "*A. reticulata*, Red River," in the handwriting of that botanist, is contained in the Herbarium of the Academy of Natural Sciences of Philadelphia. From a root similar to that of *A. Serpentaria* numerous short, slender, round, flexuose, jointed stems arise, usually simple, but sometimes branched near the root. The older stems are slightly villous. the young densely pubescent. The leaves, which stand on very short

villous petioles, are round or oblong-cordate, obtuse, reticulate, very prominently veined, and villous on both sides, especially upon the veins. From the lower joints of the stem four or five hairy, jointed peduncles proceed, which bear small leafy villous bracts at the joints, and several flowers on short pedicels. The flowers are small, purplish, and densely pubescent, especially at the base and on the ovary. The hexangular capsule is deeply sulcate. This species grows from Virginia to Louisiana, Texas, Arkansas, and Oklahoma.

Properties.—Serpentaria is officially described as follows: " Rhizome in both commercial varieties oblique, subcylindrical, more or less curved, from 10 to 30 mm. in length and from 1 to 2 mm. in diameter; externally dark brown, upper portion with short stem-bases and from lower and lateral portions arise numerous, long, thin, nearly straight, yellowish-brown roots; fracture short; internally yellowish-white, wood with broad, excentric wedges; odor terebinthinate; taste bitter, aromatic. Under the microscope, transverse sections of the rhizome of both commercial varieties of Serpentaria show an outer layer of epidermal cells; a cortex of from 10 to 15 rows of parenchyma; inner bark sometimes showing strongly lignified bast-fibers, either single or distributed in a more or less interrupted circle; a xylem of broad wood-wedges separated by broad medullary rays about 8 cells wide, the walls being strongly lignified and with numerous simple pores; pith excentric, composed of polygonal cells, the walls being lignified and porous. Starch in the cells of cortical parenchyma, medullary rays and pith. The root in transverse section shows a compact, 4- to 6-rayed stele, and a large starch-bearing cortical area. The stem in transverse section shows an interrupted circle of from 6 to 10 fibro-vascular bundles, a cortex with a prominent continuous ring of strongly lignified cells, and a few non-glandular hairs. The powder is grayish-brown; when examined under the microscope it exhibits numerous starch grains, single and 2- to 4-com-pound, the individual grains being- more or less spherical or plano-convex and frequently with a central cleft, from 0.003 to 0.014 mm. in diameter; lignified elements numerous, consisting of tracheae, wood-fibers, medullary ray cells and pith cells; a few non-glandular hairs of the stem are occasionally present." *U. S.*

"Rhizome of *Aristolochia Serpentaria* tortuous and slender, about two centimetres long and three millimetres thick; on the upper surface the remains of slender, aerial stems, and on the under surface numerous wiry interlacing roots, often about seven centimetres long. Both rhizome

and roots dull yellowish-brown. Characteristic odor; taste strong, camphoraceous, bitter. Ash not more than 10 per cent. Rhizome and roots of *Aristolochia reticulata* resemble the foregoing, but are longer and thicker, and the roots are straighter." *Br.*

Holm has published an illustrated article on the pharmacognosy of serpentaria, including the morphology of the stems and leaves. (*M. R.*, xvi, p. 276.)

Texas Serpentaria contains a larger percentage of volatile oil than does the other variety of the drug. The color of serpentaria, which in the recent root is yellowish, becomes brown on keeping.

The roots of *Spigelia marilandica* are sometimes found associated with serpentaria. They may be distinguished by the absence of the bitter taste, and, when the stem and foliage are attached, by the peculiar character of these parts. (See *Spigelia*.) We have seen the young roots of *Polygala Senega* mixed with serpentaria. Independently of their difference in odor and taste, they may be distinguished by being simple, and by a projecting line running from one end to the other of the root. Another adulteration was detected by P. S. Milleman of Chicago, who found in a parcel a large quantity of "golden seal" (*Hydrastis canadensis*). The rhizomes, with rootlets attached, were from a quarter of an inch to an inch in length, and about one-eighth of an inch in diameter, but at the present time (1917) on account of the high price of senega and hydrastis neither admixture is likely to occur.

The root yields all its virtues to water and alcohol, producing with the former a yellowish-brown infusion, with the latter a bright greenish tincture, rendered turbid by the addition of water. Chevallier found in the root a volatile oil, a yellow bitter principle, soluble in water and alcohol, resin, gum, starch, albumen, lignin, and various salts. Bucholz obtained from 1000 parts, 5 of a green fragrant volatile oil, 28.5 of a yellowish-green resin, 17 of extractive matter, 181 of gummy extract, 624 of lignin, and 144.5 of water. The active ingredients are probably the volatile oil and the yellow bitter principle of Chevallier, which that chemist considers analogous to the bitter principle of quassia; alkaline solution of cupric tartrate shows, moreover, the presence of a glucose sugar. The volatile oil passes over with water in distillation, rendering the liquid milky, and impregnating it with the odor of the root. The volatile oil has been carefully investigated by J. C. Peacock (*A. J. P.*,

1891, 257). He found it to contain a terpene, $C_{10}H_{16}$, boiling at $157^{\circ} C.$ ($314.6^{\circ} F.$), of sp. gr. 0.865 (probably pinene); a compound ester boiling at $211^{\circ} C.$ ($411.8^{\circ} F.$), sp. gr. 0.9849, which on saponification yielded borneol, $C_{10}H_{18}O$, and a crystalline acid; a fraction boiling at from 239° to $240^{\circ} C.$ (462.2° - $464^{\circ} F.$), sp. gr. 0.9888, and of the composition $C_{18}H_{20}O$; and some green or bluish-green fluorescent oil in small quantity, which decomposes even when distilled under reduced pressure. The borneol ester constitutes about 60 per cent. of the oil. A principle called *aristolochine*, obtained from *A. Clematitis* and the roots of *A. rotunda* and *A. longa*, was investigated by Jul. Pohl. (*A. E. P. P.*, xxix.) He obtained it as a yellow crystalline mass, soluble in chloroform, ether, acetone, acetic anhydride, and alcohol, insoluble in petroleum benzin, benzene, and carbon disul-phide, almost insoluble in cold water, slightly soluble in hot water. An ultimate analysis gave for its composition $C_{32}H_{22}O_{13}N$. O. Hesse obtained from the root of *Aristolochia argentina* an alkaloid to which he gives the name *aristolochine*, but has furnished no formula; a principle, *aristolin*, $C_{15}H_{28}O_3$; *physosterin palmitate*, in white scales, fusing at $82^{\circ} C.$ ($179.6^{\circ} F.$); and a mixture of acids to which he gives the names *aristic acid*, $C_{18}H_{13}NO_7$, *aristidic acid*, $C_{17}H_{10}(CH_3)NO_7$, and *aristolic acid*, $C_{15}H_{13}NO_7$.

The resinous *aristic acid* has been obtained from a number of species of the genus *Aristolochia*, notably by Walz from *A. Clematitis*, by Chevallier from *A. Serpentaria*, by Dymock and Warden from *A. indica*, by Hesse from *A. argentina*, by Hooper from *A. bracteata*. Hooper has also obtained a closely allied, if not identical, resinous acid from the aristolochiaceous plant *Bragantia Wallichii*, besides an alkaloid, which, under the name of *Alpam*, has long been used in Western India as an antidote to snake venom. The allied species, *Bragantia tomentosa* of Blume, is said to be employed in Java as an emmenagogue.

Uses.—*Serpentaria* is a feeble stimulant tonic. Too largely taken, it occasions nausea, griping pains in the bowels, sometimes vomiting and dysenteric tenesmus. It has been recommended in *intermittent fevers*, and may be serviceable as an adjunct to quinine. It is sometimes given in *dyspepsia*. The dose of fluid-extract is from twenty minims to half a flui-drachm (1.3 to 1.8 mils). According to Pohl, aristolochine in sufficient dose produces in the higher animals violent irritation of the

gastro-intestinal tract and of the kidneys, with death in coma from respiratory paralysis.

Dose, fifteen to thirty grains (1 to 2 Gm.).

Off. Prep.—Tinctura Cinchonae Composita, *U. S., Br.*; Fluidextractum Serpentarise, *N. F.*; Tinctura Serpentariae, *N. F., Br.*

Sesamum. *Sesamum indicum* L. (Fam. *Pedaliaceae*).—The *benne* plant of our Southern States is annual, with a branching stem four or five feet high, and bearing opposite, petiolate leaves, varying considerably in their shape. The flowers are reddish-white, and stand solitarily upon short peduncles in the axils of the leaves. The fruit is an oblong capsule, with small, oval, yellowish seeds.

There are some ten or twelve species referred to the genus *Sesamum*, the majority of which are natives of Africa. In India one or two species occur wild, one of these, *Sesamum indicum* L. (*S. orientate* L.), has been cultivated from time immemorial in various parts of Asia and Africa. From the latter continent it is supposed that seeds were brought by the negroes to the United States, where, as well as in the West Indies, it is now cultivated to a considerable extent. The plant above described will grow as far north as Philadelphia. The seeds are employed as food by the negroes, who parch them over the fire, boil them in broths, make them into puddings, and prepare them in various other modes. By expression they yield a fixed oil, which was introduced into the Pharmacopoeia at the revision of 1880 and is official in U. S. IX. Berjot obtained from the seeds 53 per cent. of oil by means of carbon disulphide. Rautenberg reported a series of severe poisonings from the intestinal injection of sesame oil. (*J. A. M. A.*, xlvii, p. 1962.) These accidents, he believes, are due to adulteration of the oil.

Benne Leaves.—These abound in a gummy matter, which they readily impart to water, forming a rich, bland mucilage, much used in the Southern States as a drink in various complaints to which demulcents are applicable, as in *cholera infantum*, *diarrhea*, *dysentery*, *catarrh*, *acute cystitis*, *strangury*, etc. The remedy has attracted attention also in the North, and has been employed with favorable results in Philadelphia. One or two fresh leaves of full size, stirred about in half a pint of cool water, will soon render it sufficiently viscid. With dried leaves hot water is used. The leaves also serve for the preparation of emollient cataplasms.

Sethia. *Sethia acuminata* Arn. (now *Erythroxylon lucidum* H. B. K.) (Fam. *Erythroxylaceae*).—The juice of this Ceylon plant or the powdered leaves—dose, fifteen grains (1.0 Gm.)—are affirmed to be an efficient vermifuge. (*P. J.*, April 7, 1883.)

Sida. *Mesbe. Sida rhombifolia* L.—*Queensland hemp* (Fam. *Malvaceae*), jelly leaf, is largely used in Australia as a demulcent. It contains a large quantity of mucilage. The fluidextract has been asserted to possess expectorant properties and to be especially

valuable in the treatment of *pulmonary tuberculosis*. Zink (*M. M. W.*, 1912), however, was unable to obtain evidence of any specific action in tuberculosis. *Sida paniculata* L. (*S. floribunda* H. B. K.), of Peru, which also contains a large quantity of mucilage, is said by Martinet to be a very active vermifuge, owing its powers, probably, to the extremely minute but very resisting spines which cover its leaves, the part used.

Siegesbeckia. *Siegesbeckia orientalis* L. (Fam. *Compositae*).—This plant is used in the Mauritius Islands in *syphilis*, *leprosy*, and various skin diseases. A white, crystalline principle, *darutine*, has been discovered in it by M. L. Auffray. (*P. J.*, vol. xvi, 1047; also *B. M. J.*, June 25, 1887.)

Silene. *Silene virginica* L. (Fam. *Caryophyllaceae*). *Catchfly*. *Wild Pink*.—The wild pink, growing from Western New York to Minnesota and southward, was considered by the Indians poisonous and by Barton an anthelmintic. It is a slender herb having thin-spatulate or oblong-lanceolate leaves and deep crimson or scarlet flowers in a loose raceme.

Silphium. *Silphium laciniatum* L. *Polar Plant*. (Fam. *Compositae*).—The rosin weed, or compass plant, of Ohio, yields an oleoresin, which is said to be used in making chewing gum. (*A. J. P.*, 1881, 487.)

Simaruba.—Under this name the U. S. P. formerly recognized the bark of the root of *S. amara* Aublet (*S. officinalis* DC.) *Ecorce de simarouba*, Fr. *Simarubarinde*, *Ruhrinde*, G. *Corteccia di Simaruba*, It. *Cortesa de Simaruba*, Sp. (Fam. *Simarubaceae*.) This is a tree of considerable height, having alternate branches, with a bark which in the old tree is black and somewhat furrowed, in the young is smooth, gray, and marked here and there with broad yellow spots.

Simaruba bark is in long pieces, from 4 to 12 cm. wide and 2 to 5 mm. thick, folded lengthwise, light, flexible, tenacious, very fibrous, externally of a light brownish-yellow color, rough, warty, and marked with transverse ridges, internally of a pale yellow. It is without odor, and of a bitter taste. It readily imparts its virtues, at ordinary temperatures, to water and alcohol. The infusion is at least equally bitter with the decoction, which becomes turbid as it cools. Its constituents, according to Morin, are a bitter principle identical with *quassin*, $C_{10}H_{12}O_3$, to which Gilling (*P. J.*, 1908, lxxxii) ascribes the formula, $C_{22}H_{30}PO_9$, a resinous matter, a volatile oil having the odor of benzoin, malic acid, gallic acid in very minute proportion, an ammoniacal salt, calcium malate and oxalate, some mineral salts, ferric oxide, silica, ulmin, and lignin.

It is a native of French Guiana and the Islands of Dominica, Martinique, St. Lucia, St. Vincent and Barbadoes, in the West Indies. A closely related species, having, however, dioecious instead of monoecious flowers, nourishes in Jamaica, San Domingo, Bahama Islands, Panama and Guatemala, extending even to Florida; it is called in Jamaica mountain damson, and is known as *S. glauca* DC. (*S. officinalis* Macf., not DC.) The two species have probably identical medicinal properties. The bark of the root is the part employed, the wood being nearly tasteless and inert. The middle bark contains much resin. A decoction of the bark and leaves of *S. versicolor*

St.-Hil. (*Cortex Paraibae*), is employed in Brazil as an antidote for snakebites and in the treatment of *syphilis* and *tapeworm*; the powder is used against vermin.

Simaruba possesses the same tonic properties as other simple bitters. In large doses it is said to purge and vomit. On account of its difficult pulverization, it is seldom given in substance. The best mode of administration is by infusion. The dose is from twenty grains to a drachm (1.3-3.9 Gm.).

Simulo.—The dried fruit of *Capparis coriacea* Burch., one of the *Capparidaceae*, has been recommended as a palliative in *epilepsy*, also in *chorea*. (See *T. G.*, 1888, 1889; and *Th. M.*, Aug., 1888.)

SINAPIS ALBA. U.S.

WHITE MUSTARD Sinap. Alb. [Yellow Mustard]

"The ripe seeds of *Sinapis alba*, Linne (Fam. *Cruciferae*), without the presence or admixture of more than 5 per cent. of other seeds or other foreign matter. Preserve powdered White Mustard in tightly-closed containers." *U. S.*

Sinapis Albae Semina, *Br.* 1898; White Mustard Seeds; Yellow Mustard Seed; *Moutarde blanche*, *Fr. Cod.*; *Semen Erucae*, *P. G.*; *Weisser Senfsamen*, *Weisser Senf*, *G.*; *Senape bianca*, *It.*; *Mostaza blanca*, *Sp.*

Neither black nor white mustard is any longer official in the British Pharmacopoeia.

Yellow or white mustard is a native of Europe and is extensively cultivated, being occasionally spontaneous, in the United States. The commercial supplies are obtained from England, Holland, Germany and California.

Properties.—The official description of white mustard is as follows: "Sub-globular, from 1.5 to 2.5 mm. in diameter; testa yellowish, nearly smooth; embryo yellowish, oily, with two large cotyledons; inodorous, taste mildly pungent, acrid. The powder is light yellowish or pale brownish-yellow, developing a slight odor when moistened; when examined under the microscope it exhibits numerous tissues of the embryo containing small aleurone grains and a fixed oil, the latter forming in large globules on the addition of hydrated chloral T.S.; fragments of seed-coat comparatively few, nearly colorless, with small,

characteristic stone cells and large epidermal cells, the outer walls being mucilaginous. The powder contains few or no starch grains. White Mustard does not yield allyl isothiocyanate upon distillation with steam (distinction from *Black Mustard*). White Mustard yields not more than 9 per cent. of ash." *U. S.*

For an illustrated monograph on the pharmacognosy of white mustard, see Winton and Moeller, "*Microscopy of Vegetable Foods*." The only adulterant of white mustard are the seeds of the white Indian *colza*, obtained from *Brassica campestris* Sarson (L.) Prain. They are distinguished in having a more pronounced ridge over the radicle. Under the microscope the seeds have an indistinct epidermis, the collenchymatous subepidermal layer is wanting, and the palisade cells are quite large compared with white mustard. For further information see *Sinapis Nigra*.

SINAPIS NIGRA. U. S.

BLACK MUSTARD Sinap. Nig. [Brown Mustard]

"The ripe seeds of *Brassica nigra* (Linne) Koeh (Fam. *Cruciferae*), without the presence or admixture of more than 5 per cent. of other seeds or other foreign matter. Preserve powdered Black Mustard in tightly-closed containers." *U. S.*

Sinapis Nigrae Semina *Br.* 1898; Black Mustard Seeds; Semina Brassicae; Moutarde noire, *Fr. Cod.*; Moutarde, *Fr.*; Semen Sinapis, *P. G.*; Senisamen, Schwarzer Senf.; Senape nera, *It.*; Mostaza (Semilla de), *Sp.*

Linnaeus described two genera, *Brassica* and *Sinapis*, and subsequent botanists have greatly disagreed as to whether they should be considered identical or not. The revisers of the U. S. P. have adopted the opinion of Engler and Pranti and of Britton and Brown, that the two genera are distinct. The genus *Sinapis* differs from *Brassica* in that the pods of the former are terminated by a long, flat, sword-like beak, whereas in *Brassica* the beak is cylindrical or conical.

Common or black mustard (*Brassica nigra*), is an annual plant, with a stem three or four feet in height, divided and subdivided into numerous spreading branches. The leaves are petiolate and variously shaped. Those near the root are large, rough, lyrate-pinnate, and unequally

toothed, those higher on the stem are smooth, and less lobed, and the uppermost are entire and narrow. The flowers are small, yellow, and stand closely together upon peduncles at the upper part of the branches. The pods are smooth, erect, nearly parallel with the branches, quadrangular, and furnished with a slender beak; seeds numerous, dark brown.

The white mustard is also annual. It is rather smaller than the preceding species. The lower leaves are deeply pinnatifid, the upper sublyrate, and all irregularly toothed, rugged, with stiff hairs on both sides, and pale green. The flowers are in racemes, with yellow petals, and linear, green calycine leaflets. The pods are spreading, bristly, rugged, roundish, swelling in the position of the seeds, ribbed, and provided with a very long ensiform beak.

Both *Sinapis alba* and *Brassica nigra* are natives of Europe and cultivated in our gardens, and *B. nigra* has become naturalized in some parts of this country. Their flowers appear in June. The seeds are kept in the pharmacies, both whole and in the state of very fine powder as prepared by the manufacturers for the table. The latter is sometimes mixed with spices and ground into a smooth paste with water in a mill resembling a paint mill, and then is known as *French mustard*.

The seeds of *Brassica ibertifolia*, according to O. Harz, are sometimes sold as true white mustard seed. He examined some obtained from Bavaria, which had been returned by customers to the dealers on account of their bitter and disagreeable taste. He furnishes characteristic microscopical tests for distinguishing the false from the true mustard seed. His statement, however, that powdered white mustard seed when mixed with water is odorless, and that the false gives off a strong odor of essential oil of mustard, would seem to be a good reason, if correct, for preferring the false seed. (*P. J.*, 1887, 478.)

The *Brassica juncea* (L.) Coss. (*Sinapis juncea* L.), is extensively grown in India, and its seeds are largely exported to Europe. The same plant is also cultivated in Southern Russia. The seeds afford a very fine yellow mustard flour, and, according to Paul Birkenwald, yield 1.67 parts per hundred of volatile oil, against 1.89 parts per hundred by the true black mustard seed. (*S. W. P.*, 1888.)

Black mustard seeds are officially described as " ellipsoidal or irregularly

spheroidal, from 1 to 1.6 mm. in diameter; testa deep reddish-brown, sometimes yellowish-brown and with a grayish tinge, minutely pitted or reticulate; embryo greenish-yellow or dark yellow, oily, with two large cotyledons; odor when dry, slight, on moistening very irritating; taste strongly pungent and acrid. The powder is light brown or greenish-brown; on moistening developing a strongly pungent, irritating, characteristic odor; when examined under the microscope it exhibits numerous tissues of the embryo, the cells containing small aleurone grains and a fixed oil, the latter forming in large globules on the addition of hydrated chloral T.S.; fragments of seed-coat conspicuous, with large, polyhedral, dark yellow areas, enclosing small, yellowish stone cells, each of the latter with a dark lumen. The powder contains few or no starch grains. Black Mustard, upon distillation with steam, yields allyl isothiocyanate (distinction from *White Mustard*). Black Mustard yields not more than 9 per cent. of ash." *U. S.*

Both white and black mustard afford a powder, which has a somewhat unctuous appearance, and cakes when compressed. This is commonly called *flour of mustard*, or simply *mustard*, and is prepared by crushing and pounding the seeds and then sifting them, the purest flour being obtained by a second sifting. Both the black and the white seeds are used in its preparation. Formerly it was adulterated with wheat flour colored by turmeric, to which cayenne pepper was added to render the mixture sufficiently hot. Pure mustard powder contains very few starch granules, but was formerly adulterated with farinaceous powders; the U. S. P. VIII required that White or Black Mustard should conform to the following test: " If 1 Gm. of powdered White (or Black) Mustard be exhausted by slow percolation with alcohol, and the marc mixed with 200 Cc. of water and heated to boiling", and if, after cooling, sufficient cold water be added to make the mixture measure 1000 Cc., the addition of 4 Cc. of tenth-normal iodine V.S. should not produce a dark blue color (limit of starch); *U. S. VIII.*

The epidermis of white mustard seeds contains a mucilaginous substance which is extracted by boiling- water. An excellent basic monograph on the pharmacognosy of black mustard is that given by Winton and Moeller in "*The Microscopy of Vegetable Foods.*" Tschirch and Oliva have made a comparative study of the seeds of the Cruciferae, with special reference to the variations found in the seed-coat of the several species of mustard. (*S. W. P.*, xliii, p. 614.) Spaeth give's the results of chemical and microscopical study of the mustards

and some of their adulterants in *Ph. Zentralh.*, xlix, p. 698. Carles has also contributed a valuable article on the pharmacognosy of the different mustard seeds and the commercial varieties of mustard flour in *J. P. C.*, 1913, pp. 438 and 535. The most common adulteration of black mustard is *charlock*, which is the seeds of *Brassica arvensis* (L.) Ktze. This plant is especially abundant in the Northwestern part of the United States and the Dakota mustard contains varying mixtures of brown mustard and charlock. The presence of charlock is very easily determined by the use of a solution of chloral hydrate which changes the color of the palisade cells to a crimson red.

When bruised or powdered, both kinds of mustard impart their active properties wholly to water, but in a very slight degree to alcohol.

They yield upon pressure a fixed oil, called *oil of mustard*, of a greenish-yellow color, little odor, and a mild not unpleasant taste; and the portion which remains is even more pungent than the unpressed seeds. The fixed oil of mustard consists of the glycerin compounds of stearic, oleic, and *erucic* or *brassic acid*, $C_{22}H_{42}O_2$, a homologue of oleic acid. Small quantities of *behenic acid*, $C_{22}H_{44}O_2$, also occur in oil of black mustard. This fixed oil is a yellow non-drying oil of from 0.915 to 0.920 sp. gr. at 15° C. (59° F.), solidifying at from -12° to -16° C. (10.4-3.2° F.). It has been long known that black mustard seeds yield by distillation with water a very pungent volatile oil, containing sulphur. Guibourt conjectured, and Robiquet and Boutron proved, that this oil does not pre-exist in the seeds, but is produced by the action of water. Hence the absence or very slight degree of odor in the seeds when bruised in a dry state, and their pungency when water is added. It seemed reasonable to suppose that the reaction in this case was similar to that exercised by water upon bitter almonds (see *Amygdala Amara*), and this has been proved to be the fact by the experiments of Simon, Bussy, Boutron, and Fremy. The composition and peculiar decompositions of the volatile oil of black mustard have already been described. (See *Oleum Sinapis Volatile*.)

A principle was extracted by Will from white mustard seed, with the aid of alcohol. It has been named *sinalbin*, and has the formula $C_{30}H_{44}N_2S_2O_{16}$. It is decomposed, after the analogy of sinigrin (potassium myronate), into *acrinyl sulphocyanate*, C_7H_7OCNS , *sinapine bisulphate*, $C_{16}H_{25}NSO_9$, and sugar, $C_6H_{12}O_6$, an albuminoid

substance being formed at the same time. "The acrinyl sulphocyanate (C₇H₇OCNS) is a very active principle, oily, insoluble in water, not volatile. It may be obtained by causing ether to act on the product of the decomposition of sinalbin. Treated by an alkali and then neutralized by an acid, it colors ferric chloride red." (*J. P. C.*, Avril, 1872, 327.)

The analyses of mustard seeds and mustard flour given in the table below, are by Piesse and Stansell. (*Analyst*, 1880, p. 161.),1

1 Analyses of Mustard.	White Mustard, whole seeds.		White Mustard, ground.		Brown Mustard, whole seeds.	Brown Mustard ground.	
	Yorkshire.	Cambridge.	Superfine.	Fine.	Cambridge.	Superfine.	Fine.
Moisture.....	9.32	8.00	6.30	5.78	8.52	4.35	4.52
Fatty oil.....	25.56	27.51	37.18	35.74	25.54	36.96	38.02
Cellulose.....	10.52	8.87	3.90	4.15	9.01	3.09	2.06
Sulphur.....	0.99	0.93	1.33	1.22	1.28	1.50	1.48
Nitrogen.....	4.54	4.49	5.05	4.89	4.38	4.94	5.01
Albuminoids.....	28.37	28.06	31.56	30.56	26.50	29.81	30.25
Myrosin and albumin.....	5.24	4.58	7.32	6.67	5.214	6.46	6.78
Soluble matter.....	27.38	26.29	36.31	36.60	24.22	31.14	32.78
Volatile oil.....	0.06	0.08	0.03	0.04	0.047	1.437	1.50
Potassium myronate.....	.....	.....	.....	.....	1.692	5.141	5.366
Ash.....	4.57	4.70	4.22	4.31	4.98	5.04	4.84

According to F. W. Widmayer (*D. C.*, 1904, 8), the oil from yellow seed is of a greenish-yellow color, that of the brown seed a much darker shade. Both have but little odor and a mild, not unpleasant taste. Mustard seed oil is a semi-drying oil. The analytical data showing maximum and minimum results by M. L. Tolman and L. S. Munson on five samples are as follows: Specific gravity at 15.5° C. (59.9° F.), 0.9147 to 0.9193; Butyrorefractometer reading (15.5° C. (59.9° F.)), 74.5 to 76.5; Index of refraction at 15.5° C. (59.9° F.), 1.4750 to 1.4762; Maumene number 61.4 to 79.4; Specific temperature reaction 130.9 to 190.3; Hubl number, 98.4 to 113.0; Saponification value, 173 to 182.8; Melting point of fatty acids, 20.8 to 21.5° C. 69.4 - 70.7° F.); Free fatty acids oleie, 0.13 to 1.13 per cent.; Solidification from -8° to -18° C. (17.6° to -0.4° F.). One remarkable feature of this oil is its penetrating or diffusing power. Barrels that will hold olive, cotton seed, or petroleum, oil or even new oil or alcohol barrels invariably leak on being filled with it, and it is said by one who has had extensive experience in the mustard business that it has been known to come through -a tank which had stood a pressure of 80 pounds of steam. (*D. C.*, 1904,8.)

J. U. Lloyd has proposed standards for black and white mustard seed, mainly directed towards limiting the proportion of starch; the latter is not a constituent of ripe mustard seed, but commercial mustard nearly

always contains starch, due to starch-bearing seeds accidentally present in the mustard seed, or to fraudulent admixture. (A. J. P., 1898, 433.) Dieterich (*Ph. Ztg.*, Oct. 3, 1900, 767) proposed an assay for mustard seed, mustard oil and mustard paper.

Uses.—Mustard seeds swallowed whole operate as a laxative, and have acquired some reputation as a remedy in *dyspepsia*, and in other affections attended with torpid bowels and deficient excitement. The white seeds are preferred, and are taken in the dose of a tablespoonful (15.5 Gm.) once or twice a day, mixed with molasses, or previously softened and rendered mucilaginous by immersion in hot water. They probably act in some measure by mechanically stimulating the bowels. The powder, commonly called simply mustard, in the quantity of from one to two teaspoonfuls (3.9-7.7 Gm.), is an efficient and prompt—although unpleasant—stimulant emetic, especially valuable in *narcotic poisoning*. As a condiment mustard acts as a stimulant to the gastric mucous membrane, increasing according to Gottlieb (*A. E. P. P.*, 1894, xxxiii, 261), also the pancreatic secretion. By virtue of this stimulant action it will sometimes relieve obstinate *hiccough*.

But mustard is most valuable as a rubefacient. Mixed with water in the form of a cataplasm, and applied to the skin, it very soon produces redness with burning pain, which in less than an hour usually becomes insupportable. When a speedy impression is not desired, especially when the sinapism is applied to the extremities, the powder should be diluted with an equal, or double, portion of wheat flour. Care should be taken not to allow the application to continue too long, as vesication with obstinate ulceration, and even sphacelus, may result. This caution is particularly necessary when the patient is insensible and the degree of pain can afford no criterion of the sufficiency of the action. In making a mustard plaster the admixture of alcohol, vinegar, or other fluid than water, should be avoided as hindering the development of the volatile oil. The volatile oil is powerfully rubefacient, and capable of producing speedy vesication, but certainly is less controllable than is

the mustard poultice. For external application as a rubefacient, 10 to 20 drops of the oil may be dissolved in a fluidounce of alcohol, or 6 or 8 drops in a fluidrachm of almond or olive oil. (See *Linimentum Sinapis Compositum*, N. F.) To form a sinapism it has been recommended to mix 20 drops of the volatile oil with a gelatinous mass made by heating together 3.5 drachms of glycerin and 5 drachms of starch. Lebaigue

proposes applying to one sheet of paper a concentrated solution of *potassium myronate*, and to a second a concentrated solution of *myrosin*, and drying them. When used, the leaves are to be moistened and placed to the surface, one over the other. Volatile oil of mustard is formed by the reaction of the two principles, and a sinapism is obtained. (*J. P. C.*, Aout, 1868, p. 118.) The volatile oil of mustard has been given internally in *colic*, two drops being incorporated with a six-ounce mixture, and half a fluidounce (15 mls) given for a dose. In overdoses it is highly poisonous, producing gastro-enteric inflammation, and probably perverting the vital processes by pervading the whole system. Its odor is perceptible in the blood, and is said to impart the smell of horse-radish to the urine. A *spirit of mustard* may be prepared by macerating, for two hours, 250 parts of powdered black mustard with 500 parts of cold water, then adding 120 parts of alcohol of 86 per cent., and distilling over 120 parts of spirit.

Dose, of mustard aeed, one to two drachms (3.9-7.7 Gm.).

Off. Prep.—Emplastrum Sinapis, U. S.

Sisymbrium. *Sisymbrium officinale* (L.) Scop. *Hedge Mustard. Herbe aux chantres, Tortelle*, Fr. *Wildersenf, Hederich*, G. (Fam. *Cruciferae*).—This annual, growing in Europe and in waste grounds in the United States, is said to be diuretic and expectorant, and has been recommended in chronic *coughs, hoarseness, and ulceration* of the mouth and fauces. The juice of the plant may be used mixed with honey or sugar, or the seeds may be taken in substance. *Sisymbrium Sophia* L., or the *flax weed*, a plant which grows sparingly in waste places in the United States, was formerly official. It is of a pungent odor when rubbed, and of an acrid, biting taste. W. Zopf attributes its poisonous qualities to a volatile alkaloid. (*Zeit. f. Nat. Pharm. Central*, 1894, 494.) The herb has been used externally in *indolent ulcers* and the seeds internally in *worms, calculous complaints, etc.* *Diploaxis muralis* DC., (*S. Murale* L.), a plant growing about Atlantic ports, has been used in France in *scurvy, scrofula*, and other cachetic affections, especially associated, in the form of a syrup, with potassium iodide. (*Ann Ther.*, 1863, 126.) Grazing sheep are said to be killed in Southern France by feeding on *Diploaxis tenuifolia* DC., and human poisoning has occurred. This species is also sparingly localized like *D. muralis*. George Heyl has separated a toxic and apparently uncrystallizable alkaloid. (*Ap. Ztg.*, May 30, 1900.)

Sium.—*Sium cicutaefolium* Schrank (fam. *Umbelliferae*), which grows in British America and the United States, particularly along the water courses of the valleys of the Pacific slope, and is the hemlock water parsnip of this country, is positively asserted to be poisonous. A. R. Porter and N. Rogers (*A. J. P.*, 1876, 348, 483) found in it an active resinous body, toxic to animals. Oil of *Sium cicutaefolium* is stated by Rabak to be found in the plant in the proportion of 0.5 per cent. It is yellow and has

an odor resembling that of caraway. (*Mid-Druggist*, 1905, 5.) *S. Sisarum* L., or *skirret*, a plant of Chinese origin, cultivated in Europe, has a sweetish, somewhat aromatic root. The latter is used in much the same manner as the oyster plant and parsnip. It is supposed to be a useful diet in chest complaints.

Skimmia. *Skimmia japonica* Thumb. *Miramashikimi*. (Fam. *Rutaceae*).—From this dwarf-growing holly-like shrub, which is cultivated on account of its dark, shining, evergreen leaves and clusters of bright-red berries, Eykman separated a glucoside, *skimmin*, and a decomposition product, *skimmetin*. (*Abhandl. d. Tokyo Diagaku*, No. 10, Tokyo, 1883.) J. Honda (*A. E. P. P.*, Oct., 1904), however, finds that the activity of the plant depends upon the presence of the crystalline alkaloid, *skimmianine*. It is a muscle poison, producing no primary excitement in the muscle, but an increasing paralysis, the influence of the alkaloid extending to involuntary muscles, such as the heart, so that in mammals arterial pressure is progressively decreased.

Soja. *Glycine hispida* Maxim. (*Soja hispida* Moench.) *Soy Bean*. *Soja* or *Sahuca Bean*. *Miso*. (Fam. *Leguminosae*).—Soja is an important food plant and forage crop. It is an annual having hairy, trifoliate leaves, inconspicuous, violet-colored flowers, and forms broad legumes containing 2 to 5 seeds. The latter are compressed, spherical and vary from brownish-green to brownish-black. Meissel and Bocker (*A. J. P.*, 1885, 108) give the composition of soja bean as follows: water, 10 per cent.; soluble casein, 30; albumen, 0.5; insoluble casein, 7; fat, 18; cholesterin, etc., 2; dextrin, 10; starch, 5; cellulose, 5; ash, 5; traces of sugar and an amido compound. Stingi and Morawski (*Monatsschrift fur Chemie*, April, 1886) have determined the presence in this bean of a ferment said to be one of the most powerful known in its action upon starch, two-thirds of which it converts into sugar and one-third into dextrin. Soja bean has been suggested as a diabetic food, but it contains upwards of 25 per cent. of carbohydrates.

Solanum.—The genus *Solanum* contains a number of species which are possessed of active physiological properties and some of which have been used to a considerable extent in medicine.

S. carolinense L. *Horse Nettle*. *Sand Brier*. *Poisonous Potato*. *Apple of Sodom*.—Under the name of *Solanum* the N. F. IV has made the berries of *S. carolinense* official and has introduced fluid-extract of solanum made with a menstruum of two volumes of alcohol and one volume of water.

"The air-dried ripe fruit of *Solanum, carolinense* Linne (fam. *Solanaceae*)." N. F. IV.

"Globose, slightly depressed, somewhat shriveled and wrinkled in drying, from 0.8 to 2 cm. in diameter, orange-yellow, glabrous, fleshy, two-celled, many-seeded, calyx and pedicel usually persistent; calyx stellate pubescent, deeply five-lobed, the lobes ovate or ovate-lanceolate, acuminate and enclosing half or more of the berry; seeds orbicular, flat, yellow, smooth, shining. Odor pepper-like; taste bitter and acrid.

"Solanum yields not more than 6 per cent. of ash." N. F. IV.

This is a coarse perennial weed growing in waste sandy ground in the United States as far west as Iowa and as far south as Florida, and yields an orange-yellow berry which is said to be the most active part of the plant. For study of microscopic structure, see *A. J. P.*, vol. lxxix. It has been examined by G. A. Krauss (*A. J. P.*, 1890, 601, and 1891, 65 and 216) and Harry Kahn (*A. J. P.*, 1891, 126). Krauss found two active principles corresponding probably to *solanine*, $C_{42}H_{75}NO_{15}$, and *solanidine*, $C_{41}H_{71}NO_2$, together with a characteristic organic acid to which he gives the name *solanic acid*. J. U. Lloyd believes that the alkaloid in this plant is not identical with solanine, and proposes to call it *solnine*. (*A. J. P.*, 1894, 61, and 1897, 76, 89, 108.) E. Q. Thornton (*T. G.*; xii, 1896) finds that in frogs this solanum produces stupor with tetanic spasms, not prevented by section of the cord. It is said to have long been used by the negroes of the South in the treatment of the so-called falling sickness, and in 1889 it was recommended by J. L. Napier as of value in epilepsy. H. C. Wood has found that, although when given by itself its usefulness is very limited, as an adjuvant to the bromides it lessens the size of the doses necessary to keep the convulsions in check. Not less than a fluidrachm (3.75 mils) of the fluidextract should be given three times a day. No unpleasant effects have been produced by it. The N. F. recognizes a fluidextract.

S. aculeatissimum Jacq., known as *Apple of Sodom*, is indigenous to Brazil; the fruit yields traces of *solanine*.

S. bacciferum ?), of Jamaica, yields the so-called *Susumber berries*, which are habitually used as fruit by the natives, but Manners has recorded in the *Ed. M. J.*, 1867, fatal poisoning by these berries, death being preceded by dilated pupils and collapse. It is probable, however, that the berries were not true susumber berries but were the product of some other species of solanum.

S. Chenopodium, F. Muell.—In this plant, which is a native of Queensland, C. E. Sage has found the alkaloid *solanine*. According to E. B. Ormerod the plant is useful in the treatment of *dysentery*. (*P. J.*, lxxviii, 1902.)

Under the English title *Bittersweet* the N. F. IV recognizes "The dried stems and branches of *Solanum Dulcamara* Linne (Fam. *Solanaceae*)." N. F. The Latin title is *Dulcamara*, the synonyms *Stipites Dulcamarae*, *Tiges de Douceamere (de Morelle grimpante)*, *Douce amere*, Fr. *Bittersuss*, *Bittersuss-Stengel*, *Alpranken*, G. *Dulcamara*. *Dulcamara* is a climbing shrub with a woody branching stem and purplish, cymose flowers, with lemon-yellow anthers. The bright scarlet berries remain after the falling of the leaves. The plant grows in wet places and around dwellings and is common to Europe and North America, and in the United States grows from New England to Ohio. All portions of the plant are very active. Fatal results from the eating of the berries by a child have been recorded. (*P. J.*, 1861.) For medicinal purposes the plant should be gathered in the autumn after the fall of the leaf, and the extreme twigs should be selected. That grown in high and dry situations is said to be the best.

It is described in the N. F. as "In short sections about 5 mm. or less in thickness, cylindraceous, somewhat angular, longitudinally striate, more or less warty, usually

hollow in the center; bark thin, externally pale greenish, or light greenish-brown, glabrous, marked with alternate leaf scars, internally green, the greenish or yellowish wood occurring in one or two concentric rings. Odor slight; taste bitter, afterwards sweet.

"The powder is greenish-yellow and, when examined under the microscope, exhibits tracheae up to 0.05 mm. in diameter and with bordered pores; lignified wood fibers with few pores; non-lignified bast fibers with walls up to 0.02 mm. in thickness; fragments of cork cells; few, simple, unicellular hairs up to 0.8 mm. in length, and with the lumina distinct in the lower portions only; few starch grains, spheroidal, up to 0.012 mm. in diameter; sphenoidal crystals of calcium oxalate numerous, up to 0.007 mm. in length.

" Bittersweet yields not more than 6 per cent. of ash." y. F. IV.

The dried twigs are inodorous, though the stalk in the recent state emits, when bruised, a peculiar, rather nauseous odor. Their taste, which is at first bitter and afterwards sweetish, have given origin to the name of the plant.

Boiling water extracts all their virtues. These are supposed to depend, at least in part, upon the alkaloid *solanine*. Wittstein (1852) supposed another alkaloid, *dulcamarine*, to be present, but Geissler (1875) showed that this substance was a glueoside, and not an alkaloid, yielding on decomposition with dilute acids *dulcamaretin* and sugar. He assigned the formula $C_{22}H_{34}O_{10}$ to dulcamarine, and $C_{16}H_{26}O_6$ to dulcamaretin. (Fluckiger, *Pharmacopgraphia*, 2d ed., p. 451.) Besides solanine, the stalks of *S. Dulcamara* contain, according to Pfaff, a peculiar principle to which he gave the name of *picroglycion*, indicative of the taste, at once bitter and sweet, which it is said to possess. This was obtained by Blitz, in the following manner: The aqueous extract was treated with alcohol, the tincture evaporated, the residue dissolved in water, the solution precipitated with lead subacetate, the excess of this salt-decomposed by hydrogen sulphide, the liquor then evaporated to dryness, and the residue treated with acetic ether, which yielded the principle in small isolated crystals by spontaneous evaporation. Frederick Davis (*Y. B. P.*, 1902) found the two alkaloids, solanine and solanidine, the glucoside solanein, and the bitter principle dulcamarin, in fresh specimens of the plant.

Dulcamara possesses feeble narcotic properties, with the power of increasing the secretions, particularly those of the kidneys and skin. George B. Wood observed, when the system was under its influence, a dark purplish color of the face and hands, and at the same time considerable languor of the circulation. In overdoses it produces nausea, vomiting, faintness, vertigo, and convulsive muscular movements. (*London Med. Gaz.*, 1850.)

Anaphrodisiac properties have been attributed to *dulcamara*, and it has also been employed with alleged benefit in chronic *rheumatism*. But its chief use has been in the treatment of scaly cutaneous eruptions, such as *lepra*, *psoriasis*, and *pityriasis*. A fluidextract is official in the N. F. *Dulcamara* may be given in doses of from thirty

grains to a drachm. (2-3.9 Gm.).

D. Freire has obtained from the fruit of *S. grandiflorum*, or wolf fruit, of Brazil, a toxic alkaloid, *grandiflorine*. (*C. R. A. S.*, cv.)

S. Jacquinii Willd. is used in India as a diaphoretic and expectorant.

S. Lycopersicum L. *Tomato Plant* (formerly termed the *Love Apple*).—The tomato is believed by many practitioners to be an injurious article of diet to gouty persons on account of the great acidity of the juice, an acidity which T. D. McElhenie has demonstrated to be due at least in part to citric, malic, and oxalic acids. (*A. J. P.*, 1872.) Solanine is said not to be present in the juice but has been found by George W. Kennedy (*P. J.*, 1873) in the herbaceous part of the plant. It probably also exists in the seeds. (*A. J. P.*, xxxiv.)

S. nigrum L. *Black, or Garden, or Common Nightshade. Duscle. Hound's Berry. Morelle*.—Tills is a simple leaved annual plant, growing widely in shaded and rich open ground throughout the United States. The leaves have been used in medicine in the treatment of *scrofulous dyscrasias*, and are said to produce diaphoresis when in overdose; also nausea, purging, and nervous disturbance. The poisonous properties commonly attributed to this plant are, however, to be doubted, since Dunal of Montpellier, states, as the result of numerous experiments, that the berries are not poisonous to man or the inferior animals; and the leaves are said to be consumed in large quantities in the Isles of France and Bourbon and in the Hawaiian Islands by the natives as food, having been previously boiled in water. In the latter case the active principle of the plant may have been extracted by decoction. Introduced by importers under the name of juruteba, this plant was examined by Kobert and found to be inert. According to Peckoldt, however (*Ph. Rund.*, 1889), true jurubeba is *Solanum insidiosum* Mart., from which the results would have been more favorable. It is used in Brazil in *gonorrhoea* and *syphilis*.

S. Pseudocapsicum L., or *Jerusalem or Winter Cherry*, a plant cultivated for greenhouse or house decoration when covered with its bright colored berries, yields a fruit whose resemblance to the common cherry is said to have led to its being eaten by children with fatal results.

S. rostratum Dunal. *Sand Bur. Buffalo Bur. Beaked Nightshade. Bull Nettle*.—This very prickly plant, which grows on the prairies from Nebraska to Mexico, and is noteworthy as having been the original food of the Colorado beetle or potato bug, has yielded to W. S. Amos an alkaloid. (*Notes on N. R.*, iv.)

Narcotic properties have been attributed to the leaves, stalks and unripe berries of *S. tuberosum* L., or common white potato, and the extract has been used in various diseases. Worsham, of Philadelphia, found the extract, in the quantity of nearly one hundred grains, to cause no sensible effect. (*Phila. Journ. of the Med. and Phys. Sciences*, vi, 22.)

A case is recorded of death in a girl of fourteen, from eating the unripe fruit of the

potato. (*B. M. J.*, Sept. 3, 1859.) The prominent symptoms were partial stupor, speechlessness, jactitation, hurried breathing, lividness of the skin, cold sweats, very frequent and feeble pulse, and a constant spitting through the closed teeth of viscid frothy phlegm.

It is probable that the properties of the plant vary with the stage of growth, or with the place and circumstances of culture. C. Haaf found solanine in old potatoes which had begun to germinate, in the proportion of 0.16 in 500 parts, and in very young potatoes, deprived of their coating, precisely the same quantity. Fully ripe potatoes, which had not begun to sprout, gave a negative result. (*N. R. Pharm.*, 1864, p. 559.) Solanine has also been found in the germs of potatoes by Schmiedeberg. (*A. E. P. P.*, 1899, xxxvi, 361.)

Solidago. *Goldenrod. Verge d'Or*, Fr. *Gold-ruthe*, G.—There are very numerous species of this composite genus in the United States. Of these *S. odora* Ait., or the *Sweet Golden-rod*, was formerly official. *S. Virgaurea* L. [now *S. Raudii* (Porter) Britton], which occurs on dry or granitic soil in the northern United States and Europe, was formerly directed by the Dublin College. It is aromatic, astringent, in hot infusion diaphoretic, and is asserted to be diuretic. (*Rev. Gen. de Clin. et de Therap.*, 1889.) For a study of the flowers of *S. bicolor* L., by Adam Conrath, see *A. J. P.*, 1873, 253. For an analysis of *S. rugosa* Mill., see *A. J. P.*, 1893, 122.

Sonchus. *Sonchusoleraceus* L. *Common Sow Thistle*. (Fam. *Compositae*.)—A coarse weed, having runcinate-pinnatifid leaves clasping by a heart-shaped base and producing corymbs of pale yellow flowers in summer and autumn. This European plant is commonly found in waste places around dwellings in the United States. The brownish gum left after the evaporation of the juice of this plant is said to be a powerful hydragogue cathartic, in doses of from two to four grains (0.13-0.26Gm.). Combined with aromatics or belladonna, it may be used instead of elaterium in *dropsy*. (*Med. Bull.*, July, 1888.) It has also been used as a so-called cure for the opium habit. (*Pac. Pharm.*, 1908, 113.)

Sophora. *S. speciosa* Benth. *Coral Bean*,— From the poisonous seeds of this leguminous Texan tree, H. C. Wood obtained a volatile liquid alkaloid (*sophorine*) whose chloride is crystalline (see *A. J. P.*, 1878), and which, according to P. O. Plugge, is identical with cytisine. This same alkaloid probably exists in many species of the genus, as Parsons found a liquid alkaloid in *S. sericea* Nutt., *crazy-weed*, which grows in Colorado and Mexico (*Rep. Commissioner of Agricult.*; 1879, and *N. R.*, 1881, 67; see also Kalteyer and Neill, *A. J. P.*, 1866, 465), and Greshoff (*P. J.*, xxii). The latter found a poisonous alkaloid in the leaves of *S. tomentosa* L., the seeds and roots of which are used in Ceylon and Java as a remedy for cholera. Plugge, however (*A. Pharm.*, 1895), affirms that *matrine*, the alkaloid discovered by Nagai in *S. angustifolia*, is distinct from cytisine.

Sorbus. *Sorbus Aucuparia* L. (Now *Pyrus Aucuparia* (L.) Erhr.) *Mountain Ash. Rowan Tree. Sorbes*, Fr. *Eberesche, Vogelbeere*, G. (Fam. *Rosaceae*.)—A small European tree extensively cultivated in the United States and becoming naturalized.

Its fruit contains a peculiar kind of sugar called *sorbinose*, $C_6H_{12}O_6$, isomeric with levulose. It reduces Fehling's solution, but is not fermentable with yeast. Hofmann has also discovered two news acids, which he designates as *sorbic* and *parasorbic acids*, $C_6H_8O_2$. Sorbic acid forms colorless needle-like crystals fusing at $134.5^\circ C$. ($274^\circ F.$), while parasorbic acid is a lactone-like body, which, on heating with concentrated acids or solid alkali, changes into sorbic acid. M. J. Boussingault has found in it a crystalline saccharine principle, *sorbitol*, isomeric with mannitol, melting, when anhydrous, at from 110° to $111^\circ C$. (230° - $231.8^\circ F.$), when hydrated, at $102^\circ C$. ($215.6^\circ F.$). Its formula is $C_6H_{14}O_6$. It does not undergo the vinous fermentation. (*P. J.*, 1872, 28.) The seeds of the fruit contain 22 per cent. of fixed oil. The fruit has been used in *scurvy*, and in infusion, as a remedy in *hemorrhoids* and *strangury*. All parts of the tree are astringent, and may be employed in tanning and dyeing black. *S. americana* Marsh, (now *Pyrus americana* (Marsh.) DC.), or *American Mountain Ash*, probably has similar virtues to the European species. Edwin Johanson found the fruit to yield from 4.92 to 6.6 per cent. of malic acid. (*Ph. Z. R.*, i, 1882.)

Sorghum.—A cane-like plant resembling Indian corn, from which it is distinguished by producing large heads of small grains. There are a number of varieties and these are usually distinguished as "saccharine" sorghums and "non-saccharine" sorghums. The former contain a sugary sap and are referred to *Andropogonarundinaceus* var. *saccharatus*. The latter are commonly known as *broom corn* or *Kaffir corn* and are varieties of *A. arundinaceus* var. *Durrha*. The saccharine sorghums are cultivated in the United States to some extent as a forage crop. They are not used in the manufacture of sugar, owing to the difficulty of effecting its crystallization. Broom corn has been cultivated in the United States since 1798 and is especially adapted to the manufacturer of brooms and brushes. In some of the semi-arid districts of the West it is reported that cattle have been poisoned from eating of the green sorghum, usually of a second growth. This is apparently due to the production of hydrocyanic acid in the leaves.

Spartium. *Spartium junceum* L. *Spanish Broom*. (Fam. *Leguminosae*.) —A small shrub, indigenous in the south of Europe, and cultivated in our gardens as an ornamental plant. The flowers are large, yellow, and of an agreeable odor. Spanish broom, in its medicinal properties closely resembles *Scoparius*, but appears to be from five to six times more active, 6 Gm. of the dried plant, given in infusion, having produced very violent poisoning; serious results have been produced by the substitution of the Spanish for the *true broom*. The dried flowers are readily differentiated, those of the true broom having a small, bell-shaped calyx with two unequal lobes, the upper of which is bidentate, the lower minutely tridentate, and the style always rolled, while in *Spartium junceum* the calyx is deeply cleft to the base on one side only, and the style is deeply rolled.

The symptoms produced by overdoses are vomiting and purging, with renal irritation. The seeds have been used to a considerable extent in *dropsy* in doses of from ten to fifteen grains (0.65-1.0 Gm.) three times a day in the form of tincture.

Sphaeranthus. *Sphaeranthus indicus* L. (Fam. *Compositae*.)—An herbaceous plant

having winged stems and widely distributed in Africa, Asia and Australia. It is used as a general tonic, deobstruent, alterative, and aphrodisiac, under the names of *Mundi Gorakmundi*, *Murmuria*, and *Kottakkarandai*. Dymock has found it in a deep cherry-colored essential oil.

SPIGELIA. U. S.

SPIGELIA [Pinkroot]

"The dried rhizome and roots of *Spigelia marilandica* Linne (Fam. *Loganiaceae*), without the presence or admixture of more than 10 per cent. of stems or other foreign matter." *U. S.*

Maryland, Carolina or Indian Pink, Worm-grass, Worm-weed, American worm-root. Star-bloom; Spigelie du Maryland, *Fr.*; Marylandische Spigelie, Spigelie, *G.*; Spigelia, *It.*

Two species of *spigelia* have attracted attention as anthelmintics—*S. Anthelmia* L., of South America and the West Indies, and *S. marilandica* L. of this country. *Spigelia Anthelmia* L., of South America is an annual plant, from one or two feet in height, with thin, shortly petioled leaves, those of the lower stem being lanceolate, those above varying from very broadly lanceolate to ovate, with a distinct tendency to a rhomboidal outline and attaining a length of over four inches. It is much used as an anthelmintic in its native country, and its rhizome is said to have appeared in the European markets. The only specimens which we have seen, however, have been the whole dried plant, of which the attached rhizomes are much smaller and the rootlets much finer than in the North American species. It is affirmed that in overdoses this rhizome is a powerful poison, which has caused death not only in the domestic animal but also in man.

The Carolina pink (*Spigelia marilandica*) is an herbaceous perennial plant. The stems, several of which rise from the same rhizome, are simple, erect, four-sided, nearly smooth, and from twelve to twenty inches high. The leaves are opposite, sessile, ovate-lanceolate, acuminate, entire, and smooth, with the veins and margins slightly pubescent. Each stem terminates in a one-sided spike, and supports from four to twelve flowers with very short peduncles. The calyx is persistent, with five long, subulate, slightly serrate leaves, reflexed in the ripe fruit. The corolla is funnel-shaped, and much longer than the calyx, with the tube inflated in the middle, and the border divided into

five acute, spreading segments. It is of a rich carmine color externally, paler at the base, and orange-yellow within. The edges of the segments are slightly tinged with green. The stamens, though apparently very short, and inserted into the upper part of the tube between the segments, may be traced down its internal surface to the base. The anthers are oblong, heart-shaped; the ovary superior, ovate; the style about the length of the corolla, and terminating in a linear fringed stigma projecting considerably beyond it. The capsule is double, consisting of two cohering, globular, one-celled portions, with many seeds.

The plant is a native of our Southern and Southwestern States, being seldom found north of the Potomac. It grows in rich soils on the borders of woods, and flowers from May to July. The rhizome and roots are the only portions recognized in the Pharmacopoeias. The drug was formerly collected in Georgia and the neighboring States by the Creek and Cherokee Indians, who disposed of it to the white traders. After the emigration of the Indians, the supply of spigelia from this source very much diminished, and at one time it nearly if not quite ceased. But a new source of supply was opened from the Western and Southwestern States, and it is now again obtainable. The commercial supplies being so restricted, some attention has been given to the cultivation of the plant. The Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C., has grown spigelia under shade, and Miss Henkel states that it is readily cultivated in Georgia. (*D. C.*, lvi, p. 132.)

No drug has had a commercial history like spigelia. For twenty years or more it was largely substituted by *Ruellia ciliosa* Pursh. Sanders reported examining 57 samples of pink-root which were obtained from various sections of the country and none were genuine. (*Jour. A. Ph. A.*, 1912, p. 502.) To Prof. Greenish (*A. J. P.*, 1891, p. 226) belongs the credit for the first pharmacognostic description of this common substitute, although he incorrectly attributed it to *Phlox Carolina* L. (*P. ovata* L.). He pointed out that it was distinguished by the fact that it contained stone cells and cystoliths of calcium carbonate. Greenish's work was confirmed by Holm (*A. J. P.*, 1906, p. 553) and by Stockberger (*Ph. Rev.*, 1907, p. 2). His false identification continued in literature for several years, probably owing to the statements of the large drug houses which make a specialty of collecting American drugs. (*Proc. A. Ph. A.*, 1909, p. 1171.) The presence of *Phlox ovata* L. in commercial lots of spigelia has not been confirmed, and Kraemer illustrates the

pharmacognosy of the rhizome and roots of this drug in *A. J. P.*, 1910, p. 470. Moser, however, affirms that *Phlox ovata* and *P. glaberrima* L. are frequently collected and sold as spigelia. (*A. J. P.*, 1909, p. 576.) Among some of the adulterants which have been identified are the rhizomes of goldenseal and caulophyllum, although a large variety of rhizomes are no doubt more or less intermixed.

Properties.—Pinkroot is officially described as " rhizome horizontal or slightly oblique, more or less flexuous, somewhat branched, from 1.5 to 5 cm. in length and from 2 to 5 mm. in diameter; externally dark brown, slightly annulate, with scars of bud scales, the upper surface knotty from approximate stem-bases, bearing cup-shaped scars; from the lower and lateral portions arise numerous, long, rather coarse, sparingly branched, brittle roots; fracture short, internally differentiated into three nearly equal zones of pith, wood and bark; odor slightly aromatic; taste bitter, pungent. Few if any of the roots exhibit thin, terminal portions with the bark stripped from the slender strands of wood. Stems usually attached to the upper portion of the rhizome, nearly cylindrical, attaining a length of 6 cm. and a diameter of 3 mm., light grayish-brown to purplish-brown, nodes annulate, marked by opposite leaf-scars. Under the microscope, transverse sections of the rhizome of *Spigelia* show a dark brown, more or less exfoliated epidermal layer; a cortex composed of from 10 to 15 rows of starch-bearing parenchyma; a distinct zone of sieve tissue from 0.075 to 0.15 mm. in width; a compact woody area composed of tracheae and tracheids which are hardly distinguishable from each other, both kinds of vessels being marked with bordered pores; an internal sieve closely resembling the sieve in the bark; and a pith composed of fairly uniform, nearly polygonal, thin-walled cells, more or less filled with small starch grains. Transverse sections of the root show a large cortex, the cells of which are more or less filled with small starch grains and a central stele of 6 or 8 radial fibro-vascular bundles, which in the older roots are united by a strong development of lignified cells. The stem in transverse section is distinguished from the rhizome by a narrower woody zone, the tracheae having spiral thickenings, and by a nearly uninterrupted circle of non-lignified bast-fibers in the bark. The powder is grayish-brown; when examined under the microscope it exhibits starch grains generally numerous, at times, however, few, spherical or slightly angular, from 0.002 to 0.006 mm. in diameter; fragments of lignified tracheae and tracheids conspicuous ; fragments of tracheae with spiral thickening relatively few; bast-fibers few, very long, non-lignified; occasional

fragments of the reddish-brown epidermal cells. *Spigelia* yields not more than 10 per cent. of ash." *U. S.*

The virtues of *spig'elia* are extracted by boiling water. The root, analyzed by Feneulle, yielded a fixed and volatile oil, a small quantity of resin, a bitter substance supposed to be the active principle, a mucilaginous saccharine matter, albumen, gallic acid, the malates of potassium and calcium, etc., and woody fiber. The principle upon which the virtues of the root are thought to depend is brown, of a bitter nauseous taste, like that of the purgative matter of the leguminous plants, and when taken internally produces vertigo and a kind of intoxication. An analysis of the root by R. H. Stabler yielded as results a bitter uncrystallizable principle upon which the virtues of the medicine are supposed to depend, a little volatile oil, tannic acid, inert extractive, wax, resin, lignin, and salts of sodium, potassium, and calcium.

The active principle is a volatile alkaloid discovered by W. L. Dudley (*Am. Chem.*, vol. i, p. 150), who, on the contrary, found that the active principle of *spigelia* is a volatile alkaloid. He made it by distilling the ground root with milk of lime over a paraffin bath, and collecting the distillate in hydrochloric acid. After evaporation to dryness, the residue is taken up with alcohol and crystallized out of solution. He compared the reactions of this alkaloid, which he called *spigeline*, with those of nicotine, coniine, and lobeline. *Spigeline* yields a brownish-red precipitate with a solution of iodine in potassium iodide, a white crystalline precipitate with potassio-mercuric iodide, and a white flocculent precipitate with meta-tungstic acid. Boorsma (*P. J.*, 1898, 89) found 0.0005 Gm. of *spigeline* to be lethal to guinea pigs.

Uses.—The activity of *spigelia* is somewhat diminished by time. *Spigelia* is generally considered among the most powerful anthelmintics, especially esteemed against the *round-worm*. In the ordinary dose it usually produces little sensible effect on the system; more largely given it acts as a cathartic, though unequal and uncertain in its operation; in overdoses it is said to cause vertigo, dimness of vision, dilated pupils, spasms of the facial muscles and of the eye-lids, and even general convulsions. The death of two children who expired in convulsions was attributed to it by Chalmers. H. A. Hare (*Med. News*, March, 1887) has found that in the lower animals it produces symptoms similar to those just described, namely, dilatation of the pupil, exophthalmia, strabismus, progressive muscular weakness of spinal origin, cardiac

depression, and death from failure of respiration. The narcotic effects are said to be less likely to occur when the medicine purges, and to be altogether obviated by combining it with cathartics. The danger from its employment cannot be great, as it is in very general use in the United States, in both regular and domestic practice, and we never hear at present of serious consequences. Its effects upon the nervous system have been erroneously conjectured to depend on other roots sometimes mixed with the genuine. The vermifuge properties of spigelia, first learned from the Cherokee Indians, were made known to the medical profession by Lining, Garden, and Chalmers, of South Carolina.

It may be given in substance or infusion, or as the fluidextract. The infusion may be made by macerating half a troyounce of the root in a pint of boiling water. It is usually combined with senna or some other cathartic, to insure its action on the bowels. A preparation much sold under the name of *worm tea* consists of spigelia, senna, manna, and savin, mixed together, in various proportions, to suit the views of different individuals.

Dose, of the powdered root, for an adult, one or two drachms (3.9-7.7 Gm.), to be repeated morning and evening for several days successively, and then followed by a brisk cathartic.

Off. Prep.—Fluidextractum Spigeliae, *U. S.*

Spilanthus. *Spilanthus Acmella* Murr. (*S. oleracea* L.) *Para Cress. Cresson de Para, Fr. Parakresse, G.* (Fam. *Compositae*.)—A plant of India, used as a masticatory for *toothache*; when chewed it produces a copious salivation. (*A. J. P.*, xlv, 323.)

Spiraea.—Many if not all of the species of this genus contain a colorless volatile oil, very similar to the oil of gaultheria, but composed mainly of salicylic aldehyde, with only smaller amounts of methyl salicylate. The species which have been submitted to actual analysis are the *Spiraea Ulmaria* L. (*Filipendula Ulmaria* (L.) Maxim.), commonly known as *Queen of the Meadow*, or *Meadow-sweet*—a European plant which has been introduced into this country; also the European species *S. lobata* Jacq. and the species *S. Filipendula* L. (*Filipendula vulgaris* Moench.), which grows in Southern Europe and Northern Africa. A yellow, crystalline powder of a bitter taste, insoluble in water, slightly so in alcohol, readily soluble in ether, and having an acid reaction. *Spiraeic acid* (now recognized as salicylic acid) (*J. Pr. Chem.*, xix) was separated from the flowers of *S. Ulmaria* by Lowig and Weidmann, and has been found by Rochebrune in the flowers of *S. Filipendula* L.

The roots of probably most of the species contain tannic acid, gallic acid, and when fresh some of the volatile oils. (*A. J. P.*, 1887.) The root of *Spiraea tomentosa* L.

(*Hardback, Steeplebush, or Whitecap*), was formerly recognized in the U. S. Pharmacopoeia. It is an indigenous shrub growing in low grounds from New Brunswick and Nova Scotia to the mountains of Georgia and westward. The stems and lower surfaces of the ovate-lanceolate, serrate leaves are whitish and tomentose. The rose-colored flowers are disposed in terminal, compound, crowded spikes or racemes.

The flowers of *Spiraea*, possess to a very feeble extent the medicinal virtues of salicylic acid, and have been used as diuretic and tonic in the form of decoction. The roots are astringent, and have been used in the treatment of *diarrhea* in doses of from five to twenty grains (0.32-1.3 Gm.) of the aqueous extract repeated *pro re nata*.

SPIRITUS

SPIRITS

Alcoolats, *Fr.*; Geiste, *G.*; Spirito, *It.*

Spirits, as the term is here used, are alcoholic solutions of volatile principles formerly in general procured by distillation, but now frequently prepared by simply dissolving the volatile principle in alcohol or diluted alcohol. The distilled spirits are prepared chiefly from aromatic vegetable substances, the essential oils of which rise with the vapor of alcohol and condense with it in the receiver. Some of the oils, however, will not rise at the temperature of boiling alcohol, but may be distilled with water. In this case it is necessary to employ diluted alcohol or proof spirit, with the water of which the oil comes over in the latter part of the process. As the proof spirit of commerce is often impregnated with foreign matters, which give it an unpleasant flavor, it is better to use alcohol which has been carefully rectified, and to dilute it with the due proportion of water, as directed by the U. S. Pharmacopoeia. In preparing the spirits, care should be taken to avoid the color and empyreumatic flavor arising from the decomposition of the vegetable matter by heat. Sufficient water must, therefore, be added to cover the vegetable matter after the alcohol shall have been distilled, and, as a rule, the heat should be applied by means of a water bath, or of steam. The aromatic should be macerated for some days with the alcohol before being submitted to distillation, as the oil, being thus dissolved, rises more readily with the spirituous vapor than when confined in the tissue.

The aromatic spirits are used chiefly to impart a pleasant odor and taste to mixtures, and to correct the nauseating and griping effects of other medicines. They serve also as carminatives in *flatulent colic*, and as

agreeable stimulants in *debility of the stomach*.

SPIRITUS AMYGDALÆ AMARÆ. U. S.

SPIRIT OF BITTER ALMOND

Sp. Amygd. Amar. [Essence of Bitter Almond]

Alcoole d'essence amande amere, *Fr.*; Bittermandelgeist, *G.*

"Oil of Bitter Almond, ten mils [or 162 minims]; Alcohol, eight 'hundred mils [or 27 fluidounce's, 24 minims]; Distilled Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Dissolve the oil in the alcohol, and add enough distilled water to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Note: This Spirit is intended for medicinal use; it must not be used for flavoring foods." *U. S.*

Although the U. S. P. states that "this spirit is intended for medicinal use; it must not be used for flavoring foods" *U. S.*, it has little medicinal virtue except for its flavor. Because of the hydrocyanic acid in the oil of bitter almond this preparation will contain approximately 0.03 per cent. of that acid and hence cannot be used incautiously. It would have been better to have replaced this spirit with a solution of benzaldehyde.

Dose, from two to eight minims (0.12-0.5 mil).

Off. Prep.—Elixir Anisi, *N. F.*

SPIRITUS ANISI. U. S., Br.

SPIRIT OF ANISE Sp. Anisi

Essence of Anise; Teinture d'essence d'anis vert, *Fr. Cod.*; Anisgeist, *G.*

Oil of Anise, one hundred mils [or 3 fluid-ounces, 183 minims] ; Alcohol, a sufficient quantity to make one thousand mils [or 33 fluid-ounces 6¹/₂ fluidrachms]. Mix the oil with sufficient alcohol to make the product measure one thousand mils [or 33 fluidounces. 6¹/₂ fluidrachms]." *U. S.*

"Oil of Anise, 100 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Dissolve. When not clear, shake with a little powdered

talc and filter." *Br.*

Dose, as a stomachic and carminative, from twenty to sixty minims (1.3-3.75 mils), properly diluted.

SPIRITUS ARMORACIÆ COMPOSITUS. Br.

COMPOUND SPIRIT OF HORSERADISH

Esprit (alcoolat) de Raifort composee, Alcoolat antiscorbutique, *Fr.*;
Zusammengesetzter Meerrettiggeist, *G.*

"Horseradish Root, scraped, 125 grammes; Dried Bitter-Orange Peel, bruised, 125 grammes; Nutmeg, bruised, 3 grammes; Alcohol (90 per cent.), 625 millilitres; Distilled Water, 750 millilitres. Macerate the Horseradish Root in the Distilled Water for one hour, add the other ingredients, and distil one thousand millilitres. Specific gravity 0.917 to 0.927." *Br.*

This may be used advantageously as an addition to diuretic remedies, in *dropsy* attended with debility, especially in the case of drunkards.

Dose, from one to four fluidrachms (3.75-15 mils).

SPIRITUS AURANTII COMPOSITUS. U. S.

COMPOUND SPIRIT OF ORANGE Sp. Aur. Co.

Teinture d'essence d'orange, *Fr. Cod.*; Esprit d'orange composee, *FT.*;
Zusammengesetzter Orangegeist, *G.*

*"Oil of Orange, two hundred mils [or 6 fluidounces, 366 minims] ; Oil of Lemon, fifty mils [or 1 fluidounce, 331 minims]; Oil of Coriander, twenty mils [or 325 minims] ; Oil of Anise, five mils [or 81 minims]; Alcohol, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix them. Keep the product in completely filled, well-stoppered bottles, in a cool and dark place." *U. S.*

This compound spirit has been introduced for the purpose of producing the orange flavor in making the official aromatic elixir, and in various *N. F.* elixir's. It will be found by physicians to be a useful and fragrant

addition to prescriptions.

Off. Prep.—Elixir Aromaticum, *U. S.*

SPIRITUS CAJUPUTI. Br.

SPIRIT OF CAJUPUT

Teinture (alcoole) d'essence de Cajeput, Alcoole d'essence de Cajeput, *Fr.*; Cajeputgeist, *G.*

"Oil of Cajuput, 100 millilitres; Alcohol (90 per cent.) sufficient to produce 1000 millilitres. Dissolve. When not clear, shake with a little powdered talc and filter." *Br.*

For an account of the medicinal properties and uses of oil of cajuput, of which this is simply an alcoholic solution, see *Oleum Cajuputi*.

Dose, from five to twenty minims (0.3-1.3 mls), properly diluted.

SPIRITUS CINNAMOMI. U. S., Br.

SPIRIT OF CINNAMON Sp. Cinnam.

Teinture (alcoole) d'essence de Cannelle, Esprit de Cannelle, *Fr.*; Zimmtspiritus, *G.*; Spirito di cannella, *It.*

"Oil of Cinnamon, one hundred mls [or 3 fluidounces, 183 minims]; Alcohol, a sufficient quantity to make one thousand mls [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the oil with sufficient alcohol to make the product measure one thousand mls [or 33 fluidounces, 6¹/₂ fluidrachms]." *U.S.*

"Oil of Cinnamon, 100 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Dissolve. When not clear, shake with a little powdered talc and niter." *Br.*

The spirit of cinnamon is an agreeable aromatic cordial.

Dose, from ten to thirty minims (0.6-1.8 mls) in water.

SPIRITUS JUNIPERI. U. S., Br.

SPIRIT OF JUNIPER Sp. Junip.

Teinture d'essence de Genievre, *Fr, Cod.*; Spiritus Juniperi, *P. G.*; Wachholderspiritus, *G.*

"Oil of Juniper, fifty mils [or 1 fluidounce, 331 minims]; Alcohol, a sufficient quantity to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the oil with sufficient alcohol to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]." *U. S.*

"Oil of Juniper, 100 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Dissolve. When not clear, shake with a tittle powdered talc and filter. This Spirit is of twice the strength of the corresponding preparation of the British Pharmacopoeia, 1898." *Br.*

This spirit is used chiefly as an addition to diuretic infusions. It is about 33 per cent. stronger than the spirit official before 1890.

Dose, from thirty to sixty minims (1.8-3.75 mils).

SPIRITUS JUNIPERI COMPOSITUS. U. S.

COMPOUND SPIRIT OF JUNIPER Sp. Junip. Co.

Teinture (alcoole) d'essence de Genievre compoae, *Fr.*; Zusammengesetzter Wachholderspiritus, *G.*

"Oil of Juniper, eight mils [or 130 minims]; Oil of Caraway, one mil [or 16 minims] ; Oil of Fennel, one mil [or 16 minims]; Alcohol, fourteen hundred mils [or 47 fluidounces, 162 minims] ; Water, a sufficient quantity, to make two thousand mils [or 67 fluidounces, 301 minims]. Dissolve the oils in the alcohol, and gradually add enough water to make the product measure two thousand mils [or 67 fluidounces, 301 minims]." *U. S.*

This spirit is a useful addition to diuretic infusions and mixtures in debilitated cases of *dropsy*. It corresponds very closely to Holland gin.

Dose, from two to four fluidrachms (7.5-15 mils).

SPIRITUS LAVANDULÆ. U. S., Br.

SPIRIT OF LAVENDER Sp. Lavand.

Teinture (alcoole) d'essence de Lavande, *Fr.*; Spiritus Lav-andulse, *P. G.*; Lavandelapiritus, *G.*

"Oil of Lavender, fifty mils [or 1 fluidounce, 331 minims]; Alcohol, a sufficient quantity to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the oil with sufficient alcohol to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]." *U. S.*

"Oil of Lavender, 100 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Dissolve. When not clear, shake with a little powdered talc and filter." *Br.*

Spirit of lavender is used widely as a perfume, and as an ingredient in other preparations. The perfume usually sold under the name of *lavender water* is not a distilled spirit, but an alcoholic solution of the oil, with the addition of other odorous substances. The following is given by Brande as one of the most approved recipes for preparing it. "Take of rectified spirit five gallons, essential oil of lavender twenty ounces, essential oil of bergamot five ounces, *essence of ambergris* [made by digesting one drachm of ambergris and eight grains of musk in half a pint of alcohol] half an ounce. Mix." The *Br.* spirit is double the strength of the *U. S.* preparation. It is a grateful stimulant and carminative when administered in sweetened water.

Dose, of the *U. S.* Spirit, from ten to thirty minims (0.6-1.8 mils); of the *Br.* Spirit, five to twenty minims (0.3-1.3 mils).

Off. Prep.—Mistura Ferri Composita, *N. F.*

SPIRITUS MENTHÆ PIPERITÆ. U. S., Br.

SPIRIT OF PEPPERMINT Sp.Menth.Pip. [Essence of Peppermint]

Teinture d'essence de Menthe, *Fr. Cod.*; Spiritus Menthae Piperitae, *P. G.*; Pfefferminzspiritus, Englische Pfefferminz-essenz, *G.*; Alcohol de

menta piperita, *Sp.*

"Oil of Peppermint, one hundred mils [or 3 fluidounces, 183 minims]; Peppermint, bruised, ten grammes [or 154 grains]; Alcohol, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Macerate the peppermint leaves, freed as much as possible from stems, during one hour in five hundred mils [or 16 fluidounces, 435 minims] of water and then strongly express them. Mix eight hundred mils [or 27 fluidounces, 24 minims] of alcohol with the oil, add the macerated leaves and enough alcohol to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms], macerate the mixture during six hours, with frequent agitation, and then filter it. Preserve the product in amber-colored bottles." *U. S.*

"Oil of Peppermint, 100 millilitres; Alcohol (90 per cent.) sufficient to produce 1000 millilitres. Dissolve. When not clear, shake with a little powdered talc and filter." *Br.*

The distilled spirit has no advantage over a simple solution of the oil in alcohol; and this mode of preparing it has been adopted both in the U. S. and British Pharmacopoeias. The American spirit is green in color, but the British is almost colorless. P. H. Utech suggests the maceration of the peppermint in water for two hours, washing and draining, before adding to the solution of the oil; water soluble matter is removed and a more permanent green color produced. He recommends the same treatment for the spearmint in making spirit of spearmint, and the U. S. P. IX adopted this plan. It has long been popularly used under the name of *essence of peppermint*. The spirit of peppermint affords a convenient method of administering a dose of the volatile oil, being of such a strength that when dropped on loaf-sugar it may be taken without inconvenience.

Dose, ten to thirty minims (0.6-1.8 mils), given as just mentioned, or mixed with sweetened water.

SPIRITUS MENTHÆ VIRIDIS. U. S.

SPIRIT OF SPEARMINT *Sp. Ment. Vir.*

Tinctura Olei Menthe Viridis, U. S. 1850; Essence of Spearmint; Grune Minzessenz, G.

"Oil of Spearmint, one hundred mils [or 3 fluidounces, 183 minims]; Spearmint, bruised, ten grammes [or 154 grains] ; Alcohol, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Macerate the spearmint leaves, freed as much as possible from stems, during one hour in five hundred mils [or 16 fluidounces, 435 minims] of water and then strongly express them. Mix eight hundred mils [or 27 fluidounces, 24 minims] of alcohol with the oil, add the macerated leaves and enough alcohol to make one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms], macerate the mixture during six hours, with frequent agitation, and then filter it. Preserve the product in amber-colored bottles." *U. S.*

The remarks made on the Spirit of Peppermint are equally applicable here.

Dose, ten to thirty minims (0.6-1.8 mils).

SPIRITUS MYRISTICÆ. Br.

SPIRIT OF NUTMEG [Essence of Nutmeg]

Teinture (alcoole) d'essence de Muscade, *Fr.*; Muskat-spiritus, *G.*

"Oil of Nutmeg, 100 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Dissolve. When not clear, shake with a little powdered talc and filter." *Br.*

It is used chiefly for its flavor. Spirit of nutmeg was not retained in the U. S. P. IX. It was made in the U. S. P., 1890, by dissolving 50 mils of nutmeg in 950 mils of alcohol. (See *Oleum Myristicæ.*)

Dose, from five to twenty minims (0.3-1.3 mils).

SPIRITUS ROSMARINI. Br.

SPIRIT OF ROSEMARY

Spiritus Anthos; Teinture d'essence de Romarin, *Fr. Cod.*; Rosmarinspiritus, *G.*; Alcohol de romero, *Sp.*

"Oil of Rosemary, 100 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Dissolve. When not clear, shake with a little powdered talc and filter." Br.

This spirit is not official in the United States

Pharmacopoeia IX. It is a grateful perfume, and is used chiefly as an odorous ingredient in lotions and liniments.

Sponge. *Spongia*. *Spongia officinalis*. *Eponge*, Fr. *Schwamm*. *Badeschwamin*, G.—The sponge is "a flexible, fixed, torpid, polymorphous animal, composed either of reticular fibers or masses of small spires interwoven together, and clothed with a gelatinous flesh, full of small mouths on its surface, by which it absorbs and ejects water." Until recently sponges were classified as colonial *Protozoa*, the lowest group of animals, but they are now brought under a separate phylum known as *Porifera* (or *Spongiaria*) a name applied to them because of their abundance of water pores. The latter are of two kinds, both opening into the digestive canals and ramifying passages of the sponge. Some of these are large, but most of them are small, being in the nature of inhalant pores or inlets for admitting the water. The current through these pores is a constant one which is induced by countless flagella which occur in definite enlargements on the canals and known as ciliated chambers. This current contains the minute organisms which are carried to the digestive cavities and upon which the animal feeds. Through these canals oxygen is distributed, the waste matters eliminated and fertilization of the eggs is effected. Sponges inhabit the bottom of the sea, where they are fixed to rocks or other solid bodies, and are most abundant within the tropics. They are collected chiefly in the Mediterranean and Red Seas, the West Indies and the coast of Florida and Central America. In the Grecian Archipelago, Crete, Cyprus, on the coast of Asia Minor, Syria, Barbary and the Bahama Islands, sponge fisheries constitute a very important industry. Formerly most of the sponges used in the United States were brought from the Mediterranean waters, but since 1852 the Bahamas and the coast of Florida have furnished much of the commercial supply. When collected they are enveloped in a gelatinous coating, which forms part of the animal. For details of fishery and preparation, see P. J., xx. Large quantities of the coarser kinds are imported from the Bahamas, but the finest and most esteemed are brought from the Mediterranean, especially from the coast of Syria. Recently the cultivation of sponges has been undertaken on an extensive scale. Small fragments are cut under water from the live sponge, and fixed upon a sandy bottom by means of skewers. In three years they will have grown sufficiently to be marketable.

Sponge, as found in commerce, is in yellowish-brown masses of various shapes and sizes, light, porous, elastic, and composed of fine, flexible, tenacious fibers, interwoven in the form of cells and meshes. It usually contains numerous minute fragments of coral or stone, or small shells, from which it must be freed before it can be used for ordinary purposes. Sponge is prepared by macerating it for several days in cold water, beating it in order to break up the concretions which it contains, and dissolving what cannot thus be separated of the calcareous matter by hydrochloric acid diluted with

thirty parts of water. By this process it is rendered perfectly soft, and fit for surgical use. It may be bleached by steeping it in water impregnated with sulphurous acid, or by exposure in a moist state to the action of chlorine. It is stated that sponges which have been soaked in pus and infectious matters will recover their primitive condition by soaking in a 4 per cent. solution of potassium permanganate, then in a 25 per cent. solution of official sulphurous acid, and finally thorough washing in an abundance of water. (*A. J. P.*, xlv, 355.) When intended for surgical purposes, the softest, finest, and most elastic sponges should be selected; for forming *burnt sponge* the coarser will answer equally well. According to Hatchett, the chemical constituents of sponge are gelatin, coagulated albumin, common salt, and calcium carbonate. Magnesia, silica, iron, sulphur, and phosphorus have been detected in it, as also iodine and bromine, combined with sodium and potassium. From the experiments of Croockewit, it would appear that sponge is closely analogous to, if not identical with, the *fibroin* and *sericin* of silk, differing from it only in containing iodine, sulphur, and phosphorus. (*Ann. Ch. Ph.*, xlviii, 43.) Schlossberger, however, has shown that it is distinct, in its very slight solubility in ammoniacal solution of copper hydroxide and in its yielding leucine and glycocoll when treated with diluted sulphuric acid, while sericin yields under similar treatment tyrosine and serin. He names the principle *spongin*.

Sponges are used for mechanical purposes only. Sponge tent is employed for dilating sinuses. This is prepared by dipping sponge into melted wax, compressing it between two flat surfaces till the wax hardens, and then cutting it into pieces of a proper form and size. By the heat of the body the wax becomes soft, and the sponge, expanding by the imbibition of moisture, gradually dilates the wound or sinus in which it may be placed. When a conical sponge tent of uniform caliber is required, as for dilating the uterine cavity, a better plan is to cut the sponge into a conical shape while fresh and compress when moist, by winding it carefully with a fine tightly drawn cord, removing the cord when perfectly dry, and dipping the tent into melted wax, so as to get a thick coating. For other modes of preparing sponge tent, as well as of saturating the sponge at the same time with substances calculated to make a, remedial impression, as phenol, alum, lead acetate, etc., see *A. J. P.*, 1868, 410; 1869, 446.

Spongia Usta, *Burnt Sponge*, was formerly official (*Spongia Usta*, U. S. 1850), but is no longer used in medicine. For method of preparation, analysis, and therapeutic properties, see 16th edition, *U. S. D.*

STAPHISAGRIA. U. S. (Br.)

STAPHISAGRIA Staphisag. [StavesacreJ

"The ripe seeds of *Delphinium Staphisagria* Linne (Fam. Eanunculacete), without the presence or admixture of more than 2 per cent. of foreign vegetable matter." U. S. " Stavesacre Seeds are the dried ripe seeds of *Delphinium Staphisagria*, Linn." Br.

Staphisagrias Semina, Br.; Semen Staphisagriae, Staphidiagriae or Pedicularis;

Stavesacre Seeds; Staphisaigre, *Fr. Cod.*; Stephanskomer, Lausekorn, *G.*; Stafisagria, *It.*

Delphinium Staphisagria L., or stavesacre, is a handsome, annual or biennial plant, one or two feet high, with a simple, erect, downy stem, and palmate, five- or seven-lobed leaves, supported on hairy petioles. The flowers are bluish or purple, in terminal racemes, with pedicels twice as long as the flower, and bracteoles inserted at the base of the pedicel. The sepals are five in number, irregular, petal-like, the upper one being spurred at the base. The petals are four, irregular, the two upper having long spurs which are inclosed in the spur of the calyx, the two lower having short claws. The pistils form a many seeded pod or capsule in fruit.

The plant is a native of the south of Europe. E. M. Holmes calls attention to the remarkable fact that the plant in the English botanic gardens hitherto considered to be *Delphinium Staphisagria* is in reality another species, i.e., *Delphinium pictum* Willd. The author accounts for the absence of the true plant in botanic gardens partly by the fact that it is only half-hardy in Great Britain, while *D. pictum* is hardy, and partly by the reason that the illustrations in several works on medicinal plants—even in Bent-ley and Trimen's "Medicinal Plants"—are incorrect or unreliable. The two species are distinguished as follows: *D. Staphisagria* has very hairy stems, glandular hairs being mixed with the long spreading soft hairs; flowers that when well-developed have an ultramarine blue tint; a calyx with very short or almost obsolete spur; carpels containing only four or five seeds. *D. pictum* Willd., has shorter soft hairs, but no glandular hairs on the stems; the flowers are of a pale lilac color; the spur is as long as the calyx segments; each carpel contains ten or twelve seeds, and these are only half the size of those of *D. Staphisagria*. The true *D. Staphisagria* extends from Teneriffe around both the northern and southern coasts of the Mediterranean to Asia Minor. It is quite possible, therefore, that varieties having blossoms of different tints may occur. The evidence obtainable, however, goes to show that the form of the plant from which the seed of commerce is obtained has clear blue flowers. (*Y. B. P.*, 1899, 390.) For description of other species of this genus, see *Delphinium*.

Properties.—The seeds of stavesacre are officially described as "irregularly triangular, flattened, or somewhat tetrahedral, one side being-convex, from 4 to 7 mm. in length and from 3 to 6 mm. in breadth;

externally dark brown, becoming lighter with age, and coarsely reticulate; easily cut, showing- a somewhat light brown, oily endosperm, enclosing a small embryo at the pointed end; odor slight, disagreeable; taste intensely bitter and acrid. Under the microscope, transverse sections of Staphisagria show an outer layer of nearly tabular, thick-walled, non-lignified cells, some being extended centrifugally, and forming the reticulations of the seed-coat; 2 or 3 rows of parenchyma cells with more or less irregular thin walls; a thin layer of very small, thick-walled cells with numerous, lattice-like or reticulate pores; endosperm large, composed of polygonal cells enclosing small aleurone grains and fixed oil, the latter forming in large globules on the addition of hydrated chloral T.S." *U. S.*

"Irregularly triangular or obscurely quadrangular, arched, blackish-brown when fresh, but becoming dull greyish-brown on keeping. Surface wrinkled and deeply pitted; kernel soft, whitish, oily. No marked odor; taste nauseous, bitter and acrid." *Br.*

The seeds of the field larkspur (*D. Consolida* L.) and of *D. Ajacis* L. are being largely used in place of the official staphisagria; in fact, they are recognized in the National Formulary. These are readily distinguished, being about 2 mm. in length and- of a black or blackish-brown color.

The virtues of staphisagria are extracted by water and alcohol. Analyzed by Lassaigne and Feneulle it yielded a brown and a yellow bitter principle, a volatile oil, about 30 per cent. of a fixed oil, albumen, a nitrogenous substance, a mucilaginous saccharine matter, mineral salts, and a peculiar alkaloid called *delphinine*, which exists in the seeds combined with an excess of malic acid. Marquis, in Dragendorff's laboratory in 1877, isolated the following four alkaloids : *delphinine*, $C_{22}H_{35}O_6N$, a crystallizable alkaloid, of bitter taste, weak alkaline reaction, soluble in alcohol, ether, and chloroform; *delphinoidine*, $C_{42}H_{68}O_7N_2$, amorphous, soluble in ether, alcohol, chloroform, reaction strongly alkaline, fusing point from 110° to 120° C. (230° - 248° F.); *delphisine*, $C_{27}H_{46}O_4N_2$, crystallizing in warty aggregations, soluble in ether, alcohol, and chloroform; *staphisagrine*, $C_{22}H_{33}O_5N$, only obtained amorphous, difficultly soluble in water and ether, easily soluble in alcohol and chloroform, of bitter taste, fusing point 90° C. (194° F.), of alkaline reaction in alcoholic solution. If delphinine be rubbed up with an equal quantity of malic acid, and some drops of concentrated

sulphuric acid added, there will be produced an orange-red color passing into rose, growing deeper after some hours, and finally changing from the edges to violet, and at last becoming cobalt blue. (Tattersall, *Chem. News*, 41.) It is stated that no other alkaloid and no other organic acid, except malic, affords

this reaction. (*Pflanzenstoffe*, 2d ed., 1884, 617.) The total amount of alkaloids is about 1 per cent. According to Charalampi Kara-Stojanow (In. Dis., Dorpat, 1890), delphinine and *delphisine* have the same composition, $C_{31}H_{49}O_7N$, crystallize from their solutions in ether and petroleum benzin in identical forms, and have their melting points at 189° and 191° C. (372.2° and 375.8° F.), while *delphinoidine* has the formula $C_{25}H_{12}O_4N$. Ahrens (*Ap. Ztg.*, 1899, 361) obtained from the residue of the seeds of *D. staphisagria*, from which delphinine, delphinoidine, delphisine and staphisagraine had been extracted, the alkaloid *staphisagroine* (*Ber. d. Chem. Ges.*, 1899, 1581). For Katz's process for extracting delphinine, see *Ph. Ztg.*, 1900, 735.

Uses.—The seeds were formerly used as an emetic and cathartic, but have been abandoned in consequence of their violence. A strong tincture has been employed as an embrocation in *rheumatism*. The ointment is used to destroy lice and the *itch-mite*. *Staphisagria* should never be used internally, and when it is applied externally, care should be exercised not to put it on an abraded surface, but only upon the unbroken epidermis. In some countries the seeds are used like *Cocculus Indicus* to intoxicate fish.

When given in poisonous doses to the lower animals, *delphinine* produces excessive salivation, followed by violent and repeated vomiting, great disturbance of respiration, failure of heart action, gradual enfeeblement of voluntary motion and of sensation, and a peculiar fibrillary spasm of the muscles of the abdomen, which is said to be characteristic of the poisoning. Elevation of temperature and glycosuria have both been noticed; death is said to occur always from failure of respiration, though the heart is greatly enfeebled and finally ceases in diastole. According to Gauthier, the period of depression of the heart and of sensibility is preceded by one of excitement. The pupils are dilated and the motor nerve finally paralyzed. (*L. M. R.*, Oct., 1887.) Turnbull, in his work *On the Medical Properties of the Ranunculaceae* states that pure delphinine may be given to the extent of three or four grains a day, in doses of half a grain each, without exciting vomiting,

and without producing much intestinal irritation, though it sometimes purges. In most instances it proves diuretic, and gives rise to sensations of heat and tingling in various parts of the body. Externally, it acts like veratrine, but, according to Turnbull, produces more redness and burning and less tingling than that substance. He has employed it in *neuralgia*, *rheumatism* and *paralysis*. It may be applied by friction, in the form of ointment or alcoholic solution, in proportions varying from ten to thirty grains of the alkaloid to an ounce of the vehicle, and the friction should be continued till a pungent sensation is produced. Turnbull probably had an impure alkaloid; the doses just mentioned would not be safe with a pure delphinine.

Staphisagrine is said to act like delphinine, except that it does not depress the heart so much or produce fibrillary contractions. Although cases of human poisoning's have occurred with *staphisag'ria*, we know of none in which the result has been fatal. The symptoms are similar to those produced in the lower animals. Robert states that the alkaloids of *staphisagria* all resemble aconitine in their action, but that delphinidine has some narcotic action.

Off. Prep.—Fluidextractum *Staphisagriss*, U. S.; Unguentum *Staphisagriae*, Br.

Statice. *Statice Limoniun* (L.) Gray. [Now *Limonium carolinianum* (Walt.) . Britt.] Marsh Rosemary. Ink Root. Sea Lavender. *Romarin des Marais*, *Lavande triste*, Fr. *Strandneike*, G. (Fam. *Plumbaginaceae*.)—It is an indigenous maritime plant with a perennial, very astringent, root, sending up annually tufts of leaves, which are obovate or cuneiform, entire, obtuse mucronate, smooth, and on long foot-stalks.

Marsh rosemary grows in the salt marshes along the sea coast from Labrador to Texas, and flowers from July to September. The root, which was formerly in the Secondary List of the U. S. Pharmacopoeia, is large, spindle-shaped, or branched, fleshy, compact, rough, and of a purplish-brown color. It is bitter and extremely astringent, but odorless. It contains tannic acid (12.4 per cent.), volatile oil, resin, and other substances. (*A. J. P.*, xiv, 116.) *Statice* is powerfully astringent, and in some parts of the United States, particularly in New England, is much employed, especially as a local application, in decoction, to aphthous and ulcerative affections of the mouth and fauces.

In Brazil and Buenos Ayres the roots of *S. brasiliensis* Boiss. are employed under the name of *Buaycura* or *Guayoura*. (*P. J.*, 1878, ix, 466.) For a description of the physical and chemical characteristics of the root, see *P. J.*, vol. xv, 86. In Russia and Spain the very large roots of *S. latifolia* Sm. are used for tanning, and in Morocco the roots of *S. mucronata* L. are stated to be employed, under the name of *safirifa*, as a nervine.

Sticta. *Lungmoss. Lungwort.*—The lichen *Sticta pulmonacea*, a native of Europe, used largely by the natives in the treatment of *pulmonary complaints*. It owes its activity chiefly to *stictic acid*, which is bitter and possesses a powerful astringent action.

STILLINGIA. U. S.

STILLINGIA Stilling. [Queen's Root]

"The dried roots of *Stillingia sylvatica* Linne (Fam. *Euphorbiaceae*). Preserve *Stillingia* in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects." *U. S.*

Silver Leaf, Queen's Delight, Yaw Root; Stillingie, *Fr., G.*

Stillingia sylvatica is an indigenous perennial plant* commonly called *Queen's delight*, with herbaceous stems, two or three feet high, and alternate, sessile, oblong or lanceolate-oblong, obtuse serrulate leaves, tapering at the base, and accompanied with stipules. The staminate and pistillate flowers are distinct upon the same plant. They are yellow, and arranged in the form of a spike, of which the upper part is occupied by the male, the lower by the female flowers. The staminate florets are scarcely longer than the bracteal scales. The plant grows in pine barrens from Maryland to Florida and west to Kansas and Texas, flowering in May and June. When wounded it emits a milky juice.

Properties.—The root, which is the part used, is large, thick, and woody. It is officially described as "entire, terete, unequally tapering, rarely branched, usually in pieces attaining a length of 40 cm. and from 0.5 to 3 cm. in diameter, externally reddish-brown, longitudinally wrinkled; fracture very fibrous; internally the bark is light reddish-brown, thick, spongy, finely fibrous, with numerous resin cells and easily separable from the porous, radiate wood; odor distinct; taste bitter, acrid and pungent. The powder is pinkish-brown or light reddish-brown; when examined under the microscope it exhibits numerous starch grains from 0.005 to 0.035 mm. in diameter, mostly single, very variable in shape, and usually with a central cleft; numerous fragments, with more or less tabular secretion cells, containing a reddish-brown, amorphous, resinous substance; fragments of tracheae mostly with simple pores and associated with wood-fibers, the walls

being very thin, lignified and possessing numerous, transverse, slit-like simple pores; bast-fibers long, narrow, the walls thick and slightly lignified; fragments of reddish-brown cork cells; occasionally crystals of calcium oxalate in rosette aggregates about 0.035 mm. in diameter. *Stillingia* yields not more than 5 per cent. of ash." *U. S.*

The odor is slight, peculiar, and somewhat oleaginous, but in the recent root. is said to be strong and acrimonious. The taste is bitterish and pungent, leaving an impression of disagreeable acrimony in the mouth and fauces. Holm gives an excellent illustrated article on the pharmacognosy of *stillingia* in *Merck's Rep.*, xx, p. 412. W. Saunders has obtained from the root a volatile oil, which he found to possess the odor, taste, and peculiar acrimony of the root in a high degree. He procured six and a quarter ounces from five pounds of the dried root. It had a thick consistence, and required the addition of alcohol to render it fit for manipulation. Wm. Bichy (*A. J. P.*, 1885, p. 529) found an alkaloid which he named *stillingine*. It was obtained as an amorphous powder, volatilizable on heating, forming a sulphate in fine scale-like crystals.

Uses.—In large doses *Stillingia* is emetic and cathartic, but is rarely used for these purposes. Smaller quantities have been supposed to exercise an alterative effect upon the system and are used in *syphilitic* and *scrofulous* conditions. The drug is probably, however, without any real value.

Dose, half a drachm to a drachm (2.0-3.9 Gm.).

Off. Prep.—Fluidextractum *Stillingiae*, *U. S.*;

Elixir *Corydalis Compositum* (from Fluidextract), *N. F.*; Fluidextractum *Stillingiae Compositum*, *N. F.*; Syrupus *Stillingiae Compositus*, *N. F.*

Stipa.—According to Gillespie (*B. M. J.*, Oct., 1898), a number of species of this genus of grasses are actively poisonous, and have caused death in horses and other domestic animals. Of such character especially are *Stipa viridula* Trin., *Stipa inebrians* Hance, and *Stipa sibirica* Lam., of the Russian steppes. A few experiments made with *Stipa viridula* Trin., a plant growing in the prairies and meadows from western Minnesota to the Dakotas and southernward, indicated that it acts powerfully upon the brain and spinal cord.

Stipa. Vaseyi Scribner.—According to Vernon Bailey this grass, which grows on the mountains of California, is a very active narcotic, producing in animals, which graze upon it, sleep lasting for a week or longer. (See Farwell, *Merck's Rep.*, 1911, p. 271.)

STRAMONIUM. U. S. (Br.)

STRAMONIUM Stramon. [Jamestown Weed, Jimson Weed]

"The dried leaves of *Datura Stramonium* Linne, or of *Datura Tatula* Linne (Fam. Solan-aces), without the presence or admixture of more than 10 per cent. of stems or other foreign matter, and yielding not less than 0.25 per cent. of the total alkaloids of Stramonium." *U. S.* "Stramonium Leaves are the dried leaves of *Datura Stramonium*, Linn." *Br.*

Stramonii Folia, Br., U. S. 1890—Stramonium Leaves; Herba Stramonii; Thornapple Leaves; Thorn, Devil's or Mad Apple, Apple of Peru, Stink-weed, Jamestown (Jimson) Lily, Devil's Trumpet, Derotry; Stramoine ou Pomme-epineuse, *Fr. Cod.*; Feuilles de Stramoine, *Fr.*; Folia, Stramonii, *P. G.*; Stechapfelblatter, *G.*; Stramonio, *It.*; Estramonio (Hojade), *Sp.*

The *thornapple* (*Datura Stramonium*) is an annual plant, of rank and vigorous growth, usually about three feet high, but in a rich soil attains a height of six feet or more. The root is large, whitish, and furnished with numerous rootlets. The stem is erect, round, smooth, somewhat shining, simple below, dichotomous above, with numerous spreading branches. The leaves are petiolate, five or six inches long, of an ovate-triangular form, irregularly sinuated and toothed at the edges, unequal at the base, dark green on the upper surface, and pale beneath. The flowers are large, axillary, solitary, and ped-uncled, having a tubular, pentangular, five-toothed calyx, and a funnel-shaped corolla with a long tube, and a wavy plaited border, terminating in five acuminate teeth. The upper portion of the calyx falls with the deciduous parts of the flower, leaving its base, which becomes re'flexed and remains attached to the fruit. This is a large, fleshy, roundish-ovate, four-valved, four-ocular capsule, thickly covered with sharp spines, and containing numerous seeds, attached to a longitudinal placenta in the center of each locule. It opens at the summit. There are two varieties of this species of *Datura*, one with a green stem and white flowers, the other with a dark reddish stem minutely dotted with green, and purplish flowers striped with deep purple on the inside. The latter is now considered as a distinct species, being the *D. Tatula* of Linnaeus. The properties of both are the same.

It is doubtful to what country this plant originally belonged. Many

European botanists refer it to North America, while we in return trace it to the old continent. Nuttall considers it as having originated in South America or Asia, and it is probable that its native country is to be found in some part of the East. It is said to grow wild, abundantly in Southern Russia, from the borders of the Black Sea eastward to Siberia. Its seeds, being retentive of life, are taken in the earth put on shipboard for ballast from one country to another, not infrequently springing up upon the passage, and thus propagating the plant in all regions which have any commercial connection. In the United States it is found everywhere in the vicinity of cultivation frequenting dung heaps, the road sides and commons, and other places where a rank soil is created by the deposited refuse of towns and villages. Its flowers appear from May to July or August, according to the latitude. Where the plant grows abundantly, its vicinity may be detected by the rank odor which it diffuses to some distance around. Notwithstanding the abundance of the plant, it is being cultivated in order to obtain a drug which shall be of uniform quality. The Bureau of Plant Industry, U. S. Department of Agriculture, has conducted experiments on a large scale. Several hundred pounds of leaf were grown, cured by artificial heat in a tobacco barn, and marketed at a price in advance of the highest quoted figure. Mitlacher has reported his observations on the cultivation of stramonium in *Zeit. Oest. Apoth.*, 1, p. 391. Miller has conducted comparative experiments on *D. Stramonium* and *D. Tatula*. (*A. J. P.*, Ixxiv, p. 446.)

All parts of it are medicinal. The leaves, seeds, and root were formerly recognized by the U. S. P., the leaves and seed in the U. S. P., 1890, but in the U. S. P. VIII and IX the seeds were not included and the leaves alone are official under the title *Stramonium*. The leaves may be gathered at any time from the appearance of the flowers till the autumnal frost. In this country the plant is generally known by the name of *Jamestown (vulgo, Jimson) weed*, derived probably from its having been first observed in the

neighborhood of that old settlement in Virginia. In India *Datura alba*, *D. ferox*, and *D. fatuosa* are employed as poisons. The last has been admitted to the Br. (See *Daturae Folia*.) Under the names of *Man t'o lo fa*, *Wan t'o lo hua*, and *Nau yeung fa*, the Chinese use as a medicine the flowers of the *Datura alba*; according to Frank Browne, they contain 0.485 per cent. of hyoscyne, free from other alkaloids. *El Bethene*, a *Datura* of the Sahara Desert, is capable of causing delirium, coma, and death, and it is probable that all the species of the genus are

poisonous. A. R. L. Dohme (*Proc. A. Ph. A.*, 1894, 231) examined stramonium to determine the value in alkaloid of the various parts of the plant; he found that, in general, the fresh parts yielded more than the dried parts; the stems contained the most alkaloid, the seeds next, then the leaves, and the roots the least of all.

The *fresh leaves* when bruised emit a fetid narcotic odor, which they lose upon drying. Their taste is bitter and nauseous. These properties, together with their medicinal virtues, are imparted to water and alcohol. Water distilled from them, though possessed of their odor in a slight degree, is destitute of their active properties. They contain, according to Promnitz, 0.58 per cent. of gum, 0.6 of extractive, 0.64 of green starch, 0.15 of albumen, 0.12 of resin, 0.23 of saline matters, 5.15 of lignin, and 91.25 of water. The leaves, if carefully dried, retain their bitter taste. They are officially described as "usually much wrinkled and either loose or more or less matted together; laminas when entire from 2 to 30 cm. in length, having petioles from 0.5 to 8 cm. in length; inequilaterally ovate, summits acute or acuminate, bases unequal, one side extending from 3 to 12 mm. below the other, margins sinuate, toothed or angled, the teeth being few, acute or acuminate and with rounded sinuses; frequently with numerous circular perforations which may have become filled with cork; upper surfaces dark green, sparsely hairy, especially upon the veins, lower surfaces light green; odor distinct, heavy and narcotic; taste unpleasant, nauseous. Stems cylindrical, usually flattened, attaining a length of 30 cm. and a diameter of 7 mm.; longitudinally wrinkled, occasionally with 1 or more deep furrows, light greenish-brown to purplish-brown. The powder is brownish-green; upon clearing the fragments with hydrated chloral T.S. and examining under the microscope, it shows numerous elliptical stomata, about 0.025 mm. in length, and surrounded usually with 3 neighboring cells; cells of the mesophyll containing numerous small chloroplastids; calcium oxalate either in rosette aggregates, from 0.01 to 0.02 mm. in diameter, or in rod-like crystals, or in the form of sphenoidal micro-crystals; non-glandular hairs few, characteristic, 2- to 4-celled, attaining a length of 0.5 mm., the basal cell about 0.04 mm. in width, some of the cells more or less collapsed, the outer walls with numerous, slight, centrifugal projections; glandular hairs few, with 1-to 2-celled stalks and usually 2- to 4-celled, glandular heads; tracheae annular or spiral, fragments of the tracheal wall frequently detached. Stem fragments show large annular or spiral tracheae which occasionally are thickened, with simple or bordered pores and associated with wood parenchyma; fragments

with long, narrow unequally thickened collenchymatous cells; parenchyma with sphenoidal micro-crystals; wood-fibers occasional; bast-fibers absent. Stramonium yields not more than 20 per cent. of ash." *U. S.*

J. S. Ward has found commercial stramonium leaves freely adulterated with those of *Carthamus helenioides* and *Xanthium Strumarium*. (*P. J.*, lxvi, 326.) For a paper on the structure of the leaves of *D. Stramonium*, *Atropa Belladonna*, and *Hyoscyamus niger* by Schlotterbeck and van Zwaluwenburg, see *Proc. A. Ph. A.*, 1897, 202. Holm has published an illustrated article on the morphology of stramonium. (*M. R.*, xxii, p. 162.) Rosenthaler has subjected the leaves of stramonium to pyro-analysis and obtained a distinctive and characteristic sublimate. (*B. P. G.*, xxi, p. 530.)

The following are some of the more common synonyms used to designate stramonium seeds: *Stramonii Seminar*, *Stramonium Seed*, *Semen Stramonii*, P. G.; *Semences (Graines) de Stramoine*, Fr.; *Stechapfelsamen*, G., which were formerly official. The seeds are small, kidney-shaped, pitted and wrinkled, flattened on the sides, of a dark-brown almost black color, inodorous unless bruised, and of the bitter, nauseous taste of the leaves, with some degree of acrimony. The testa is dull brownish-black, hard, and encloses a cylindrical curved embryo, which is embedded in a whitish oily albumen. They are much more energetic in their action on the system than are the leaves. Hirtz and Hopp inferred from their experiments that one part of an extract prepared from them was equal in strength to five parts of an extract prepared in precisely the same manner from the leaves. (*Ann. Ther.*, 1862, p. 22.)

Geiger and Hesse succeeded in isolating an alkaloid, to which the name *daturine* was given, and which Trommsdorff has repeatedly procured by their process. Von Planta (*A. J. P.*, 23, p. 38) found that daturine was identical with atropine, and this result has since been confirmed; but Ladenburg (*Ber. d. Chem. Ges.*, 13, p. 909) found that *Datura Stramonium* contains two alkaloids, which he designated as *heavy daturine* and *light daturine*.

The more difficultly soluble heavy daturine fuses at 113.5° to 114° C. (236.3 °-237.2° F.), and must be considered as a mixture of *atropine* and *hyoscyamine*. It yields a gold salt fusing between 135° and 150° C. (275°

and 302° F.), out of which, by crystallization repeated six times and by rejection each time of the mother liquor, is obtained hyoscyamine gold-chloride fusing at 158° to 160° C. (316.4°-320° F.). From the mother liquors by evaporation is obtained nearly pure atropine gold chloride fusing at, 135° to 140° C. (275°-284° F.). If the heavy daturine be repeatedly crystallized out of dilute alcohol, pure atropine can be isolated from it, fusing at 113.5° to 114.5° C. (236.3°-238.1° F.), and yielding a lusterless gold salt fusing at 135° to 139° C. (275°-282.2° F.). The light daturine is the alkaloid which Ladenburg and Meyer in a previous study had shown to be identical with hyoscyamine. Hence *Datura Stramonium* contains the two alkaloids *atropine*, C₁₇H₂₃O₃N, and hyoscyamine, isomeric with the other, which *Atropa Belladonna* also contains. (*A. J. P.*, 1884, 440.) The mother liquors from which hyoscyamine is obtained yield a difficultly crystallizable base, first called hyoscine, but now known as *scopolamine*. Its gold salt is more difficultly soluble than the gold salts of atropine and hyoseyamine, and affords a means of separation. The base, when purified, can be crystallized out of ether in colorless crystals, melting at 59° C. (138.20 F.). Its formula is C₁₇H₂₁O₄N, and it is decomposed by boiling with baryta water into *scopolin*, C₈H₁₃NO₂, and *atropic acid*, C₉H₈O₂. (Schmidt, *Pharm. Chemie*, 3te Auf., ii, 1339.)

Gerard (see *J. P. C.*, 1892, 8) studied *daturic acid* obtained from stramonium seed. D. Holde has, by means of benzene, extracted from stramonium seed 16.7 per cent. of a fixed oil. (*P. J.*, lxx, p. 90.) This has been examined by J. M. Baird and F. E. Sleeper, see *Proc. A. Ph. A.*, 1903, 324.

Uses.—Stramonium is so similar to belladonna in the symptoms produced by it in small or large doses, in its toxicity and its general physiological and therapeutic action, that the two drugs are practically identical. Furthermore, they are about the same strength in activity, so the preparations may be used in similar doses. Stramonium has been employed in all the conditions for which belladonna is more commonly used, but has acquired special repute in the treatment of asthma, this probably being due to the fact that the practice of smoking *Datura ferox* in that disease was introduced into Great Britain from the East Indies by General Gent, and that afterwards the English species was substituted for that employed in Hindostan. Formerly the roots were chiefly used, but at present the dried leaves are exclusively employed.

The beneficial effect is doubtless due to the presence of atropine which paralyzes the endings of the pulmonary branch of the vagus, thus relieving the bronchial spasm, for Gunther (*W. K. W.*, 1911, p. 748) has shown that the smoke from a stramonium cigarette containing 1.25 Gm. of stramonium leaves contains as much as 0.5 Mgm. of atropine. The leaves may be made up into cigarettes or smoked in a pipe, either with or without a mixture of tobacco; more commonly, however, the coarsely ground leaves are mixed with equal parts of potassium nitrate, in order to increase combustion, and burned in a saucer.

Death is said to have been produced by the free use of the India *Datura ferox*, but it seems hardly possible that the species which is found in North America would produce such a result.

The seeds are more powerful than the leaves. The seeds were once officially recognized, but the presence of a large amount of fixed oil made it difficult to extract them or to make stable preparations from them and the leaves have taken their place. They may be given in the dose of one-half to one grain (0.032-0.065 Gm.) twice a day; an extract made by evaporating the decoction, in one-quarter or one-half the quantity. The inspissated juice of the fresh leaves was formerly very commonly prescribed; but the alcoholic extract is now almost exclusively used, the dose being half a grain (0.032 Gm.). (See *Extractum Stramonii*.)

Dose, of the leaves, one to three grains (0.065-0.2 Gm.).

Off. Prep.—*Extractum Stramonii* (Pilular and Powdered), *U. S.*; *Tinctura Stramonii*, *U. S.*, *Br.*; *Unguentum Stramonii* (from Pilular Extract), *U. S.*; *Fluidextractum Stramonii*, *N. F.*

Strychnos Potatorum L. *Chilbinj. Cleaning Nuts. Indian Gum Nuts.* (Fam. *Loganiaceae*).—The nuts of this species of *Strychnos* are very largely used in some parts of India for clearing muddy water, and are stated to have found their way into American commerce. (*A. J. P.*, 1871.) The fruit is also employed by the native practitioners of Hindostan, under the name of *nirmali*, as an *emetic* and in *dysentery*. They do not contain strychnine. In clearing water, one of the dried nuts is rubbed hard for a short time around the inside of the earthen water pot; on settling, the water is left pure and tasteless. The seeds contain a large quantity of an albuminous principle, upon which their virtues probably depend. The tree, which grows to a very large size, produces a shining, black, one-seeded berry (that of the *nux vomica* being many-seeded). The seeds are described (*P. J.*, 1871, 44) as broadly lenticular, about half an inch in diameter and a quarter of an inch in thickness, of a dirty whitish-gray color,

and covered with a thick coating of delicate appressed hairs. These are so small that the seed to the naked eye looks mealy. Under the microscope the hairs are seen to be agglutinated in groups of from three to six, and to consist each of a single pointed cylindrical cell.

Stylophorum. *Stylophorum diphyllum* (Michx.) Nuttall. (Fam. *Papaveraceae*.)—This plant, commonly known as "*Celandine Poppy*," is found in damp woods from western Pennsylvania to Wisconsin and Tennessee. In its foliage and flowers it resembles *Chelidonium majus*. According to E. Schmidt, the root contains *chelidonine*, with a second alkaloid closely related to, if not identical with, *chelerythrine*. (*A. J. P.*, 1888.)

Stylosanthes. *Stylosanthes biflora* (L.) B. S. P. (Fam. *Leguminosae*.) —This low, branching perennial has wiry stems, 3-foliolate leaves and small yellow flowers. It is found in the pine barrens of the Eastern and Central United States and it is asserted that it possesses the power of relieving abdominal uterine pains during the latter months of gestation, and is also a uterine tonic during parturition. Dose, of the fluidextract, from ten to twenty minims (0.6-1.3 mils) three times a day.

STYRAX. U. S. (Br.)

STORAX [Liquid Storax]

"A balsam obtained from the wood and inner bark of *Liquidambar orientalis* Miller (Fam. *Hamamelidaceae*)." *U. S.* "Prepared Storax is a viscid balsam obtained from the wounded trunk of *Liquidambar orientalis*, Mill., purified by solution in alcohol, filtration, and evaporation of the solvent." *Br.*

Styrax Praeparatus, *Br.*; Prepared Storax; Styrax Liquidus, Balsamum Storacis, Balsamum Styracis, Balsamum Styrax Liquidua; Styrax liquide, *Fr. Cod.*; Styrax, *P. G.*; Storax, Flussiger Storax, *G.*; Storace liquido. *It.*; Estoraque liquido, *Sp.*

All species of the genus *Liquidambar* as well as those of a related genus, *Altingia*, yield *storax*. The product most valued, however, is that obtained from *L. orientalis* Miller.

The *oriental sweet-gum* (*Liquidambar orientalis*) is a tree from twenty to forty feet high. The palmate leaves have each of their divisions obscurely three-lobed, and are serrate, perfectly smooth, bright green and shining on the upper and pale on the under surface. The tree is a native of Asia Minor, in the southwestern parts of which it forms large forests. It yields the so-called *liquid storax*.

According to the researches of Moeller, storax is a pathological rather than a physiological product; when the young wood is injured secretion reservoirs are formed in which the storax is produced. (*O. Z.*, 1.) In collecting the drug the outer bark is first heavily bruised, so as to injure the inner bark, and after a time the outer bark having been removed the inner bark is scraped off. According to Maltass, this inner bark is first pressed cold in horse-hair bag's, after which hot water is thrown over the bags and they are again pressed. Lieutenant Camp-bell states that the inner bark is first boiled with water, and, a portion of the balsam which rises having been skimmed off, is then pressed so as to extract the remainder. The residuary bark, after expression, is dried in the sun, and employed in various parts of Turkey for fumigation. It is the drug known in commerce as *Storax bark* or *Cortex Thymiamatis*. (Han-bury, P. J., 1857, xvi, 463.) The balsam is sent in casks to Constantinople, Smyrna, and other ports of the Levant.

Several kinds of storax have been described. The purest was the *storax in grains*, which was in whitish, yellowish-white, or reddish-yellow tears, about the size of a pea, opaque, soft, adhesive, and capable of uniting so as to form a mass. Another variety, formerly called *styrax calamita*, from the circumstance, it is supposed, that it was brought wrapped in the leaves of a kind of reed, consisted of dry and brittle masses, formed of yellowish agglutinated tears, in the interstices of which was a brown or reddish matter. The French call it *storax amygdaloide*. This and the preceding variety had a pleasant odor like that of vanilla. Neither of them, however, is now found in the markets. It is probable that one or both of these varieties may have been the product of *Styrax officinale*. A third variety, which was formerly seen in commerce, *styrax calamita*, was in brown or reddish-brown masses of various shapes, light, friable, yet possessing a certain degree of tenacity, and softening under the teeth. Upon exposure, it becomes covered upon the surface with a white efflorescence of styracin. It evidently consisted of sawdust, united with a portion of the balsam. As found in commerce, it was usually in the state of a coarse, soft, dark-colored powder, mingled with occasional light friable lumps of various sizes, and containing very little of the balsam. When good, it should yield, upon pressure between hot plates, a brown resinous fluid having the odor of storax. Hanbury states that some of this variety is prepared at Trieste, Venice, and Marseilles, by mixing the residue of the liquidambar bark remaining after expression, and reduced to coarse powder, with genuine liquid storax. (*P. J.*, April, 1863.)

American Storax, *Liquidambar styraciflua*, or *Sweet Gum* of our Southern States.—Its geographical range reaches into Mexico, and it yields a storax-like product in an abundance proportionate to the heat of the climate. A specimen from Guatemala is described by Fliickiger and Hanbury as a yellow, opaque resin, of honey-like consistence, becoming transparent, amber-colored, and brittle by exposure to the air, and having a rather terebinthinous balsamic odor and but little taste. Sometimes it occurs as a thick golden-brown fluid. It contains cinnamic acid and styracin. (*A. J. P.*, 1874, p. 161.) It is soluble in alcohol, and has been gathered to a considerable extent in the United States for the preparation of chewing gum. The resins of *Liquidambar formosana* and *L. altigiana* are known in Eastern commerce. *Malay storax* is an aromatic resinous product obtained from the *Altingia excelsa* Noronha (*L. altigiana* Bl.) It is sometimes called rasamala resin and contains tannic acid besides a very minute amount of cinnamic and benzoic acids.

A fourth variety, which, under the name of *liquid storax*, is the one commonly used, is a semi-fluid, adhesive substance, brown or almost black upon the surface exposed to the air, but of a slightly greenish-gray color within, and of an odor somewhat like that of balsam of Peru, though less agreeable. It is kept in jars.

Properties.—The storax used by pharmacists should correspond to the following official description and tests: "Storax is a semi-liquid, grayish, sticky, opaque mass, depositing" on standing a heavy, dark brown stratum; transparent in thin layers, and having a characteristic odor and an acrid taste. It is heavier than water. It is insoluble in water, but completely soluble (with the exception of accidental impurities) in an equal weight of warm alcohol; almost completely soluble in ether, acetone, benzene, or carbon disulphide. When heated on a water-bath, Storax becomes more fluid, and if it is then agitated with warm, purified petroleum benzin, the supernatant liquid, on being decanted and allowed to cool, is not darker than pale yellow and deposits white crystals of cinnamic acid and cinnamic esters. The separated crystals evolve the odor of benzaldehyde when heated with diluted sulphuric acid and potassium permanganate. Incinerate about 0.5 Gm. of Storax; not more than 1 per cent. of ash remains. Dissolve about 10 Gm. of Storax, accurately weighed, in 20 mls of hot alcohol; the undissolved residue, after washing it on a filter with hot alcohol and drying at 100° C. (212° F.), does not exceed 2.5 per cent. The combined filtrate and

washings, after the evaporation of the alcohol at a temperature not exceeding 60° C. (140° F.) and drying the residue for one hour at 100° C. (212° F.), leave a brown, transparent, semi-liquid product representing not less than 60 per cent. of the weight of Storax taken; this product is soluble in ether, with the exception of a few flakes, but only partially soluble in purified petroleum benzin. Dissolve about 1 Gm. of Storax, purified as described above, and accurately weighed, in 50 mils of alcohol, add 0.5 mil of phenolphthalein T.S., and titrate with half-normal alcoholic potassium hydroxide V.S. The acid value so obtained is not less than 56 nor more than 85 (see Part III, Test No. 10). Mix about 1 Gm. of Storax, purified as described, and accurately weighed, in a 250 mil flask with 50 mils of purified petroleum benzin, add 25 mils of half-normal alcoholic potassium hydroxide V.S. and allow the mixture to stand twenty-four hours, with frequent shaking. Then add 0.5 mil of phenolphthalein T.S. and titrate with half-normal hydrochloric acid V.S. It shows a saponification value of not less than 170 nor more than 230 (see Part III, Test No. 9)." *U. S.*

As found in commerce, storax is usually so much adulterated as to require purification before it can be used, and in both Pharmacopoeias processes were formerly given. Whenever not originally pure enough for use, it should be dissolved in alcohol, the solution strained, and the alcohol distilled off to a certain extent, and then completely evaporated at a gentle heat. Among the substances used in the adulteration of storax is turpentine. To detect it Hager employed the following method. He liquefied the resin, in a tube, by means of a water bath, added half its volume of absolute alcohol, and hastened the solution by agitation; he then treated it with several volumes of benzin. This operation was repeated twice. The liquors obtained were then evaporated, in a tared vessel, and there was secured, for pure storax, a colorless residue (45 to 55 per cent.), with a light-blue opalescence; for that mixed with turpentine, a residue more considerable, yellowish, and having the terebinthinate odor. (*J. P. C.*, Fev., 1876, p. 161.) The quality of storax at present on the market appears to be very much inferior to what it was a few years ago. It is stated (*P. J.*, 1911, Ixxxvii, p. 86) that whereas in 1907 the commercial storax averaged about 19 per cent. of cinnamic acid with an acid number of 68.9, that upon the market in 1911 contained only about 2.5 per cent. of cinnamic acid, and had an acid number around 100. It is not improbable that this deterioration is due to the extraction of cinnamic acid before it is marketed.

Storax melts with a moderate heat, and, when the temperature is raised, takes fire and burns with a white flame, leaving a light, spongy, carbonaceous residue. It imparts its odor to water, which it renders yellow and milky. Its active constituents are dissolved by alcohol and ether. Neumann obtained from 480 grains of storax 120 of aqueous extract, and from an equal quantity 360 grains of alcoholic extract. Containing volatile oil and resin, and yielding ben-oic or cinnamic acid by distillation, it is entitled to rank as a balsam.

The most abundant constituent of storax is probably *storesin*, $C_{36}H_{55}(OH)_3$, discovered in 1877 by W. von Miller. This is present in two forms, designated respectively alpha and beta, both free and in the form of a cinnamic ester. Storesin is an amorphous substance, melting at

168° C. (334.4° F.), readily soluble in petroleum benzin. *Cinnamic esters of phenylpropyl, cinnamic ester of ethyl, cinnamic ester of benzyl, and especially cinnamate of cinnamyl*, $C_9H_7O_2.C_9H_9$, the so-called *styracin* of Bonastre, have also been observed. This last compound can be removed by ether, benzene, or alcohol after the separation from the resin of the cinnamic acid; it is insoluble in water, and volatile only in superheated steam. It crystallizes in tufts of long rectangular prisms, which melt at 38° C. (100.4° F.), but frequently do not solidify readily. By concentrated solution of potassium hydroxide, it is resolved into a cinnamate and cinnamic alcohol (*styrone*), $C_9H_{10}O$, which latter is not present in liquid storax. The yield of cinnamic acid varies from 6 to 12 per cent., or even, according to Lowe, as much as 23 per cent. of crystallized cinnamic acid can be obtained. The acid dissolves abundantly in ether, alcohol, or hot water, slightly in cold watery it is inodorous, but has an acrid taste. It fuses at 133° C. (271.4° F.), and boils at 290° C. (554° F.). Another minor constituent of storax is a fragrant substance melting at 65° C. (149° F.), and possessing the odor of vanillin, which Rump (*Ber. d. Chem. Ges.*, 1878, 1034) identified. Miller also shows that water removes from the drug a little free benzoic acid. There is further found in liquid storax a hydrocarbon, C_8H_8 , first prepared by Simon in 1839, which exists in the resin as a liquid, and also in a polymeric form as a solid. The former, called styrol, styrene, or cinnamene styrene, has a sp. gr. of 0.924, and a boiling point of 146° C. (294.8° F.). It is a colorless, mobile liquid, possessing the odor and burning taste of liquid storax. It has since been formed synthetically, and has been recognized as *phenylethylene*, $C_6H_5.CH=CH_2$. When

heated for a considerable time to 100° C. (212° F.), or for a shorter period to 200° C. (392° F.), it is converted without change of composition into the colorless, transparent solid *metastyrol*, which, unlike styrol, is not, soluble in alcohol or in ether. Lastly, there has been found in liquid storax, by J. H. van t'Hoff (1876), about 0.4 per cent. of a pleasant-smelling laevo-rotatory oil of the formula C₁₀H₁₆O. (*Pharmacographia*, 2d ed., 274 and 275.) Tschirch and L. v. Itallie (*A. Pharm.*, Sept., 1901, 506) state that styrax contains free cinnamic acid, vanillin, styrol, styracin, cinnamic acid-ethyl ester, cinnamic acid-phenyl-propyl ester and storesinol partly free and partly as cinnamic acid ester.

Uses.—Styrax is a stimulating expectorant and feeble antiseptic, which was at one time used in various *pulmonic catarrhs*, also in *gonorrhoea* and *leucorrhoea*, but at present is very seldom used except as a constituent of the compound tincture of benzoin. Externally, mixed with two or three parts of olive oil, liquid storax was found by H. Schultze, of Magdeburg, to be very effective as a local remedy in scabies.

Dose, ten to twenty grains (0.65-1.3 Gm.).

Off. Prep.—Tinctura Benzoini Composita, *U. S.*, *Br.*

SUCCI

JUICES

Sues vegetaux, *Fr.*; Pflanzensaft, *G.*

Though introduced to professional notice by Squire in the year 1835, and subsequently used by many practitioners, the juices were recognized but once by the U. S. Pharmacopoeia (1870). They consist of the expressed juices of fresh plants, preserved by the addition of one-third of their bulk of alcohol. Considering the great inequality in strength, and, of course, the uncertainty in operation, of fresh juices themselves, varying according to the soil, climate, mode of cultivation, season, and the age of the plant, it may be questioned whether they merit the prominence which has been given them in the past.

SUCCUS LIMONIS. Br.

LEMON JUICE

"Lemon Juice is the freshly expressed juice of the ripe fruit of *Citrus Medica*, Linn., var. *β Limonum*, Hook. f." Br.

Limonis Succus, *U. S. P. VIII*; Succus Citri; Sue de Citron (de Limon), *Fr. Cod.*; Citronensaft, Limonensaft, *G.*; Succo di limone, *It.*; Zumo de limon, *Sp.*

We are supplied with lemons and limes chiefly from the West Indies, the Mediterranean and California. Though the former of these fruits only is directed by the Br., lime juice is recognized by the N. F., and both kinds are employed indiscriminately for most medicinal purposes, and the lime affords a juice at least equal, in proportional quantity and acidity, to that obtained from the lemon.

The seed of the lime contains 58 per cent. of fixed oil, which is said to equal in flavor the best olive oil. Its tendency to resist rancidity is reputed to be very great. ((, 1894, 411.) Lime juice is official in the N. F. IV under the title of *Succus Citri* .

As lemons rapidly deteriorate on keeping, if exposed to the air, the suggestions of protecting them by dipping them in melted paraffin, or by using a varnish of shellac dissolved in alcohol, made by George Mee, of London, are not without value. Mee found that lemons thus covered with varnish continued sound for a period of many months. (See *A. J. P.*, 1866, p. 474.)

The juice is the part for which the fruit is most esteemed. It is sharply acid, with a peculiar grateful flavor, and consists chiefly of water, citric acid (from 6 to 10 per cent.), gum and sugar (from 3 to 4 per cent.), and inorganic salts (2.28 per cent.). It sometimes has in it a little volatile oil, derived by pressure from the rind. It is " a slightly turbid, yellowish liquid. Taste sharply acid. Specific gravity 1.030 to 1.040. 20 millilitres require for neutralisation not less than 20 and not more than 25.7 millilitres of N/1 solution of sodium "hydroxide, corresponding to a proportion of not less than 7 and not more than 9 grammes of citric acid in 100 millilitres. The residue obtained on evaporation, dried at 110° C. (230° F.), yields not more than 3 per cent. of ash. 100 millilitres of Lemon Juice are neutralised by about 11.4 grammes of Potassium

Bicarbonate, by about 9.5 grammes of Sodium Bicarbonate, and by about 16.5 grammes of Sodium Carbonate." *Br.*

The U. S. P. IX does not recognize lemon juice, the U. S. P. VIII provided the following tests: " It reddens blue litmus paper and should contain from 7 to 9 per cent. of citric acid. If a few drops of barium chloride T.S. be added to filtered Lemon Juice, no turbidity or white precipitate should be produced (absence of sulphuric acid or sulphates). If an equal volume of sulphuric acid containing a few drops of alcohol be added to Lemon Juice, and the liquid heated, no odor of acetic ether should be developed (absence of acetic acid). Upon the addition of solution of potassium acetate (1 in 3) and alcohol in excess, no white crystalline precipitate should form after allowing the liquid to stand fifteen minutes (absence of tartaric acid). At least 10 mls of normal potassium hydroxide V.S. should be required to neutralize 10 mls of Lemon Juice, phenolphthalein T.S. being used as indicator." *U. S. VIII.*

As lemons cannot always be obtained, the juice is often kept in a separate state, but, from its liability to spontaneous decomposition, it speedily becomes unfit for medicinal use, and, though various means have been resorted to for its preservation, it can never be made to retain for any length of time its original flavor unaltered. One of the most effectual methods of preserving the juice is to allow it to stand for a short time after expression, until a coagulable matter separates, then to filter, and introduce it into glass bottles, with a stratum of almond oil or other sweet oil upon its surface. It will keep still better if the bottles containing the filtered juice be permitted, before being closed, to stand for fifteen minutes in a vessel of boiling water. Another mode is to add one-tenth of alcohol and to filter. The juice may also be preserved by concentrating it either by evaporation with a gentle heat, or by exposure to a freezing temperature, which congeals the aqueous portion and leaves the juice much stronger than before. When used, it may be diluted to the former strength, but though the acid properties are retained, bottled lemon juice is frequently found to be preserved with sulphur dioxide, which dissolves in it to form sulphurous acid. The presence of this preservative interferes with some of its pharmaceutical uses and such a product should not be employed for medicinal purposes. The flavor of the juice is found to have been deteriorated. Lemon syrup is another form in which the juice is preserved.

The proportion of citric acid in lemon juice varies greatly, ranging from

4.5 to nearly 9 per cent. Stoddart found the acidity to diminish rapidly with the advance of summer, with little change in the sp. gr. of the juice. (P. J., Oct., 1868.) H. H. Robins, after examining large consignments of lemons, states that the average yield of citric acid taken from a year's receipts was 35.23 grains in a fluidounce. (C. D., 1896, 742.) A solution of tartaric acid in water, with the addition of a little sulphuric acid, and flavored with the oil of lemon, has been fraudulently substituted for lemon juice, particularly as an antiscorbutic on long voyages, for which purpose it is quite useless. An application of the test for tartaric and sulphuric acids will at once detect the fraud.

The proportion of citric acid in lime juice is required by the N. F. IV to be not less than 5 Gm. nor more than 10 Qm. to each 100 mils. It is required to be free from sulphuric acid, but is permitted to contain 0.04 Gm. of 802 in each 100 mils. Other preservatives are prohibited as are also artificial colors.

Uses.—Lemon juice is refrigerant, and, properly diluted, forms a refreshing and agreeable beverage in *febrile* and *inflammatory affections*. It may be given with sweetened water in the shape of lemonade, or may be added to the mildly nutritive drinks, such as albumen water, barley water, etc., usually administered in fevers. It is also much employed in the formation of those diaphoretic preparations known by the names of *neutral mixture* and *effervescing draught*. One of the most beneficial applications of lemon juice is to the prevention and cure of *scurvy*, for which it may be considered almost a specific. For this purpose, ships destined for long voyages should always be provided with a supply of the preserved juice. In England every foreign-going ship is required by law to take such a supply of lemon or lime juice that every seaman shall have a daily allowance of an ounce after having been ten days at sea. Its antiscorbutic effects have been found to be due to the presence of one of a class of chemical activators called *vitamines*. It has been employed with advantage in *acute rheumatism* in doses of from one to four fluidounces (30-120 mils) from four to six times a day. Locally applied it acts as an astringent and has been used with benefit in *pruritus of the scrotum*, in *uterine hemorrhage* after delivery, in *sunburn*, and as a gargle in *diphtheritic sore throat*.

Off. Prep.—Syrupus Limonis, *Br.*; Trochiscus Acidi Carbolici, *Br.*

SUCCUS SCOPARII. Br.

JUICE OF BROOM

Sue de Genet a Balais, *Fr.*; Besenginstersaft, *G.*

"Bruise fresh Broom Tops; press out the juice; to every three volumes of juice add one volume of Alcohol (90 per cent.); set aside for seven days; filter." *Br.*

In large doses this juice is prone to disturb the stomach and bowels. It is more appropriately used as an adjuvant to other diuretics than alone.

Dose, as a diuretic, one to two fluidrachms (3.75-7.5 mils).

SUCCUS TARAXACI. Br.

JUICE OF TARAXACUM

Sue de Piasenlit, *Fr.*; Lowenzahnwurzelsaft, Lowenzahnsaft, *G.*

"Bruise Taraxacum Root; press out the juice; to every three volumes of juice add one volume of Alcohol (90 per cent.); set aside for seven days; filter." *Br.*

Dose, two fluidrachms to half a fluidounce (7.5-15.0 mils).

SUMBUL. U. S.

SUMBUL [Musk-root]

"The rhizome and roots of *Ferula Sumbul* (Kauffmann) Hooker filius (Fam. *Umbelliferae*)." U. S.

Sumbul Radix, Br.; Racine de Sumbul, *Fr.*; Sumbulwurzel, Moschuswurzel, *G.*

Under the name of *sumbul* or *jatamansi*, a root has long been used in India, Persia, and other parts of the East, as a perfume, an incense in religious ceremonies, and medicinally. It was the root of a then unknown plant, supposed to be umbelliferous, and, from the character of the root, to grow in low wet places. The plant is said to inhabit no part of British India, but the regions to the north and east of it, as Nepaul,

Bootan, Pucharia, etc. The root is taken northward to Russia, and reaches the rest of Europe through Petrograd. The physicians of Moscow and Petrograd were the first to employ it on the continent of Europe. Granville first introduced it to the notice of the profession in Great Britain and in this country. It has also been imported into England from India, whither it was brought from a great distance. The plant which is now recognized by the U. S. P. as the source of the sumbul is the *Ferula Sumbul* Hooker fil.

Ferula Sumbul was first discovered by the Russian Fedtschenko in 1869, growing at an elevation of 3000 feet in the mountains which separate Russian Turkestan from Bucharia. In 1871 it was described by Kauffmann, who erected a new genus on characters dependent upon the enormous size of the vittae in the immature fruit. The plant has been cultivated in the Moscow botanical gardens, and, less successfully, at Kew, and it has been found that the vittae almost disappear in ripening, and do not afford a good generic character. The plant is a large umbellifer, reaching a height of eight feet, and having a solid, cylindrical, slender stem, which in the upper part gives origin to about twelve slender divaricate branches. The root-leaves are two and a half feet long, with short, channelled, broadly dilated, completely clasping petioles. They are triangular in outline, tripinnate, with the alternate divisions fine. The stem-leaves rapidly decrease in size until they become mere sheathing bracts. The flowers are polygamous, the fruit from three-eighths to one-half inch long by one-fourth inch wide; the mericarps oblong-oval, dorsally much compressed, thin, with three faint, thread-like, dorsal ridges; no dorsal vittae, and commissural ones collapsed. J. E. Aitchison states (*Tr. Linn. Soc.*, ser. 2, Bot., 69) that the root of *Ferula suaveolens*, which has only a faint musky odor, is one of the kinds exported from Persia to Bombay by the Persian Gulf.

Properties.—Sumbul is officially described as "in transverse segments, attaining a length of 10 cm. and a diameter of 7 cm.; externally light brown to dark brown, longitudinally wrinkled and showing in the upper portions a smooth, grayish, epidermal layer, occasionally with the short stem-bases attached; fracture short, fibrous, spongy; internally light yellow or brownish-yellow, arrangement of wood irregular and with yellowish-brown or blackish resinous patches frequently extending over the entire ends of the segments; odor peculiar, musk-like; taste bitter and somewhat aromatic. The powder is grayish-brown; when examined under the microscope it exhibits numerous, irregular, brownish-black

fragments and well-defined isolated tracheae, the latter with distinct end-walls, and, mostly with reticulate thickenings and from 0.03 to 0.1 mm. in width; occasional fragments of polygonal epidermal cells with yellowish-brown walls; numerous, nearly colorless, yellowish-brown and reddish-brown fragments consisting of a granular substance in which the cellular structure is not well defined; long, narrow fragments consisting of more or less collapsed leptome or sieve tissue; occasional fragments of well-defined parenchyma with a few, nearly spherical starch grains, from 0.003 to 0.012 mm. in diameter." *U. S.*

The root has been analyzed by Reinsch and other German chemists, and found to contain volatile oil, two balsamic resins, one soluble in alcohol, the other in ether; wax, gum, starch, a bitter substance soluble in water and alcohol, and an acid which was named *sumbulic acid*, but which Riecker and Reinsch showed to be *angelic acid*, $C_5H_8O_2$, accompanied by a little valeric acid, $C_5H_{10}O_2$. Solution of potassium hydroxide is said to convert the resin into the potassium salt of an acid called szim-bulamic, but which has not been sufficiently investigated. The musk-like odor seems to be connected with the balsamic resins, and probably depends on some principle associated with them not yet isolated. The volatile oil, of which 0.33 per cent. is yielded by distillation, has a taste like that of peppermint. On dry distillation it yields a bluish oil which contains *umbelliferone*. Philip H. Utech (*A. J. P.*, 1893, p. 465) has extracted and purified the resin soluble in alcohol. He obtained it as a soft, whitish, translucent resin which, on drying at $110^\circ C.$ ($230^\circ F.$), yielded a clear, transparent, amber-colored product having a bitter taste and the aromatic odor of the root. It constituted 6.1 per cent. of the drug. J. H. Hahn (*Proc. Penna. Ph. Assoc.*, 1896, 75) found 17.25 per cent. of fixed oil in sumbul.

A proximate analysis reported by Hcyi and Hart (*A. J. P.*, Dec., 1916, p. 546, shows the following results: Moisture, 10.17 per cent.; starch, 7.70 per cent.; pentosans, 10.60 per cent.; crude fiber, 17.15 per cent.; protein, 5.50 per cent.; dextrin, 1.40 per cent.; ash, 6.50 per cent.; sucrose, 1.64 per cent.; reducing sugar, 0.51 per cent., volatile oil, 1.10 per cent.; resins, 17.1 per cent. Alkaloids were not detected. The volatile oil did not show the presence of sulphur. *Umbelliferon* was detected, as was also *betaine*. *Vanillic acid* ($C_8H_8O_4$) was identified in the resinous portion and a phytosterol was also recognized as being present. Acetic, butyric, angelic and tiglic acids were among the volatile acids, while

among the non-volatile acids were oleic, linoleic, tiglic, cerotic, palmitic and stearic.

Uses.—Sumbul is supposed to have a quieting influence on the nervous system and is used in the treatment of various *hysterical* conditions. By many it is believed to have an especial relation to the pelvic organs and it is widely employed in *dysmenorrhea* and allied disorders. It has also been used as a stimulant to mucous membranes not only in *chronic dysenteries* and *diarrheas*, but in *chronic bronchitis*, especially with *asthmatic tendency*, and even in *pneumonia*.

Murawieff, of Russia, prepares the resin, which he considers to be the active principle, by macerating the root first in water, and then in a solution of sodium carbonate, washing it well with cold water, drying it, treating it with alcohol, filtering the tincture, adding a little lime and again filtering, separating the lime by sulphuric acid, agitating with animal charcoal, again filtering, distilling off nearly all the alcohol, mixing the residuum with water, driving off the remaining alcohol, and, finally, washing the precipitate with cold water, and drying it.

Half an ounce of a tincture produced narcotic symptoms, such as confusion of the head, a tendency to snore, even when awake, feelings of tingling, etc., with a strong odor of the medicine from the breath and skin, which continued for a day or two and gradually passed off. (*N. R.*; Oct., 1874, p. 309.)

Dose, one-half drachm to two drachms (2.0-7.7 Gm.).

Off. Prep.—Fluidextractum Sumbul, *U. S.*; Extractum Sumbul, *U. S.*; Tinctura Sumbul, *N. F.*

Sweet Pellitory.—The root of *Tanacetum umbelliferum* Boiss. (Fam. *Compositae*), of India, according to David Hooper, contains pyrethrine in minute proportions with fat and wax, an organic acid which is a pigment, glucose, and inulin. (*P. J.*, xxi, 1890.)

Swietenia. *Swietenia febrifuga* Roxb. (*Soyimida febrifuga* Jugs.) *Rohan Bark*. (Fam. *Meliaceae*.)—The bark of this East Indian tree contains a bitter principle and is said to be much used as an antiperiodic in half drachm (2 Gm.) doses. The extract is used in *dysentery* like kino.

Swietenia Mahogoni Jacq., or *mahogany tree*, which grows in the West Indies and other parts of tropical America, has also a bitter, astringent bark, containing catechin. (*Bull. Soc. Chim. Paris*, xxiv, 118.) The oil of the seeds is said to be used as a

purgative in the West Indies. The bark of *S. senegalensis* Desv. (*Khayasenegalensis* A. Juss.), *Juribali* bark, is used on the coast of Africa in the cure of *intermittents*, and Cavehtou extracted an alkaloid from it. (Am. J. M. S., N. S., xx, 168.)

Symphytum. *Symphytum officinale* L. *Comfrey*. *Blackwort*. *Briussewort*. *Radix Symphiti*. *Radix Consolidae Majoris*. *Consoude*, Fr. *Schwarzwurzs*, *Beinwurz*, G.—A perennial, European plant often cultivated. Its root is spindle-shaped, branched, often more than 2.5 cm. thick and 3 dm. long, externally smooth and blackish, internally white, fleshy, and juicy. By drying it becomes wrinkled, of a firm, horny consistence, and of a dark color within. It is almost inodorous, and has a mucilaginous, feebly astringent taste. Titherley and Coppin in 1912 found 0.8 per cent. of *allantoin*, $C_4H_6N_4O_3$, in the rhizome. It contains mucilage in great abundance (according to Lewis, more than althsea, root), and a little tannin. It was formerly highly esteemed as a vulnerary. According to Maealister (*B. M. J.*, Jan. 6, 1912), *allantoin*, in aqueous solution in strengths of 0.3 per cent. has a powerful action in hastening epithelial formation, and is a valuable remedy not only in external ulceration, but also in *ulcers of the stomach* and duodenum. Comfrey is a demulcent, and is used domestically in *chronic catarrhs*, *consumption*, and other lung diseases.

Symplocos. *Symptoms racemosa* Roxb. (Fam. *Styraceae*.)—The bark of this East Indian tree is said to be a mild astringent, and especially useful in menorrhagia. (*P. J.*, Sept. 24, 1881.)

Syringa. *Syringa vulgaris* L. *Common Lilac*. (Fam. *Oleaceae*.)—The leaves and fruit of this common garden plant have a bitter and somewhat acid taste, and have been used as tonics and antiperiodics. Petroz and Robinet found in the fruit a sweet and a bitter principle. The latter was afterwards obtained pure by Meillet, who gave it the name of *lilacin*, and by Bernays, who called it *syringin*. It has been investigated by Kromayer (*A. Pharm.* (2), cxiii, 19), who established its glucosidal character, gave it the formula $C_{17}H_{24}O_9 + H_2O$, and showed its identity with the *ligustrin* of Poley. It forms long, white, stellate needles, which are tasteless, easily soluble in hot water and alcohol, insoluble in ether. The crystals become anhydrous at 115° C. (239° F.), and fuse at 212° C. (413.6° F.). As an antipyretic and anti-periodic drug it is said to be very valuable, especially when administered in the relapsing fever of *malaria*. On heating with dilute acids it breaks up into *syringenin*, $C_{11}H_{14}O_4$, and a fermentable glucose. The *syringenin* (which has been recognized as *oxy methyl coniferin*) is a light, rose-red amorphous mass, soluble in alcohol, insoluble in water and ether.

SYRUPI.

SYRUPS

Sirops, Fr. *Cod.*; Sirupi, P. G.; Sirupe, G.; Sciroppi, It., Jarabe, Sp.

Syrups are concentrated solutions of sugar in aqueous fluids, either

with or without medicinal impregnation. When the solution is made with pure water, it is named *syrup* or *simple syrup*; when made with water charged with one or more medicinal agents, it is called in general terms a *medicated syrup*, and receives its special designation from the substance or substances added.

Medicated syrups are prepared by dissolving sugar in infusions, vinegars, decoctions, expressed juices, fermented liquors, or simple aqueous solutions, or by adding a medicating substance, like a tincture or a fluidextract, to simple syrup. When the active matter of the vegetable is not readily soluble in water, is associated with soluble matter which it is desirable to avoid, or is volatilized or decomposed by a heat of 100° C. (212° F.), it is sometimes extracted by diluted alcohol, the spirituous ingredient of which is subsequently driven off.

The process of percolation has been applied for the solution of the sugar and is offered as an alternative process in a number of official preparations. This process offers several advantages over the older methods. The amount of labor attending the operation is greatly reduced, no heat is employed so that volatile constituents are not injured, and the finished syrup is filtered and protected from the usual contaminations attending straining, etc.

The quality and quantity of the sugar employed are points of importance. Official granulated sugar should be employed and although the commercial grades are usually of good quality it is possible to secure a sugar of better grade, known as "druggists' dry granular" or "crystal A," which is obtained from the first runnings from the bone-black filters. In this sugar the crystals are large and the syrup is unusually free from yellowish tint, even in a heavy strata. The syrup made from this sugar is often sold as "Rock Candy Syrup."

In relation to the quantity of sugar, if in too small proportion, fermentation is apt to occur; if too abundant, crystallization. The Pharmacopoeial formula calls for 850 Gm. of sugar to make 1000 mils of syrup, the amount of water required being about 465 mils. A somewhat smaller quantity will answer where an acid, such as lemon juice or vinegar, is used.

As it is desirable, in many instances, that the active matters should be in as concentrated a state as possible in the syrup, it is often necessary

to evaporate a large proportion of the aqueous fluid in which they are dissolved. This may be done either before the addition of the sugar or afterwards. In either case care is requisite not to apply a heat too great or too long continued, lest the active principles should be injured. The use of concentrated pharmaceutical preparations, such as tinctures and fluidextracts, as the source of medication, has largely replaced other methods. The proper point of concentration for syrups which are prepared on a large scale by boiling is best ascertained by/the use of that variety of Baume's hydrometer called a *saccharometer*. This should stand at 30° in boiling syrup—30.5° in hot weather and at 35° in the syrup when it is cool. Another very accurate, though less ready, method is to ascertain the sp. gr. by weighing a portion of the liquid. Syrup, when boiling, should have a sp. gr. of about 1.261; at 25° C. (77° F.) about 1.313; this is the specific gravity of the official syrup. A third method of ascertaining the proper point of concentration is by the thermometer, which, in boiling syrup of the proper consistence, stands at 105° C. (221° F.). This indication is founded on the fact that the boiling point of syrup rises with the increase of its density.

When carefully prepared with the best refined sugar, syrups made by the hot process or by agitation in the cold usually require no other clarification than to remove any scum which may rise to their surface upon standing, and to pour them off from any dregs which may subside. But, as the sugar employed is seldom free from impurities, it may be best, as a rule, to remove the scum as it rises during the heating process, and to strain the syrup while hot through muslin or flannel. The percolation process avoids this necessity. Should syrups at any time lack the due degree of transparency, they may be filtered through paper if a hot water funnel is used, or, when likely to be injured by this treatment, may be clarified by other mechanical means, as mentioned under the head of *Syrupus*. The vicious habit practised not long ago by sugar refiners of "blueing" sugars by the use of ultramarine and other coloring agents cannot be too strongly deprecated, and it is a great benefit to pharmacy that this practice has been discontinued by most sugar refiners. (See *A. J. P.*, 1901, 119.)

The medicated syrups are liable to undergo various alterations, according to their nature and mode of preparation. The acid syrups, when too much boiled, often show a copious white deposit, which is invert sugar produced by the action of the acid upon the sugar. Even at ordinary temperatures, acids slowly convert common sugar into invert

sugar, which, being less soluble than the former, is often deposited in the form of crystalline grains. Excessive acidity soon causes a darkening of the syrup, due to caramelization of the sugar. Syrups containing too little sugar are subject to fermentation, in consequence of the presence of yeast cells. Those which contain too much, deposit a portion in the crystalline state, and the crystals, attracting the sugar remaining in solution, gradually weaken the syrup, and render it liable to the same change as when originally made with too little sugar. The want of due proportion of saccharine matter frequently also gives rise to mouldiness, when air has access to the syrup. It is said that syrups enclosed, while they are still hot, in bottles which are not full are apt to ferment, but if in well filled bottles they will generally keep better. When syrups undergo the vinous fermentation, they become covered at the surface with froth, produced by the disengagement of carbon dioxide, and acquire a vinous odor from the presence of alcohol, while their consistence is diminished by the loss of a portion of the sugar, which has been converted into that liquid. When the quantity of alcohol has increased to a certain point, the fermentation ceases, or goes on more slowly, owing to the preservative influence of the alcohol. Such syrups should never be used for pharmaceutical purposes, as no amount of rebelling can render them fit for use.

The percolation method for preparing syrups has come into general use. For some syrups it is to be preferred to the usual method of heating, and all syrups which contain a volatile principle, or one likely to be injured by heat, are preferably made by *percolation*. L. Orynski (*D. C.*, March, 1871) first drew attention to the subject. The details of the official method are given below. It was first recommended that a small piece of sponge should be used to close the lower orifice of the percolator, but this has advantageously been replaced by purified cotton. Some experience is necessary in adjusting the cotton, but the proper degree of pressure is soon learned.

To be successful in using the process, care in several particulars must be exercised. (1) The percolator should be cylindrical or semi-cylindrical, and cone-shaped as it nears the lower orifice. (2) The sugar must be coarse, else it will form into a compact mass, which the liquid cannot permeate. (3) The sponge or pledget must be introduced with care. If pressed too tightly in, it will effectually stop the process; if inserted too loosely, the liquid will pass too rapidly, and will, in consequence, be weak and turbid (not properly filtered). See also a practical paper on

this subject in *A. J. P.*, Jan., 1881, by G. H. Chas. Klie, and *Bull. Pharm.*, 1902, 1248. For a paper on *Fruit Syrups*, see *West. Drug.*, 1902, 182; *Proc. Penn. Pharm. Assoc.*, 1903, 196.

Syrups may be made (without heat) *rapidly* by putting the ingredients in a churn and agitating briskly.

"Rock Candy Syrup," the evaporated mother liquor left after crystallizing sugar in the form of large crystals, called "rock candy," has come largely into use in America. It varies much in quality as made by various manufacturers, and often contains added glucose. It should never be used indiscriminately or for making the official syrups, and it should always be carefully tested before being used for any purpose. (See analyses by L. F. Kebler, in *A. J. P.*, 1895, 143.)

At best, syrups are apt to change, and various measures have been proposed for their preservation, but the best plan is to make small quantities of syrups at a time, and to keep them, unless when wanted for immediate use, in bottles quite full and well stoppered, which should be put in the cellar or other cool place. Glycerin is often used to aid in the preservation of syrups; in special cases this may be advantageous, but the solvent properties of glycerin must be remembered, and the finished preparation may possess properties (due to the glycerin) which are not found in syrups made without glycerin, and which may therefore be injurious in prescriptions. (See *West. Drug.*, 1898, 444.)

SYRUPUS. U.S.,Br.

SYRUP [Sirup, Simple Syrup]

Syrupus Simplex; Syrupus Sacchari s. Albus; Sirop de Sucre, *Fr. Cod.*; Sirop simple, *Fr.*; Sirupus simplex, *P. G.*; Weisser Sirup, *G.*; Sciroppo semplice. *It.*; Jarabe simple, *Sp.*

"Sugar, in dry crystalline granules, eight hundred and fifty grammes [or 29 ounces av., 430 grains]; Distilled Water, a sufficient quantity, to make one thousand mils [or 33 fluid-ounces, 6 $\frac{1}{2}$ fluidrachms]. Place at the bottom of a glass percolator of suitable size, a layer of purified cotton about one-half inch in thickness, well fitted to the sides of the percolator, and moisten it with a little distilled water. Introduce the sugar into the percolator, make its surface level without shaking or

jarring, then carefully pour upon it four hundred and fifty mils [or 15 fluidounces, 104 minims] of distilled water and regulate the flow of the liquid, if necessary, so that it passes out in rapid drops. Return the first portion of the percolate until it runs through clear and, when all of the liquid has passed, follow it by distilled water, added in portions, so that all of the sugar may be dissolved and the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly. Syrup may also be prepared in the following manner: Dissolve the sugar with the aid of heat in four hundred and fifty mils [or 15 fluidounces, 104 minims] of distilled water, raise the temperature to the boiling point, strain the liquid, and pass enough distilled water through the strainer to make the product, when cold, measure one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Mix thoroughly. Syrup thus prepared has a specific gravity of about 1.313 at 25° C. (77° F.)." *U. S.*

" Refined Sugar, 1000 grammes; Distilled Water, sufficient to produce 1500 grammes. Heat together until dissolved; add sufficient Distilled Water to produce the required weight. Specific gravity 1.330. Optical rotation + 56° to + 58°" *Br.*

This syrup, when properly prepared, is inodorous, of a sweet taste without peculiar flavor, thick, viscid, nearly colorless, and perfectly transparent. It sometimes requires straining through muslin or it may be filtered through a pledget of cotton or often through paper.

From the observations of Maumene, it appears that a solution of pure cane sugar, when long kept, undergoes a molecular change analogous to that produced by the reaction of weak acids, the saccharine liquid becoming brown when boiled with potassium hydroxide. But, as this phenomenon is exhibited alike by uncrystallizable sugar and by glucose, the experiment does not determine which of those forms of saccharine matter has been produced. (*C. R. A. S.*, xxxix, 914.) Procter observed a similar change in simple syrup which had been kept in his cabinet for six years. (*A. J. P.*, xxvii, 430.) Schaeuffele, having noticed, on one occasion, in the preparation of simple syrup, that the foam exhibited a singular blue color, while a part of the cane sugar was rapidly transformed into the uncrystallizable variety, made investigations as to the cause, and was led to the conclusion that it was the presence of indigo in the loaves of sugar, introduced with the view of giving brilliancy and whiteness, but this conclusion was erroneous, as

it is well known that *ultramarine*, and not indigo, was formerly used for this purpose. The presence of a blue coloring matter in sugar was frequently noticed in this country; syrup made from such sugar was not colorless, and in a short time deposited a dark-colored sediment. Colorless "rock candy" forms' an excellent source for pure syrup (the broken crystals can be procured cheaply from the manufacturers), and syrup entirely free from impurities is required in making such preparations as syrup of hydriodic acid, syrup of ferrous iodide, etc. Joseph L. Mayer (*J. A. P. A.*, 1916, p. 712) shows that it is unfair to assume that commercial glucose is present as an adulterant of syrup, simply because it contains reducing sugar, for in a series of experiments conducted by him, working with both cold process and hot process syrups, the amount of invert sugar found after standing for one year, ranged from about 8 per cent. to over 40 per cent., depending entirely on the length of time of standing. The grade of granulated sugar known as "crystal A" or as "Druggists' Dry Granular," is used with success in some parts of the country where it can be readily obtained. It is crystallized from the first runnings from the bone-black filters.

Syrup is very useful in the formation of pills and mixtures, and in various other pharmaceutical operations in which sugar in solution is required.

The U. S. syrup is practically identical with that formerly official, being a trifle stronger, the sp. gr. being given as 1.313 at 25° C. (77° F.). That of the Br. syrup is 1.330 at 15.5° C. (60° F.), probably adapted to the climate of Great Britain, which is not so cold in winter as is ours, at least in the Northern and Middle States.

SYRUPUS ACACIÆ. U. S.

SYRUP OF ACACIA Syr. Acac.

Syrupus Gummosus; Sirop de Gomme, *Fr. Cod.*; Gummisirup, *G.*; Sciroppo di gomma arabica. *It.*; Jarabe de goma, *Sp.*

"Acacia, in selected pieces, one hundred grammes [or 3 ounces av., 231 grains]; Sugar, eight hundred grammes [or 28 ounces av., 96 grains]; Distilled Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Place the acacia in an enameled or

porcelain dish, and add four hundred and thirty mils [or 14 fluidounces, 259 minims] of distilled water, and stir occasionally until the acacia is dissolved; then, having added the sugar, place the dish on a water bath and apply heat, gradually increasing the temperature until the water in the water bath boils. Maintain this temperature for fifteen minutes, and stir the syrup from time to time until the sugar is dissolved. Strain the syrup while hot, add sufficient distilled water, recently boiled, to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms], and transfer it, while yet hot, into small bottles which have been rinsed with boiling water and heated in an oven at 160° C. (320° F.) for from fifteen to thirty minutes. Close the bottles tightly with rubber stoppers which have been just previously boiled in water for thirty minutes and cap them with paper." *U. S.*

In the 18th edition of this work the process of the *U. S. P.*, 1890, was condemned because of the tendency of the mucilage of acacia to spoil and thus make an unreliable syrup; the *U. S. P.* (9th Rev.) provides for a practically permanent preparation by the sterilization of the syrup, the containers, and the stoppers. This syrup is useful in the preparation of mixtures, pills, and troches, and is a good demulcent; but, unfortunately, the proportion of the gum to the sugar is too small to meet all the indications calling for the conjoint use of these substances. To avoid fermentation, C. B. Mann commends the use of one fluidounce of glycerin and seven fluidounces of water as the solvent. If the mucilage of acacia be made with chloroform water or a trace of chloroform be added to syrup of acacia, fermentation is measurably retarded, but the present official method is satisfactory for the purpose.

Off. Prep.—Syrupus Morphines et Acacise, *N. F.*

SYRUPUS AROMATICUS. Br.

AROMATIC SYRUP

Sirop Aromatique, *Fr.*; Aromatischer Sirup, *G.*

"Tincture of Orange, 250 millilitres; Cinnamon Water, 250 millilitres; Syrup, 500 millilitres. Mix the Tincture of Orange and Cinnamon Water; shake the mixture with a little powdered talc; filter; add the Syrup." *Br.*

This preparation of the Br. Ph., 1898, is practically a simple elixir (see *Elixir Aromaticum*); it has been introduced mainly as a vehicle or adjuvant.

SYRUPUS AURANTII. U. S., Br.

SYRUP OF ORANGE Syr. Aurant

Syrup of Orange Peel; Sirop d'Ecorce d'Orange amere, *Fr. Cod.*; Sirupus Aurantii Corticifs, *P. G.*; Pomerantenschalen-Sirup, Orangenschalensyrup, *G.*; Sciroppo di arancio amaro, *It.*; Jarabe de corteza de naranja amarga, *Sp.*

"Tincture of Sweet Orange Peel, fifty mils [or 1 fluidounce, 331 minims]; Citric Acid, five grammes [or 77 grains]; Purified Talc, fifteen grammes [or 231 grains]; Sugar, eight hundred and twenty grammes [or 28 ounces av., 405 grains]; Distilled Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Triturate the Purified Talc in a mortar with the tincture, add gradually four hundred mils [or 13 fluidounces, 252 minims] of distilled water, filter, and add sufficient distilled water through the filter to obtain four hundred and fifty mils [or 15 fluidounces, 104 minims] of filtrate; in this filtrate dissolve the citric acid and sugar by agitation without heat, and -add sufficient distilled water to make the product measure one thousand mils' [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly." *U. S.*

"Tincture of Orange, 125 millilitres; Syrup, sufficient to produce 1000 millilitres. Mix." *Br.*

The U. S. P. IX process is an improvement over all preceding formulas as the flavor is derived from the tincture of fresh orange peel and the alkaline magnesium carbonate of the U. S. P. VIII, which modified the flavor, has been replaced by inert talc, the latter being used as a distributing and filtering medium. The British preparation, which is a mere mixture of the tincture with syrup, is inferior. The syrup has an agreeable, slightly acid flavor, for which it is alone employed. For a process by E. E. Williams, using powdered pumice to disintegrate the orange peel, see *D. C.*, 1898, 125.

SYRUPUS AURANTII FLORUM. U. S. (Br.)

SYRUP OF ORANGE FLOWERS Syr. Aurant. Flor.

Syrupus Aurantii Floris, *Br.*; Sirop de Fleur d'Oranger, *Fr. Cod.*; Pomeranzenbluthensirup, *G.*; Jarabe de azahar, *Sp.*

"Sugar, eight hundred and fifty grammes [or 29 ounces av., 430 grains]; Orange Flower Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Dissolve the sugar in four hundred and fifty mils [or 15 fluidounce's, 104 minims] of orange flower water by agitation, without heat, add enough orange flower water to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms], mix thoroughly and strain. Syrup of orange flowers may also be made in the following manner: Prepare a percolator in the manner described under Syrupus. Pour four hundred and fifty mils [or 15 fluidounces, 104 minims] of orange flower water upon the sugar, return the first portions of the percolate until it runs through clear, and, when all the liquid has passed, follow it by orange flower water, until the sugar is all dissolved and the product measures one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Mix thoroughly." U.S.

"Orange-flower water of commerce, undiluted, 150 millilitres; Refined Sugar, 300 grammes; Syrup, sufficient to produce 1000 millilitres. Mix the orange-flower water with the Refined Sugar in a closed vessel; stand in a moderately warm place, shaking occasionally till dissolved; then add sufficient Syrup to produce the required volume." *Br.*

The second U. S. process, by percolation, will be preferable here. This syrup is used chiefly for flavoring mixtures.

SYRUPUS CASCARÆ AROMATICUS. Br.

AROMATIC SYRUP OF CASCARA

Sirop aromatique de Cascara Sagrada, *Fr.*; Aromatischer Amerikanisch-Faulbaumrindensirup, *G.*

"Liquid Extract of Cascara Sagrada, 400 millilitres; Tincture of Orange, 100 millilitres; Alcohol (90 per cent.), 50 millilitres; Cinnamon Water, 150 millilitres; Syrup, sufficient to produce 1000 millilitres. Mix." *Br.*

This was a new syrup in the Br. Pharm., 1898. It forms a convenient means of administering cascara, the alcohol being added to aid its preservation.

Dose, from one-half to two fluidrachms (1.8-7.5 mils).

SYRUPUS IPECACUANHÆ.

U.S. SYRUP OF IPECAC Syr. Ipecac.

Sirop d'Ipecacuanha, *Fr. Cod.*; Sirupus Ipecacuanhae, *P. G.*; Brechwurzelsirup, Ipecacuanhasirup, *G.*; Sciroppo di ipecacuanha, *It.*; Jarabe de ipecacuana, *Sp.*

"Fluidextract of Ipecac, seventy mils [or 2 fluidounces, 176 minims]; Acetic Acid, ten mils [or 162 minims]; Glycerin, one hundred mils [or 3 fluidounces, 183 minims]; Sugar, seven hundred grammes [or 24 ounces av., 303 grains]; Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Dilute the fluidextract of ipecac with three hundred mils [or 10 fluidounces, 69 minims] of water to which the acetic acid has previously been added, and mix them thoroughly by shaking, and set the liquid aside in a cool place for twenty-four hours. Then filter, and pass enough water through the filter to make the filtrate measure four hundred and fifty mils [or 15 fluidounces, 104 minims]. To this filtrate add the glycerin, dissolve the sugar in the mixed liquids, and add enough water to make the product measure one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidraehms]. Mix thoroughly, and strain, if necessary. Syrup of Ipecac may also be made in the following manner: Prepare a percolator in the manner described under Syrupus. Mix the filtrate obtained as directed in the preceding formula with the glycerin, pour the mixture upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it with water, until the sugar is all dissolved and the product measures one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly." U. S.

The present U. S. syrup is made in accordance with the suggestions of Laidley of Richmond, Va., who found the syrup, as formerly prepared, to spoil on keeping. (*A. J. P.*, xxvi, 103, and July, 1879.) (See a practical paper on this subject by A. Bobbins in *A. J. P.*, Aug., 1879.) The

substitution of glycerin for a portion of the syrup in the U. S. process is an improvement, but the addition of the very small quantity of Acetic Acid is of questionable utility. For formulae in which the drug ipecac is employed, the reader may consult *A. J. P.*, 1870, p. 127; 1871, p. 104; May, 1881.

If strictly official fluidextract of ipecac is used in making this syrup, and the process is carried out in all its details, the syrup will remain transparent; but if commercial fluid-extract is used, or if the fluidextract has not been very carefully made, it will be necessary to modify the process somewhat to secure a transparent syrup. This may be effected by allowing the diluted fluidextract in the official process for making this syrup to remain for two or three days in a cool place before filtering, and adding to the sugar.

One fluidounce of this syrup should contain the virtues of about thirty grains of ipecac.

Although this syrup possesses all the virtues of ipecac, it is used almost exclusively as a nauseating expectorant in *acute bronchitis*.

Dose, for an adult, as an expectorant, from fifteen to thirty minims (0.9-1.8 mls); as an emetic, half a fluidounce (15 mls).

SYRUPUS LACTUCARII. U. S.

SYRUP OF LACTUCARIUM Syr. Lactucar.

(sy-ru'pus lae-tu-ca'ri-i) Sirop de Lactucarium, Fr.; Lactucariumsirup, G.

"Tincture of Lactucarium, one hundred mls [or 3 fluidounces, 183 minims]; Glycerin, two hundred mls [or 6 fluidounces, 366 minims] ; Citric Acid, one gramme [or 15 grains] ; Orange Flower Water, fifty mls [or 1 fluidounce, 331 minims]; Syrup, a sufficient quantity, to make one thousand mls [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the tincture of lactucarium with the glycerin, add the orange flower water in which the citric acid has been previously dissolved, and filter, if necessary. Finally, add a sufficient quantity of syrup to make the product measure one thousand mls [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly." *U. S.*

The only disadvantage of this syrup is the slight petroleum-like taste which seems to be inseparable from lactucarium preparations made by extracting the resinous principles with petroleum benzin; the new tincture of lactucarium, notwithstanding all the care that can be given to the purification of the petroleum benzin, will still hold a trace of the benzin-residue flavor, which it communicates to the syrup. The recommendations made by various pharmaceutical writers to add a solution of an alkali to cloudy syrup of lactucarium, in order to make it transparent, are inadmissible, for Aubergier has conclusively shown that alkalies destroy the bitter principles of lactucarium.

Jos. W. England and N. D. Streeter both prefer to make the syrup directly from the lactucarium. For processes, see *A. J. P.*, 1883, pp. 393. 593.

Louis Emanuel presents an interesting contribution on the subject in the *Proc. P. P. A.*, 1912, p. 151, in which all processes as well as the product are criticised.

This syrup for half a century has been largely used on the assumption that it possessed properties similar to those of opium without the habit-forming tendency of the latter, and Aubergier's syrup has been in great vogue in Europe and to a less extent in this country. After the passage of the Food and Drugs Act in 1906, the Aubergier preparations of lactucarium were found to contain a declaration on the label of the presence of morphine. In France it is evident that lactucarium had failed to sustain its reputation, for the French Codex introduced *Sirop de Lactucarium Opiace* (1884), which contained alcoholic extract of lactucarium, with the addition of one-half the proportion of extract of opium. This was an official recognition of the feeble character of lactucarium, and inasmuch as many persons used the syrup as a substitute for opium or morphine, the fact remained that thousands were deceived and in many cases the opium habit was established. We are of the opinion that lactucarium and its preparations should no longer receive recognition. The formula for Aubergier's syrup will be found in the *U. S. D.*, 19th edition, page 1230.

Dose, two to three fluidrachms (7.5-11.25 mils).

SYRUPUS LIMONIS. Br.

SYRUP OF LEMON

Syrupus Succus Citri; Sirop de Limon (de Citron), Sirop de sue de Limon (de citron), *Fr.*; Citronensirup, Citronensaftsirup, *G.*; Jarabe de limon, *Sp.*

"Lemon Peel, in thin slices or grated, 20 grammes; Alcohol (90 per cent.), a sufficient quantity; Lemon Juice, 500 millilitres; Refined Sugar, 760 grammes. Macerate the Lemon Peel in thirty millilitres of the Alcohol for seven days; press; filter; add sufficient of the Alcohol to produce forty millilitres. In the Lemon Juice, clarified by subsidence or filtration, dissolve the Refined Sugar by the aid of gentle heat; cool; add the forty millilitres of alcoholic liquid; mix." *Br.*

The U. S. P. 1880 syrup of lemon was dropped at the 1890 revision; as it is frequently used, the process is appended.

"Lemon Juice, recently expressed and strained, forty parts [or seventeen fluidounces]; Fresh Lemon Peel, two parts [or one ounce av.]; Sugar, in coarse powder, sixty parts [or twenty-eight ounces av.]; Water a sufficient quantity, to make one hundred parts [or about two pints]. Heat the Lemon Juice to the boiling point; then add the Lemon Peel, and let the whole stand, closely covered, until cold. Filter, add enough Water through the filter to make the filtrate weigh forty parts [or measure seventeen fluid-ounces], dissolve the Sugar in the filtered liquid by agitation, without heat, and strain." U. S. 1880.

The addition of lemon peel to the preparation is an improvement, but the internal white portion of the peel should be carefully removed before adding to the hot lemon juice, or the finished syrup will have a bitter taste. (See *Limonis Cortex*.) This syrup forms a cooling and grateful addition to beverages in *febrile complaints*, and serves to conceal the taste of saline purgatives in solution.

SYRUPUS PICIS LIQUIDS. U. S.

SYRUP OF TAR Syr. Pic. Liq.

Syrupus cum aqua picea; Syrupus Piceus; Sirop de Goudron, *Fr. Cod.*; Theersirup, *G.*; Jarabe de brea, *Sp.*

"Tar, five grammes [or 77 grains]; Alcohol, fifty mls [or 1 fluidounce, 331 minims]; Magnesium Carbonate, ten grammes [or 154 grains]; Sugar, eight hundred, and fifty grammes [or 29 ounces av., 430 grains]; Water, a sufficient quantity, to make one thousand mls [or 33 fluidounces, 6¹/₂ fluidrachms]. Dissolve the tar in the alcohol, add the magnesium carbonate and fifty grammes [or 1 ounce av., 334 grains] of sugar, and after thorough trituration add four hundred and ten mls [or 13 fluid-ounces, 415 minims] of water. Stir the mixture occasionally during two hours and then filter it, returning the filtrate to the filter until the liquid is clear. Dissolve the remainder of the sugar in the clear filtrate obtained from the treatment of the tar, and strain the syrup, adding sufficient water through the strainer to make the product measure one thousand mls [or 33 fluidounces, 6¹/₂ fluidrachms]. Syrup of Tar may also be made in the following manner: Prepare a percolator in the manner described under Syrupus. Pour the clear filtered liquid obtained from the treatment of the tar as directed above upon the remainder of the sugar, return the first portions of the percolate until it runs through clear, and, when all the percolate has passed, follow it with water until the sugar is all dissolved and the product measures one thousand mls [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly." *U. S.*

In many sections of our country this syrup has been largely used. The process of the U. S. P. IX is an improvement on the one formerly official; the proportion of tar being reduced from 75 Gm. to 5 Gm. It is similar to the U. S. P. VIII process except that the washing of the tar to remove acid constituents has been omitted because these would not be present in a tar which conforms to the U. S. P. tests. The tar is dissolved in alcohol, magnesium carbonate and a little sugar added, the mixture filtered, and more sugar dissolved with the aid of a gentle heat. This syrup affords an excellent method of administering small quantities of tar in the milder forms of subacute or chronic *bronchitis*.

Dose, from one to two fluidrachms (3.75-7.5 mls).

SYRUPUS PRUNI VIRGINIANÆ. U. S., Br.

SYRUP OF WILD CHERRY Syr. Prun. Virg.

Syrup of Virginian Prune, *Br.* 1898; Sirop d'Ecorce de Cerisiel, *Fr.*; Wildkirschenrindensirup, *G.*

"Wild Cherry Bark in No. 20 powder, one hundred and fifty grammes [or 5 ounces av., 127 grains]; Sugar, eight hundred grammes [or 28 ounces av., 96 grains]; Glycerin, fifty mils [or 1 fluidounce, 331 minims]; Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the glycerin with two hundred mils [or 6 fluid-ounces, 366 minims] of water, moisten the wild cherry bark with one hundred mils [or 3 fluid-ounces, 183 minims] of this mixture, pack it firmly in a cylindrical percolator and pour the remaining one hundred and fifty mils [or 5 fluidounces, 35 minims] of the menstruum upon it. When the glycerin-water menstruum has disappeared from the surface of the drug, add sufficient water to saturate the powder and leave a stratum above it. Close the lower orifice, and, having closely covered the percolator, allow the drug to macerate for twenty-four hours. Then allow the percolation to proceed slowly, gradually adding water as a menstruum until the percolate measures five hundred mils [or 16 fluidounces, 436 minims]. Dissolve the sugar in the percolate by agitation without heat, strain and pass enough water through the strainer to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly. Syrup of Wild Cherry may also be made in the following manner: Prepare a percolator in the manner described under Syrupus. Pour the percolate obtained as directed in the preceding formula upon the sugar, return the first portions of the percolate until it runs through clear, and, when all the liquid has passed, follow it with water, until the sugar is all dissolved and the product measures one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly. This Syrup should be stored in non-metallic, tightly-closed containers, in a cool place, as it rapidly loses hydrocyanic acid even under the most favorable conditions." U. S.

"Wild Cherry Bark, in No. 20 powder, 150 grammes; Refined Sugar, in coarse powder, 750 grammes; Glycerin, 65 millilitres; Distilled Water sufficient to produce 1000 millilitres. Moisten the Wild Cherry Bark with Distilled Water; set aside for twenty-four hours in a closed vessel; pack

in a percolator; percolate with Distilled Water until four hundred and fifty millilitres have been collected; dissolve the Refined Sugar in the percolated liquid, without heat; add the Glycerin and sufficient Distilled Water to produce the required volume." *Br.*

The British Pharmacopoeia introduced this syrup into the 1898 edition. The process is modelled after the U. S. formula.

The U. S. process affords a handsome syrup with the virtues of the bark unimpaired by the injurious effects of heat. It is based upon a formula proposed by Procter and Turnpenny in *A. J. P.*, xiv, 27. The introduction of the glycerin into the receiving bottle instead of mixing it with the menstruum was dropped in the process of the U. S. P., which, in our opinion, is a mistake. The glycerin is not needed in the menstruum to increase the astringency of the syrup but it serves a useful purpose in keeping the infusion from decomposing and precipitating a reddish, insoluble substance in the receiving bottle. This syrup should never be made by adding fluidextract to simple syrup, as the fluidextract is likely to vary greatly in quality, and frequently precipitates when mixed with syrup, the syrup when made by the above process is far superior in flavor. It is largely used as a vehicle for cough mixtures.

Dose, one to four fluidrachms (3.75-15.0 mils).

SYRUPUS RHEI. U. S., Br.

SYRUP OF RHUBARB Syr. Rhei

Sirop de Rhubarbe, *Fr.*; Sirupus Rhei, *P. G.*; Rhabarber-sirup, Rhabarbersaft, *G.*

"Fluidextract of Rhubarb, one hundred mils [or 3 fluidounces, 183 minims]; Spirit of Cinnamon, four mils [or 65 minims] ; Potassium Carbonate, ten grammes [or 154 grains]; Water, fifty mils [os.1 fluidounce, 331 minims]; Syrup, oa sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the spirit of cinnamon with the fluidextract of rhubarb, and add the potassium carbonate previously dissolved in .the water, and gradually add this mixture to enough syrup to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]." *U. S.*

"Rhubarb, in No. 20 powder, 70.0 grammes; Oil of Coriander, 0.5 millilitre; Refined Sugar, 840.0 grammes; Alcohol (90 per cent.), 280.0 millilitres; Distilled Water, sufficient to produce 1000.0 millilitres. Mix two hundred and seventy millilitres of the Alcohol with three times its volume of Distilled Water. Moisten the Rhubarb with seventy millilitres of this diluted alcohol and set aside for twenty-four hours in a closed vessel; pack in a percolator; pass the remainder of the diluted alcohol slowly through the moistened powder; evaporate the percolate to four hundred and seventy-five grammes; filter; dissolve the Refined Sugar in the filtrate by the aid of heat; cool; add the Oil of Coriander dissolved in ten millilitres of the Alcohol; mix, and finally add sufficient Distilled Water to produce the required volume." *Br.*

The *Br.* process is a troublesome and imperfect method.

The U. S. syrup differs from that official before 1890 in several particulars, and, in our opinion, it is greatly improved; the activity of the rhubarb and the corrigent effects of the cinnamon are both secured without impairing the appearance of the finished syrup, while the simplicity of the manipulation must commend the process to all. In the *Br. Pharm.* 1914 oil of coriander replaced coriander fruit official in the former pharmacoposia.

The official syrup is a mild cathartic, adapted for use with infants, to which it may be given in the dose of a fluidrachm (3.75 mls).

Dose, for adults, two to three fluidrachms (7.5-11.25 mls).

SYRUPUS RHEI AROMATICUS. U. S.

AROMATIC SYRUP OF RHUBARB Syr. Rhei Arom. [Spiced Syrup of Rhubarb]

Sirop de Rhubarbe aromatique, *Fr.*; Gewurzter Rhabarbersaft, *G.*

"Aromatic Tincture of Rhubarb, one hundred and fifty mls [or 5 fluidounces, 35 minims] ; Potassium Carbonate, one gramme [or 15 grains]; Syrup, a sufficient quantity, to make one thousand mls [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Dissolve the potassium carbonate in the tincture and add this to sufficient syrup to make the product measure one thousand mls [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Mix

thoroughly." *U. S.*

A small amount of alkali is added here to prevent the syrup from becoming turbid.

The *aromatic syrup of rhubarb* is a warm stomachic laxative, too feeble for adult cases, but well calculated for the bowel complaints of infants; which are so frequent in our cities during the summer season, and as a remedy for which this preparation, or one analogous to it, has been long in use, under the name of spiced syrup of rhubarb. The dose for an infant with diarrhea is a fluidrachm (3.75 mils), repeated every two hours until the passages indicate by their color that the medicine has operated. It should be borne in mind that the syrup, as prepared by the present formula, contains one-seventh of diluted alcohol, which, though not injurious in most cases in which this syrup is used, might render it too stimulating in some instances of diarrhea in the very young infant.

Dose, one to three fluidrachms (3.75-11.25 mils).

SYRUPUS RHOEADOS. Br.

SYRUP OF RED POPPY

Sirop de Coquelicot, *Fr. Cod.*; Sirop de Pavot rouge, *Fr.*; Klatschrosensaft, *G.*

"Red-Poppy Petals, 260 grammes; Refined Sugar, 720 grammes; Alcohol (90 per cent.), 50 millilitres; Distilled Water, sufficient to produce 1000 millilitres. Add the Red-Poppy Petals gradually to four hundred millilitres of Distilled Water kept hot upon a water-bath, stir frequently, and afterwards, the vessel being removed, infuse for twelve hours. Then press out the liquid; strain; add the Refined Sugar, and dissolve by the aid of heat. When nearly cold, add the Alcohol, and sufficient Distilled Water to produce the required volume." *Br.*

The object of introducing the petals into water heated by a water bath is that they may shrink by being scalded, as otherwise they could not be completely immersed in the quantity of water directed. After this has been accomplished, they should be immediately removed from the fire, lest the liquor become too thick and ropy. The fine red color of this syrup is its only recommendation. It is very liable to ferment; according to Enders, this can be obviated by evaporating the recently prepared

syrup to dryness, keeping the powdered residue in well-stoppered bottles, and dissolving it, as wanted, in four-fifths of its weight of water.

Dose, as stated in the Br. Pharmacopoeia, one-half to one fluidrachm (1.8-3.75 mils).

SYRUPUS ROSÆ. Br.

SYRUP OF ROSE

Syrup of Roses, *Br.*; Syrupus Rosarum Rubrarum; Syrup of Red Rose; Sirop de Rose rouge, *Fr.*; Rosensirup, *G.*

Syrup of Rose was deleted from the U. S. P. IX, but the process was introduced into the National Formulary IV.

"Dried Red-Rose Petals, 50 grammes; Refined Sugar, a sufficient quantity; Distilled Water, boiling, 500 millilitres. Infuse the Red-Rose Petals in the Distilled Water for two hours; strain; press; heat the infusion to the boiling point; filter; add to the filtrate twice its weight of Refined Sugar and dissolve by the aid of heat." *Br.*

Syrup of rose is mildly astringent, but is valued most for its fine red color, on account of which it is occasionally added to mixtures. The color is developed by the small amount of diluted sulphuric acid which is added.

Dose, a fluidrachm (3.75 mils).

SYRUPUS SARSAPARILLA COMPOSITUS. U. S.

COMPOUND SYRUP OF SARSAPARILLA Syr. Sarsap. Co.

Syrupus Sudorificus; Sirop de Salsepareille compose, *Fr. Cod.*; Sirop sudorifique, *Fr.*; Zusammengesetzter Sarsaparill-sirup, *G.*; Jarabe de zarzaparrilla compuesto, *Sp.*

"Fluidextract of Sarsaparilla, two hundred mils [or 6 fluidounces, 366 minims]; Fluidextract of Glycyrrhiza, fifteen mils [or 243 minims] ; Fluidextract of Senna, fifteen mils [or 243 minims]; Oil of Sassafras, two-tenths of a mil [or 3 minims]; Oil of Anise, two-tenths of a mil [or 3 minims]; Methyl Salicylate, two-tenths of a mil [or 3 minims]; Alcohol, nineteen and four-tenths mils [or 314 minims]; Syrup, seven hundred

and fifty mils [or 25 fluidounces, 173 minims]; to make about one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the fluidextracts and add the alcohol, in which the methyl salicylate and the oils have been dissolved. Gradually add this solution to the syrup and mix thoroughly." U. S.

An important change was made in this compound syrup in the U. S. P. 1890, through the substitution of fluidextracts and volatile oils for the drugs used in the U. S. P. 1880 process. It was further improved in the U. S. P. VIII by doubling the amount of volatile oils. The present syrup is not perfectly transparent, but the U. S. P., 1890, syrup had the same fault, The simplicity of the present formula is a welcome improvement.

In the original edition of the U S. Pharmacopoeia, published in 1820, a process for a syrup of sarsaparilla was adopted, intended to present the famous French *sirop de cuisinier*. This process has been variously modified from time to time, but the present preparation possesses any possible therapeutic virtues of the original preparation.

Uses.—The *compound syrup of sarsaparilla* is a senseless survival of an ancient superstition. As pointed out elsewhere in this work, it is improbable that sarsaparilla possesses any therapeutic virtue, and even if it did the proportion in the compound syrup is too small to exert any effect upon the system. While the syrup has a pleasant flavor, owing to the licorice and volatile oils it contains, as a vehicle it would be improved by omitting the sarsaparilla and the senna.

Corrosive sublimate, which is often given in connection with this syrup, is said to be completely decomposed by it, being converted into calomel. Samuel Kennedy (*Ph. Rec.*, 1888, p. 201) showed that when corrosive sublimate was dissolved in this syrup precipitation invariably occurred; if an equal amount of sodium chloride was added, precipitation was greatly retarded. Lepage of Gisors, proposes as a substitute potassium iodohydrargyrate, which he has found not to undergo decomposition.

Dose, of the syrup, half a fluidounce (15 mils), equivalent to somewhat less than a drachm (3.9 Gm.) of the root, to be taken three or four times a day.

Off. Prep.—Syrupus Bromidorum, N. F.

SYRUPUS SCILLÆ. U. S., Br.

SYRUP OF SQUILL Syr. Scill.

Syrupus Aceti Scillae; Sirop de Scille, *Fr.*; Meerzwiebel-airup, *G.*

"Vinegar of Squill, four hundred and fifty mils [or 15 fluidounces, 104 minims]; Sugar, eight hundred grammes [or 28, ounces av., 96 grains]; Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Dissolve the sugar in the vinegar of squill with the aid of a gentle heat, then strain the syrup and, when the liquid is cold, add enough water, through the strainer, to make the product measure one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Mix thoroughly." U. S.

"Vinegar of Squill, 175 millilitres; Refined Sugar, 650 grammes; Distilled Water, sufficient to produce 1000 grammes. Mix the Vinegar of Squill with an equal volume of Distilled Water. In the mixture dissolve the Refined Sugar by the aid of gentle heat; add sufficient Distilled Water to produce the required weight." *Br.*

The present British formula is almost identical with U. S. IX, and differs from that of 1864 in taking the vinegar already formed, instead of preparing it as the first step of the process. Vinegar of Squill of the Br. Pharm. 1914 is double the strength of that formerly official. The heating should be performed as quickly as possible, to prevent undue loss of acetic acid.

This syrup is much employed as an expectorant, especially in combination with a solution of tartarized antimony. It is incompatible with ammonium carbonate, but not with ammonium chloride.

Dose, about a fluidrachm (3.75 mils).

SYRUPUS SCILLÆ COMPOSITUS. U. S.

COMPOUND SYRUP OF SQUILL Syr. Scill. Co. [Hive Syrup]

Coxe'a Hive Syrup; Sirop de Scille compose, *Fr.*; Zusam-mengesetzter Meerzwiebelsirup, *G.*

"Fluidextract of Squill, eighty mils [or 2 fluidounces, 338 minims]; Fluidextract of Senega, eighty mils [or 2 fluidounces, 338 minims] ; Antimony and Potassium Tartrate, two grammes [or 31 grains]; Distilled Water, ten mils [or 162 minims] Syrup, a sufficient quantity, to make one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Dissolve the antimony and potassium tartrate in the distilled water with the aid of heat, add this solution to seven hundred and fifty mils [or 25 fluidounces, 173 minims] of syrup and mix thoroughly. Then gradually add the fluidextracts, previously mixed, and finally, sufficient syrup to make the product measure one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidraehms]." *U. S.*

This is intended as a substitute for the popular preparation called *Coxe's hive syrup*, from which it differs chiefly in containing sugar instead of honey. Prepared as originally directed in the Pharmacopoeia, it invariably fermented from the want of sufficient concentration. This defect was corrected many years ago when sugar was substituted for honey, in consequence of the uncertain consistence and constitution of the latter. The present formula is a decided improvement, fluidextracts of squill and senega being used. Percolation has been found very well adapted for dissolving the sugar and producing a transparent syrup. The present U. S. P. process has the merit of simplicity, but, unfortunately, the fluidextract of squill is never a wholly satisfactory preparation.

The name *Coxe's hive syrup*, which is meaningless because it is not used in the treatment of hives, is said to owe its origin to a period when croup, for which the remedy is often used, was known popularly as "hives."

Compound syrup of squill combines the virtues of senega, squill, and tartar emetic, of the last of which it contains about one grain in a fluidounce. It is emetic, diaphoretic, expectorant, and frequently cathartic, and may be given with advantage in mild cases of simple croup, also in the latter stages of severe cases when the object is to promote expectoration. The dose of this syrup is, for children, from two to twenty minims (0.12-1.3 mils), according to the age, and it may be repeated in cases of croup every fifteen or twenty minutes until it causes vomiting.

Dose, for adults as an expectorant, from twenty to thirty minims (1.3-1.8 mils).

SYRUPUS SENEGÆ. U. S.

SYRUP OF SENEGA Syr. Seneg.

Sirop de Polygala, *Fr.*; Sirupus Senegae, *P. G.*; Senega-sirup, *G.*

"Fluidextract of Senega, two hundred mils [or 6 fluidounces, 366 minims]; Syrup, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the fluid-extract with sufficient syrup to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]." *U. S.*

The syrup affords a very convenient mode of exhibiting senega in pectoral complaints. Owing to the pectinous principle present in senega, the syrup made directly from the root as in the process of 1870 was always turbid. It has been frequently pointed out that the addition of an alkali renders the syrup transparent, and the 1890 process directed the use of a small quantity of ammonia water, although, if the fluidextract of senega which contains alkali be used as in the *U. S. P. IX*, this addition is unnecessary. This syrup may be given as a nauseating expectorant.

Dose, one or two fluidrachms (3.75 or 7.5 mils).

SYRUPUS SENNÆ. U. S., Br.

SYRUP OF SENNA Syr. Senn.

Sirop de S6ne, *Fr.*; Sirupus Sennae, *P. O.*; Sennasirup, *G.*

"Fluidextract of Senna, two hundred and fifty mils [or 8 fluidounces, 218 minims]; Oil of Coriander, five mils [or 81 minims]; Syrup, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the oil of coriander with the fluidextract of senna and add sufficient syrup to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly." *U. S.*

"Senna Leaves, 440.0 grammes; Oil of Coriander, 0.2 millilitre; Alcohol (90 per cent.), 2.0 millilitres; Refined Sugar, 540.0 grammes; Alcohol (20 per cent), 760.0 millilitres. Moisten the Senna Leaves with four hundred and forty millilitres of the Alcohol (20 per cent.); pack tightly in a vessel which can afterwards be closed; set aside for three days; press strongly; reserve the liquid obtained; break up the marc; moisten it with one hundred and sixty millilitres of the Alcohol (20 per cent.); set aside for twenty-four hours; press strongly; add the liquid obtained to the portion previously reserved; break up the marc; mix it with the remainder of the Alcohol (20 per cent.); set aside for three hours; press again; evaporate the resulting liquid until it is reduced to such a volume that when added to the reserved liquid the whole measures four hundred and forty millilitres. Mix the evaporated liquid with the reserved liquid; heat the product in a covered vessel to 82° C. (179.6° F.) for a few minutes; set aside for twenty-four hours; filter, and pass Distilled Water through the filter until the filtrate measures four hundred and forty millilitres; add the Refined Sugar, and dissolve in a covered vessel by the aid of gentle heat; cool; add the Oil of Coriander dissolved in the Alcohol (90 per cent.); mix." *Br.*

The process was improved in the U S. P. VIII by simply adding the fluidextract and oil of coriander to syrup, and this process has been retained in the Ninth Revision.

Dose, of the U. S. syrup of senna, for an adult, from one to four fluidrachms (3.75-15.0 mils); of the Br. syrup from one to two fluidrachms (3.75-7.5 mils).

SYRUPUS TOLUTANUS. U. S., Br.

SYRUP OF TOLU Syr. Tolu.

Sirop de Baume de Tolu, *Fr. Cod.*; Sirop balsamique, *Fr.*; Tolubalsamsirup, *G.*; Jarabe de balsamo de Tolu, *Sp.*

"Tincture of Tolu, fifty mils [or 1 fluid-ounce, 331 minims]; Magnesium Carbonate, ten grammes [or 154 grains]; Sugar, eight hundred and twenty grammes [or 28 ounces av., 405 grains]; Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6½ fluidrachms]. Rub the tincture of tolu in a mortar with the magnesium carbonate and sixty grammes [or 2 ounces av., 51 grains] of the sugar.

Then gradually add four hundred and thirty mils [or 14 fluidounces, 259 minims] of water, with constant trituration, and filter. Dissolve the remainder of the sugar in the clear filtrate, with the aid of a gentle heat, strain the syrup while hot, and add sufficient water to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Syrup of tolu may also be made in the following manner: Prepare a percolator in the manner described under Syrupus. Pour the filtrate obtained as directed in the preceding formula upon the remainder of the sugar, return the first portions of the percolate until it runs through clear, and, when all of the liquid has passed, follow it with water, until all of the sugar is dissolved and the product measures one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly." *U. S.*

"Balsam of Tolu, 25 grammes; Refined Sugar, 660 grammes; Distilled Water, sufficient to produce 1000 grammes. Add four hundred grammes of the Distilled Water, boiling, to the Balsam of Tolu; cover lightly and heat on a water-bath for half an hour, stirring frequently. Remove; add Distilled Water, if necessary, so that the liquid, when cold, measures four hundred millilitres. Filter the solution, add the Refined Sugar, dissolve by the aid of a water-bath, and finally add sufficient Distilled Water to produce the required weight." *Br.*

The U. S., 1890, process for this syrup was more satisfactory than that formerly official. It was practically a return to the U. S., 1870, method (based on Finley's process, substituting precipitated calcium phosphate for magnesium carbonate, and using a freshly made strong tincture for the official tincture of tolu.

The U. S. Pharmacopoeia VIII and IX process reintroduced magnesium carbonate with much advantage, and has the further improvement of using the official tincture of tolu instead of making the latter from the balsam by a special process. In the British process the soluble principles of the balsam are extracted by boiling it with water, but with great waste of the material, as the water dissolves but a small portion of the active matter. To obviate this waste, the same portion of balsam is, according to Brande, usually employed in successive operations, and it long continues to impart odor and taste to boiling water. W. H. Hostelley's modification is as follows: For making twenty-five ounces of syrup, take one ounce of balsam of tolu, one pound of granulated sugar,

and water which has been previously filtered through animal charcoal, enough to make twenty-five ounces; rub the tolu to a fine powder, aided by some of the sugar, and mix this with the remainder of the granulated sugar; now prepare a percolator by placing a piece of cotton in the neck, pack the powder in it, pour in the filtered water, and receive twenty-five ounces of percolate. (*A. J. P.*, 1887, p. 290.) Syrup of tolu is used chiefly to impart its agreeable flavor to mixtures. If a stronger preparation is desired, tincture of tolu may be added in the desired quantity, directing the bottle to be shaken.

Dose, one to four fluidrachms (3.75-15.0 mils).

SYRUPUS URGINEA. Br.

SYRUP OF URGINEA

"Vinegar of Urginea, 175 millilitres; Refined Sugar, 650 grammes; Distilled Water, sufficient; to produce 1000 grammes. Mix the Vinegar of Urginea with an equal volume of Distilled Water. In the mixture dissolve the Refined Sugar by the aid of gentle heat; add sufficient Distilled Water to produce the required weight." *Br.*

This syrup corresponds to the Syrup of Squill of the British Pharmacopoeia and is used for the same purpose.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

SYRUPUS ZINGIBERIS. U. S., Br.

SYRUP OF GINGER Syr. Zingib.

Sirop de Gingembre, *Fr.*; Ingwersirup, *G.*

"Fluidextract of Ginger, thirty mils [or 1 fluidounce, 7 minims]; Alcohol, twenty mils [or 325 minims]; Magnesium Carbonate, ten grammes [or 154 grains]; Sugar, eight hundred and twenty grammes [or 28 ounces av., 405 grains]; Water, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix the fluidextract of ginger and the alcohol, then triturate the liquid in a mortar with the magnesium carbonate and sixty grammes [or 2 ounces av., 51 grains] of the sugar. Then gradually add four hundred and thirty mils [or 14

fluidounces, 259 minims] of water, with constant trituration, and filter. Dissolve the remainder of the sugar in the clear filtrate, with the aid of a gentle heat, strain the syrup while hot, and add sufficient water to make the product measure one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Syrup of Ginger may also be made in the following manner: Prepare a percolator in the manner described under Syrupus. Pour the filtrate obtained as directed in the preceding formula upon the remainder of the sugar, return the first portions of the percolate until it runs through clear, and, when all the liquid has passed, follow it with water, until all of the sugar is dissolved and the product measures one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix thoroughly." *U. S.*

"Ginger, in powder, 25 grammes; Alcohol (90 per cent.), a sufficient quantity; Syrup, sufficient to produce 1000 millilitres. Prepare fifty millilitres of a strong tincture of the Ginger by the process of percolation with the Alcohol. To this add sufficient of the Syrup to produce the required volume." *Br.*

The U. S. P. process has been improved by the addition of magnesium carbonate as an aid in distributing the resinous fluidextract so as to facilitate its solution in water. It is practically a return to the U. S. 1870 method.

The British syrup, being made by the simple incorporation of the tincture with syrup, has of course all the strength of the ginger, -but is inferior to the U. S. preparation in appearance and flavor. The old plan of using water as the menstruum for the drug has been abandoned, as the syrup thus made is encumbered with mucilage and starch, and consequently rendered more liable to decomposition. In order that the preparation may be of the proper strength, it is necessary that the fluidextract should have been made with the best ginger and with the official menstruum. The syrup of ginger is much used as a warm stomachic addition to tonic and purgative infusions or mixtures, and to impart flavor particularly to carbonic acid water.

Dose, one to four fluidrachms (3.75-15.0 mils).

The Dispensatory of the United States of America Twentieth Edition (1918)

Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Tacamahac. *Tacamahaca*.—These names are applied to a resinous substance which is sometimes substituted for or admixed with Elemi resin. There are two classes of these products: (1) one having an odor resembling Elemi and including the *East Indian Tacamahac* which is probably obtained from *Calophyllum Inophyllum* L. (Fam. *Guttiferae*), and *Bourbon Tacamahac*, obtained probably from *C. Tacamahaca* Willd. The West Indian and East Indian Resin Anime is a product of one of the *Burseraceae*; (2) a second class having an odor of incense and including *Cayenne Incense*, obtained probably from *Icica heptaphylla* Aubl. (now *Protium heptaphyllum* March. (Fam. *Burseraceae*), a West Indian Tacamahac obtained from *Protium heptaphyllum* and related species. There are also several gums and resins of this same character which are obtained from *Bursera gummifera* L. and other plants of the *Burseraceae*. The resinous substance derived from *Bursera tomentosa* Triana, a tree of considerable size, of the Fam. *Burseraceae*, growing in the island of Curacoa and in Venezuela, is in irregularly shaped pieces of various sizes. The color is usually light yellowish or reddish-brown, but in the larger masses is more or less diversified. The pieces are in general translucent, though frequently covered with powder upon their surface, so as to render them apparently opaque. They are heavier than water, brittle, and pulverizable, yielding a pale yellow powder. Their odor is resinous and agreeable, their taste bitter, balsamic, and somewhat acrid. Exposed to heat, they melt and exhale a stronger odor. Tacamahac is partially soluble in alcohol, and completely so in ether and the fixed oils. It consists of resin with a little volatile oil.

The East Indian tacamahac and called *tacamahaca orientale*, or *tacamahaca in testis*, comes into the market in gourd shells covered with rush leaves. It is of a pale yellow color inclining to green, slightly translucent, soft, and adhesive, of an agreeable odor, and an aromatic bitterish taste. It is at present very rare in commerce. The tree which yields this resin produces a drupe, about as large as a plum, from the seeds of which 50 per cent. of a greenish-yellow fixed oil is obtained by expression, which is used in India for lamps, and as a local application in the *itch*. (*J. P. C.*; 1861, 23.) Guibourt describes several other varieties of tacamahac, which, however, are little known. Among them is a soft, adhesive, dark, green oleo-resin (*J. P. C.*, 3e ser., xxiv, 396), said to be procured from the *Calophyllum Tacamahaca* Willd., growing in the islands of Reunion and Madagascar. (See also Pennetier, *Matieres Premieres*, 642.)

Tacamahac was formerly highly esteemed as an internal remedy, but is now used only in ointments and plasters. Its properties are analogous to those of the turpentine. It is sometimes used as incense.

Tachia. *Tachiaguianensis* Aubl.—The root of this tree (Fam. *Gentianaceae*), is used under the name of *Caferana*, in Brazil, as an antiperiodic and tonic. According to Peckoldt it contains an organic, crystalline substance, *caferanine*. (See *Merck's Bericht*, 1889; also *Ber. d. Chem. Ges.*, 1899, No. 7.)

TAMARINDUS. Br.

TAMARIND

"Tamarinds are the fruits of *Tamarindus indica*, Linn., freed from the brittle outer part of the pericarp and preserved with sugar." *Br.* The preserved pulp of the fruit of *Tamarindus indica* Linne (Fam. *Leguminosae*)." N. F.

Fructus Tamarindorum; Tamarinier, *Fr. Cod.*; Tamarin Pulpe brute de Tamarins, *Fr.*; Pulpa Tamarindorum cruda, *P. G.*; Tamarindemus, Tamarinden, *G.*; Tamarindo, *It.*; Tamarindo (Pulpa de), *Sp.*

The tamarind tree (*Tamarindus indica*) is the only species of this genus. It rises to a great height, sends off numerous spreading branches, and has a beautiful appearance. The trunk is erect, thick, and covered with a rough, ash-colored bark. The leaves are alternate and pinnate, composed of many pairs of opposite leaflets, which are almost sessile, entire, oblong, obtuse, unequal at their base, about half an inch long by a sixth of an inch broad, and of a dark-green color. The flowers, which are in small lateral racemes, have a yellowish calyx, and yellow petals beautifully variegated with red veins. The fruit is a broad, compressed, reddish ash-colored pod, much curved, from two to six inches long, with numerous brown, flat, quadrangular seeds, contained in loculi formed by a tough membrane. Exterior to this membrane is a light-colored acid pulpy matter, between which and the shell are several somewhat branched tough ligneous strands, running from the stem to the extremity of the pod, the attachment of which they serve to strengthen. The shells are fragile and easily separated.

The tree appears to be a native of the East and West Indies, Egypt, and Arabia, though believed by some to have been imported into America. Barth, the African traveller, found it abundant in the interior of Africa.

De Candolle was doubtful whether the East and West India trees are of the same species. It is stated by writers that the pods of the former are much larger than those of the latter, and have a greater number of seeds, the East India tamarinds containing six or seven, those from the West Indies rarely more than three or four; but this seems not to be correct.

Calcutta appears to be the chief emporium for the tamarinds of the European markets. Tamarinds are also sent from the West Indies and Ecuador to England; when from this source they are preferred. The latter are known as American tamarinds, and are obtained from *T. indica*, var. *occidentalis* Gartn. They are of a light brown color, less cohesive and possess less acidity than the tamarinds from the Old World. Tamarinds are brought to us chiefly from the West Indies, where they are prepared by placing the pods, previously deprived of their shells, in layers in a cask, and pouring boiling syrup over them. A better mode, sometimes practised, is to place them in stone jars, with alternate layers of powdered sugar. They are said to be occasionally prepared in copper boilers. In the East Indies tamarinds are often prepared for market by stripping off the outer shell and pressing the pulpy interiors into a mass; sometimes they are packed as in the West Indies.

Properties.—Fresh tamarinds, which are sometimes, though rarely, brought to this country, have an agreeable, sour taste, without any mixture of sweetness. In the United States they are usually met with only in the preserved state, this is a dark-colored adhesive mass, consisting of syrup mixed with the pulp, membrane, strong, somewhat branching fibres or string-like strands, and seeds of the pod, and having a sweet acidulous taste. The brown, flattish, quadrangular seeds, each enclosed in a tough membrane, should be hard, clean, and not swollen, the string-like fibers tough and entire, and the odor without mustiness. Tamarind is officially described as " a reddish-brown, moist, sugary mass, containing strong branched fibres, and brown, shining seeds, each enclosed in a tough membrane. Taste agreeable, subacid. The pulp yields no characteristic reactions for copper." *Br.*

"A pulpy mass of a light reddish-brown color, changing with age to a dark brown, containing some branching fibers and numerous reddish-brown, smooth, oblong or quadrangular, compressed seeds, each enclosed in a tough membrane. Odor distinct; taste sweet and agreeably acid." *N. F.*

From the analysis of Yauquelin, it appears that in 100 parts of the pulp of tamarinds, independently of the sugar added to them, there are 9.40 parts of citric acid, 1.55 of tartaric acid, 0.45 of malic acid, 3.25 of potassium bitartrate, 4.70 of gum, 6.25 of pectin, 34.35 of parenchymatous matter, and 27.55 of water. K. Muller, after analyzing nine commercial varieties, states that only traces of citric and malic acids are present, but that tartaric acid and acid potassium tartrate are present in considerable amount. Copper may often be detected in preserved tamarinds, derived from the boilers in which they are prepared. Its presence may be ascertained by the reddish coat which it imparts to the blade of a spatula or other steel implement immersed in the tamarinds.

Uses.—Tamarinds are laxative and refrigerant, and infused in water form a highly grateful drink in febrile diseases. Convalescents often find the pulp a pleasant addition to their diet, and useful when a laxative action is desirable. It is sometimes prescribed in connection with other mild cathartics. Though frequently given with infusion of senna to cover its taste, it is said to weaken its purgative power, and the same observation has been made of its influence upon the resinous cathartics in general. For a formula for *fluidextract of tamarind*, see *Nat. Drug.*, 1892, 101.

Dose, from a drachm to an ounce (3.9-31 Gm.).

Off. Prep.—*Confectio Sennae, Br., N. F.*

Tanghinia. *Ordeal Bean of Madagascar.*—*Tanghinia venenifera* Poir. (*Cerbera Tanghin* Hook.) (fam. *Apocynaceae*), has been investigated, and, according to C. E. Quinquaud, is both a respiratory and a cardiac poison. (*C. R. A. S.*, cl, 534; see also *T. G.*, vol. ii, 610.) The active principle, *tanghinin*, occurs in colorless lustrous scales, efflorescing in the air, having a bitter and sharp taste, soluble in alcohol, ether, and acetic acid.

Tang-kui or Man-mu.—Under the name of *tangkui* the Chinese have used for a long time a root obtained from some umbelliferous plant closely allied to the *Levisticum officinale*, which, according to Lezenius (*Ph. Centralh.*, 1910, p. 221), is probably from the *Ligusticum acutilobum*. A fluidextract of this root has been introduced into European medicine under the name of *eumenol* and is recommended by a number of authors in the treatment of *dysmenorrhea* and other uterine complaints. The dose of this fluidextract is one table-spoonful three times a day. Bufalini, having searched in vain for an active alkaloid, believes that the activity of the substance depends upon

an ethereal oil.

Tansy. *Tanacetum*. U. S. 1890.—Under this name the U. S. Pharmacopoeia formerly recognized the tops and leaves of the *Tanacetum vulgare* L., a perennial herbaceous plant rising two or three feet in height, which is cultivated in our gardens, although growing wild in the roads and in old fields. It was originally introduced from Europe. It is in flower from July to September.

Tansy was officially described as follows:

"Leaves about 15 Cm. long; bipinnatifid, the segments oblong, obtuse, serrate or incised, smooth, dark green, and glandular; flower-heads corymbose, with imbricated involucre, a convex, naked receptacle, and numerous yellow, tubular florets." U. S., 1890. The odor is strong, peculiar, and fragrant, but much diminished by drying; the taste is warm, bitter, somewhat acrid, and aromatic. These properties are imparted to water and alcohol. According to Leppig (*Inaug Dis.*, Dorpat, 1882), both the flowers and the leaves contain the following constituents: tanacetin, tannic acid (tanacetum-tannic acid), traces of gallic acid, volatile oil, a wax-like substance, albuminoids, tartaric, citric, and malic acids, traces of oxalic acid, a laevogyrate sugar, resin, metarabic acid, parabin, and woody fiber. Of these the most important are the bitter principle *tanacetin*, to which Leppig gives the formula $C_{11}H_{16}O_4$, and which forms a very hygroscopic, brownish, amorphous mass, easily soluble in alcohol and in water, insoluble in ether. It possesses a taste at first characteristically bitter like willow bark, and then cooling and caustic. The essential oil was investigated by Bruylants (*Ber. d. Chem. Ges.*, xi, 449), according to whom it consisted of a terpene, $C_{10}H_{16}$, boiling at from 155° to 160° C. (311°-320° F.), of which 1 per cent. only is present, an aldehyde, $C_{10}H_{16}O$, boiling at from 195° to 196° C. (383°-384.8° F.), of which 70 per cent. was obtained, and an alcohol (borneol), $C_{10}H_{18}O$, boiling at from 203° to 205° C. (397.4°-401° F.), of which 26 per cent. was present. Semmler (*Ber. d. Chem. Ges.*, xxv, 3343, 3352, 3513) has specially investigated the constituent boiling at 195° C. (383° F.), and having the composition $C_{10}H_{16}O$. He finds it to be not an aldehyde, but a ketone, and calls it *tanacetone*. It is identical with the ketone found in sage oil, wormwood oil, and thuja oil. As it was first identified in this last-named oil by Wallach, and named by him *thujone*, this name is now applied to it to the exclusion of the other. (See also *Schim. Rep.*, April, 1893, and April, 1897; and Gildemeister and Hoffmann, *Aetherische Oele*.)

Tansy adds to the medicinal properties of the aromatic bitters those of an irritant narcotic. It has been recommended in *intermittents*, *hysteria*, and *amenorrhea*, but in this country is little employed in regular practice. The seeds are said to be most effectual as a vermifuge. Tansy has been used to a considerable extent 'as a domestic abortifacient, but is not only very uncertain, but also very dangerous in its action, and has in various cases produced death. The symptoms caused by it have been abdominal pain, vomiting, violent epileptic convulsions often followed by profound coma, dilated pupils, great disturbances of respiration, frequent 'and feeble pulse, and death, which has been said to be from heart failure, but is probably the outcome of a paralytic asphyxia. The minimum fatal dose can scarcely be considered to have been

positively ascertained, but a fluidrachm (3.75 mls) of the oil is said to have caused death, although recovery in one case occurred after taking half a fluidounce. Tansy tea has also caused death. (For cases, see *Am. J. M. S.*, xvi, xxiii, xxiv; *J. P. C.*; April, 1870; *J. A. M. A.* xlvii, p. 509.) Post-mortems have been reported in which no inflammation of the gastro-intestinal mucous membranes could be discovered.

The dose of the powder is from thirty grains to a drachm (2.0-3.9 Gm.) two or three times a day; but the infusion is more frequently administered.

Tapioca.—Under this name the U. S. P. formerly recognized the starch grains obtained from the bitter cassava (*Manihot utilissima* Pohl), and the sweet cassava (*M. palmata* var. *Aipi* Pohl) (Fam. *Euphorbiaceae*). The starch is extracted from the thickened root and is known in commerce by the names of *Cassava*, *Tapioca* or *Manioca Starch*, and as *Bahia*, *Rio* or *Para Arrowroot*. The plant is cultivated in Brazil and other parts of tropical America. It is also grown in Florida and other of the Southern States. In the production of the starch from the bitter cassava the hydrocyanic acid which is present in fresh roots is entirely eliminated by the process of washing and drying.

The root of the *sweet* cassava may be eaten with impunity; that of the *bitter*, which is the most extensively cultivated, abounds in an acrid, milky juice, which renders it highly poisonous if eaten in the recent state. Henry and Boutron Chalarid affirm that the bitter cassava contains hydrocyanic acid (*J. P. G.*, xxii, 119), but Peckdolt claims that its poisonous effects are due to *manihotoxine* (*Ph. Rund.*, iv, 1890).

The preparation of tapioca in Malacca is thus described by James Collins: The fresh root-stocks are thoroughly washed in tubs in a constant stream of water by the Chinese, and then peeled like turnips; they are then sliced in one machine and pulped in another, the pulp being removed in cane baskets to large wooden frames, with calico bottoms; a powerful stream of water is allowed to fall upon the pulp, a sifting motion being communicated to the strainer; as the starch is washed out, it is received into inclined troughs, and, while in a state of suspension, run into settling vats. There it is stirred and washed, and, while moist, it is removed to the drying room. Two kinds of tapioca are prepared. The flour is made by heating slightly by fires placed underneath; it is constantly stirred and turned over with iron shovels, to prevent agglutination and insure equal drying. Granular tapioca is made as follows: A long range of quallies, or small, shallow iron pans, are slightly tilted forward on ledges of brickwork, and heated with a wood fire. Each operator has a quallie and fire to himself. Taking a quantity of damp starch, he stirs it round and round with an iron shovel, and the heat is sufficient to cause the tapioca to become agglutinated together in small masses, and coated with dextrin. The drying is done with great skill over an open fire. (*C. D.*, 1884.)

Tapioca is in irregular, hard, white, rough grains, possessing little taste, partially soluble in cold water, and affording a fine blue color when iodine is added to its filtered solution. The partial solubility in cold water is owing to the rupture of the starch granules by heat. Examined under the microscope, the granules appear somewhat

plano-convex or bell-shaped and more or less compound. The individual grains vary from 0.006 to 0.030 mm. in diameter and have a distinct central circular or radiating cleft. They polarize light strongly, showing a distinct cross. *Tapioca meal*, called sometimes *Brazilian arrow-root*, and by the French *moussache*, is the fecula dried without heat. Its granules are identical with those already described. Being nutritious, and the same time easy of digestion and destitute of irritating properties, tapioca forms an excellent diet for the sick and convalescent. It is prepared for use by boiling it in water. Lemon juice and sugar are usually grateful additions, and in *low states of disease* or cases of *debility* it may be impregnated with wine and nutmeg or other aromatic.

A factitious tapioca is found in commerce, consisting of very small, smooth, spherical grains, and supposed to be prepared from potato starch. It is sold under the name of pearl tapioca.

Cassaripe is the thickened gum obtained from the root of the bitter cassava, which is said to be innocuous and so actively antiseptic as to be habitually used in Brazil for the preservation of meat. According to S. D. Risley (*Phila. Med. Journ.*, 1899), the 10 per cent. ointment of cassaripe is useful in suppurating conjunctivitis and ulcers of the cornea, applied with gentle massage three or four times a day.

TARAXACUM. U. S. (Br.)

TARAXACUM Tarax. [Dandelion]

"The dried rhizome and roots of *Taraxacum officinale* Weber (Fam. *Compositae*). Preserve the thoroughly dried drug in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects." *U. S.* "Taraxacum Root is the fresh root of *Taraxacum officinale*, Wiggers. Collected in the autumn." *Br.*

Taraxaci Radix, *Br.*, Taraxacum Root; Dandelion Root, Blowball, Milk, Witch, or Yellow Gowan, Lion's-tooth, Cankerwort; Pissenlit, Dent de Lion, *Fr. Cod.*; Radix Taraxaci cum herba, *P. G.*; Lowenzahn, *G.*; Tarassaco, *It.*; Taraxacon, Diente de Leon, *Sp.*

The dandelion is an herbaceous plant, with a perennial fusiform root. The leaves, which spring immediately from the short upright rhizome, are long, pinnatifid, generally runcinate, with the divisions toothed, smooth, and of a fine 'green color. The common name of the plant was derived from the fancied resemblance of its leaves to the teeth of a lion. The flower-stem rises from the midst of the leaves, six inches or more in

height. It is erect, simple, naked, smooth, hollow, fragile, and terminated by a large golden-colored flower, which closes in the evening and expands with the returning light of the sun. The involucre is smooth and double, with the outer scales bent downward. The florets are very numerous, ligulate, and toothed at their extremities. The receptacle is flat and naked. The pappus is stipulate, and at the period of maturity is disposed in a spherical form, and is so light and feathery as to be easily borne away by the wind, with the achene attached. Another plant resembling the common dandelion, the achenes of which, however, are narrower and bright red or reddish brown, known as the *red-seeded dandelion*, is the product of *T. erythrospermum*, Andrz., and is supposed by some to be naturalized from Europe.

The common dandelion, *Taraxacum officinale*, grows spontaneously in widely separated parts of the globe. It is abundant in this country, adorning our grass plots and pasture grounds with its bright yellow flowers, which, in moist places, show themselves with the first opening of spring, and continue to appear until near the close of summer. In India the plant is cultivated in various parts of the country, and its root collected for use between the months of September and February. (*P. J.*, Dec. 1871, 523.) All parts of the plant contain a milky bitterish juice, which exudes when they are broken or wounded. The leaves, when very young and blanched by the absence of light during their growth, are tender and not unpleasant to the taste, and are sometimes used as a salad. When older and of their natural color, they are medicinal, but the leaves of the wild plant in various stages of its early growth are used for salads by those who have cultivated a taste for this vegetable. The Pharmacopoeias recognize only the root. It should be full grown when collected, and should be employed in the recent state, as it is then most active. It does not, however, as stated by Duncan, lose nearly all its bitterness by drying, and the root dug up in the warmer seasons might, if dried with care, be employed with propriety in the succeeding winter. The juice of the root is thin and watery in the spring; milky, bitter, and spontaneously coagulable in the latter part of summer and autumn, and sweet and less bitter in the winter when affected by the frost. The months of July, August, and September are, therefore, the proper periods for collecting it.

Henry Barton, of Brighton, England, prepared the juice from the flower-stalks by crushing and pressure, adding 25 per cent. of spirit, and, after allowing it to stand for some weeks in glass bottles, filtering to

separate a very small quantity of deposit, and setting aside for use. According to Barton, it remains bright, and retains its characteristic taste. Though not so rich in solid constituents as the juice of the root, yet, having an equal bitterness, it is probably not less efficacious as a medicine, if it be true, as stated by Bentley, that the efficacy of the medicine does not depend solely on the amount of its solid constituents, but principally if not entirely on the bitter principle it contains. Barton stated that the juice is certainly one of the best preparations of taraxacum. (*A. J. P.*, 1872, p. 509.)

Properties.—The official description of *Taraxacum* follows: "Cylindrical or somewhat flattened, gradually tapering, usually in broken pieces, from 6 to 15 cm. in length and from 5 to 15 mm. in thickness; externally brown or blackish-brown, longitudinally wrinkled, having numerous root and rootlet-scars; crown simple or branched with numerous leaf-bases showing annulate markings; odor slight or inodorous; taste bitter. Under the microscope, transverse sections of the root of *Taraxacum* show a porous, pale yellow wood from 1 to 4 mm. in diameter, surrounded by a light brown bark from 2 to 6 mm. in thickness, the latter composed of concentric layers of lacticiferous vessels and sieve tissues, alternating with whitish inulin-bearing parenchyma. The rhizome portions show a small pith. The powder is light brown; when examined under the microscope it exhibits parenchyma cells which are large, thin-walled and contain irregular masses of inulin; fragments with yellowish-brown lacticiferous vessels; trachea; reticulate; intermediate fibers non-lignified, with irregular, simple and oblique pores. *Taraxacum* yields not more than 10 per cent. of ash." *U. S.* "Fresh root frequently three decimetres or more long, and twelve millimetres or more thick, smooth and yellowish-brown externally, whitish within. Fracture short, the exposed surface showing a small yellow porous wood, surrounded by a thick nearly white cortex exhibiting a variable number of irregular concentric rings, from which a milky juice exudes. Inodorous; taste bitter." *Br.*

Taraxacum should be free from the root of *Cichorium Intybus* Linne, which closely resembles it, but is usually paler, more bitter, and has the milk vessels in radiating lines. The drug consists in part of the rhizome which shows from ten to fifteen fibro-vascular bundles surrounded by the parenchyma-tissue of the pith, the diameter of which in some instances exceeds the thickness of the woody zone several times. In other respects the structure of the rhizome resembles the root, the

concentric' arrangement of the laticiferous ducts in particular excluding any possibility of mistaking the specimens for chicory, etc. (*Am. Drug.*, 1887, p. 2.) The active properties of taraxacum are yielded to water by boiling, and do not appear to be injured in the process. Dragendorff obtained from the root gathered in October and dried at 100° C. (212° F.) 24 per cent. of inulin and some sugar. The root gathered in March from the same place yielded 1.74 per cent. of *inulin*, 17 of uncrystallizable sugar, and 18.7 of *levulin*. This last-named substance, discovered by Dragendorff, has the same composition as inulin, but dissolves in cold water, and is devoid of any rotatory power. Mannite, which has been found in the infusion of the root, has been demonstrated by Smith, of Edinburgh, not to pre-exist in the root, but to be formed by spontaneous changes consequent on exposure.

A crystallizable principle has been extracted from the juice of the root by Pollex, who has named it *taraxacin*. It is bitter and somewhat acrid, fusible, but not volatile, sparingly soluble in cold water, but very soluble in boiling water, alcohol, and ether. It is obtained by boiling the milky juice in distilled water, filtering the concentrated liquor, and allowing it to evaporate spontaneously in a warm place. The taraxacin crystallizes, and may be purified by repeated solution and crystallization in alcohol or water. Kromayer (*A. Pharm.* (2), cv, 6) also obtained taraxacin, and, in addition, a second crystalline principle, *taraxacerin*, C₈H₁₆O, insoluble in water, but soluble in alcohol. According to Vogel, the infra-cellular substance of the root consists chiefly of pectose, which is the result of a metamorphosis of the substance constituting the membrane of the cells. L. E. Sayre found that the yield of taraxacin varies in roots collected at different seasons. (See *Proc. A. Ph. A.*, 1893,1894.1895, 1896,1897.)

F. B. Power (*C. D.*, 1912, p. 822) contributed the results of some investigations of this drug, in which he states that besides inulin, resin and sugar, no definite substances have previously been isolated. The *taraxacin* of Poley (1839), and the *taraxacerin* of Kromayer (1861), to which was assigned the formula C₄₀H₈₀O₅, are both alleged to be definite mixtures. Power found in the air dried English root, an enzyme, essential oil, oily resin, fatty acids, including melissic, and *p-hydroxy-phenylacetic* acid, which had never before been isolated from a plant.

The roots of various plants have been largely substituted for dandelion in England and on the Continent by the herb gatherers, and we are

informed that fraudulent substitution is not unfrequent, in this country, of the root of *Cichorium Intybus*, or *chicory*. It is rare to find chicory mixed with dandelion, the former being usually boldly substituted for the latter.

Uses.—Taraxacum was formerly supposed to possess cholagogic as well as diuretic powers. It has been used in various conditions accompanied with congested or torpid liver. There is, however, no sufficient reason for believing it possesses any therapeutic virtues. The dried root is sometimes mixed, in powder, with ground coffee, the taste of which covers that of the dandelion. It is roasted and powdered and then prepared in the same manner.

Dose, one to three drachms (3.9-11.6 Gm.).

Off. Prep.—Fluidextractum Taraxaci, *U. S. (Br.)*; Extractum Taraxaci, *U. S.; Br.*; Succus Taraxaci, *Br.*; Elixir Gentianae Glycerinatum, *N. F.*; Elixir Taraxaci Compositum, *N. F.*

Taxus. *Taxus baccata* L. *Yew Tree. If cornmun*, Fr. *Eibe*, G. (Fam. *Taxaceae*)—The fruit of this handsome evergreen appears to be a deadly poison. In a fatal case the child was found semi-comatose, with convulsions, a cold and clammy skin, difficult respirations, dilated pupils, and making attempts at vomiting. The poison is probably in the seeds. (See 16th edition, *U. S. D.*; also James Thompson, *L. L.*, 1868, 530. For fatal cases in adults, see *M. T. G.*, 1870, ii; also *L. L.*; 1870, 471; also *P. J.*, viii, 361.) W. Marme obtained from yew seeds and leaves an alkaloid, $C_{37}H_{51}NO_{10}$, to which the name of *taxine* has been given. It was a white, poisonous, crystalline powder, only slightly soluble in water, easily soluble in ether, alcohol, chloroform, benzene and carbon disulphide, but not in petroleum benzin. It fused at 80° C. (176° F.). With concentrated sulphuric acid it gave a red color, but dissolved without color in nitric and phosphoric acids. (*A. J. P.*, 1876, 353.) For Vreven's method of isolating taxine, see *P. J.*, 1806, 215. Amato and Capparelli (*Gazz. Chim.*, x, 349) prepared from the leaves a volatile alkaloid, which was soluble in cold sulphuric acid with yellow color, becoming red on heating. They also isolated a nitrogenous crystalline and colorless principle, fusing at from 86° to 87° C. (186.8°-188.6° F.), soluble in alcohol, insoluble in water, named *milossin*.

Lefebvre (*A. Pharm.*, ccxiv, 486) has isolated from the twigs of the yew a crystalline glucoside to which he gives the name "*taxicatin*." It had the formula of $C_{13}H_{22}O_7 + 2H_2O$ and a melting point of 165° C. (329° F.).

Tayuya.—The root of the *Dermophylla (Cayaponia) pendulina* Manso (Fam. *Cucurbitaceae*), is used in Brazil, under the name of *tayuya*, in syphilis, etc. (*N. R.*, 1877, 234) ; also, under the same name, the root of the *Trianosperma ficifolia* Mart.

(*Cayaponia Martiana* Cogn.), also of the Fam. *Cucurbitaceae* (P. J., x, 667), and probably various other roots. In *C. ficifolia* Cogn. two alkaloids, *trianospermine* and *trianospermitine*, and a bitter principle, *tayuyin*, have been found by Peckoldt (P. J., x, 667), and in *T. dermatophylla* a green resin, bitter extractive, and tannic acid were found by the same investigator. (B. G. T., Ixxxiv, xci. See also *Proc. A. Ph. A.*, xxiv.)

Tea. *The*, Fr. *Thee*, G.—The plant which furnishes tea—*Thea sinensis* L. (Fam. *Theaceae*) — is an evergreen shrub. It has numerous alternate branches, furnished with elliptical-oblong or lanceolate, short petiolate, pointed leaves, which are serrate except at the base, smooth on both sides, green, shining, pinnately veined and having a prominent midrib. They are two or three inches long, and from half an inch to an inch in breadth. The flowers are either solitary or supported, two or three together, at the axils of the leaves. They are of considerable size, not unlike those of the myrtle in appearance, consisting of a short green calyx with five or six lobes, of a corolla with from four to nine large unequal snow-white petals, of numerous stamens with yellow anthers and connected at their base, and of a pistil with a three-parted style. The fruit is a three-locular and three-seeded capsule.

There are two principal varieties of *T. sinensis*, viz. *viridis* L., which is a large spreading shrub, having light green lanceolate leaves from 12 cm. long to 4 cm. wide; and a second variety, *Bohea* L., which is an upright shrub with dark-green elliptical leaves 6 cm. long and 3 cm. wide. The flowers of the latter occur in groups of two or three, whereas in *viridis* they are single. There are a great many varieties of tea, on the market, and their trade value is influenced by the peculiarities of mother plant and climate and the degree of ripeness and preparation of the leaves. As a rule only the youngest leaves are gathered. The so-called black and green teas are due to the method of preparation of leaves. In the first the chlorophyll is destroyed, whereas in the latter it is unaffected. Winton gives the following characters as common to all tea leaves: "The firm, rather thick texture; the glossy upper surface; the short stem into which the base of the leaf tapers; the thick margins, rolled a little towards the inner surface, with cartilaginous teeth; the veins which branch from the midrib. at angles usually greater than 45 degrees, and at some distance from the margin form loops uniting adjoining ribs. The teeth on the margin of the leaf are shrunken multicellular glands which break off readily from the old leaves." (For discussion of microscopical characteristics, see Winton and Moeller, "The Microscopy of Vegetable Foods.")

The tea plant is a native of China and Japan, and is cultivated in both countries, but moat abundantly in the former. It has been more recently cultivated in India (Assam), Ceylon, Java and in South Carolina. In Japan it forms hedge rows around the rice and corn fields; in China, whence immense quantities of tea are exported, whole fields are devoted to its culture. It is propagated from the seeds. For particulars as to the cultivation of tea, see P. J., 1871, 386.

(An elaborate article on tea, with methods of cultivation, etc., by Win. B. Marshall, U. S. Nat. Museum, will be found in A. J. P., 1903, p. 79.)

The odor of the tea leaves themselves is very slight, and it is customary to mix with

them the flowers of certain aromatic plants, as those of the orange, different species of jasmine, the rose, *Osmanthus fragrans* Lour. (*Olea fragrans* Thumb.), of the *Oleaceae*, and *Camellia Sasanqua* (Thumb. ?), in order to render them pleasant to the smell. The flowers are afterwards separated by sifting or otherwise. (See *P. J.*, xv, 112.) Under the name of flowers of tea was at one time sold a waste product consisting of the hair of young leaves, but the flowers themselves have been used to make a beverage. (*P. J.*, lxxi, p. 453.)

Bush Tea and *HonigThee*, used at Cape Colony, South Africa, as a substitute for tea, are the dried leaves and tops of several species of *Cyclopia*, among which are *C. subternata* Vog., *C. latifolia* DC., *C. genistoides* Vent. and *C. sessiliflora* Eckl. and Zeyh. (Fam. *Leguminosae*.) According to the analysis of Henry G. Greenish, they do not contain theine, but a gluosidal body, *cyolopin*, $C_{25}H_{28}O_{13}$. (*P. J.*; xi, 549.)

The United States imported in 1915, 96,987,942 pounds of tea, valued at \$17,512,619. The largest consumer is the United Kingdom, which in 1914 took 317,664,000 pounds, and the next Russia, which took 166,064,003 pounds. Numerous varieties exist in commerce, differing in the shape communicated by rolling, in color, in flavor, or in strength; but they may be all arranged in the two divisions of green and black teas, which, at least in their extremes, differ so much in properties that it is difficult to conceive that they are derived from the same species.

Under the name of *tea oil* there has appeared in the London markets a Chinese fixed oil said to be derived from *Camellia drupifera* Lour. [*C. oleifera* Wall.), a detailed description of which, with tests, may be found in the *P. J.*, vol. xvi, 634. A similar oil is prepared in Japan from the seeds of *Camellia japonica* L. (*Ibid.*, 637, 764.)

Green tea is characterized by a dark green color, sometimes inclining more or less to blue or brown. It has a peculiar, refreshing, somewhat aromatic odor, and an astringent, slightly pungent and agreeably bitterish taste. Its infusion has a pale greenish-yellow color, with the odor and taste of the leaves. According to Warington, who examined numerous varieties of tea carefully, both by the microscope and chemical tests, many of the green teas imported into Great Britain owe their color to a powdery coating, consisting of calcium sulphate and Prussian blue; others to a mixture of these with a yellowish vegetable substance; and others, again, to calcium sulphate alone. (*P. J.*, iv, 37.)

Black tea is distinguished by a dark brown color. It is usually less firmly rolled and lighter than the green, and contains the petioles of the plant mingled with the leaves. Its odor is fainter, and of a somewhat different character, though still fragrant. Its taste, like that of green tea, is astringent and bitterish, but is less pungent, and to many persons less agreeable. To hot water it imparts a brown color, with its sensible properties of taste and odor. These vary exceedingly in degree in the different varieties, and some black teas are almost wholly destitute of aromatic or agreeable flavor. According to Blyth, green tea is prepared from young leaves which are roasted over a wood fire within an hour or two after being gathered; while the black tea leaves, on the other hand, are allowed to lie in heaps for ten or twelve hours after they have

been plucked, during which time they undergo a sort of fermentation; the leaves then pass through certain processes, and are slowly dried over charcoal fires. (Wynter Blyth, *Foods, Composition and Analysis*, 1903.) A sophisticated tea is largely exported from China, consisting of powdered tea mixed with sand and other earth, and agglutinated with gum; that which is to pass for black being colored with plumbago, and the green with the coating above referred to. On analysis, these teas were found to afford from 35 to 45 per cent. of ashes, while the genuine yields only 5 per cent. A very full account of the adulteration of tea and the methods for the detection of the same may be found in Allen, *Cow. Org. Anal.*, 2d edition.

The analyses below by Y. Kozai (*Bulletin No. 7, Imperial College of Agriculture, Japan*) have a special value, owing to the author's knowledge of tea manufacture. Unusual precautions were taken in sampling the leaves, to insure strictly parallel specimens being taken. The figures refer to the moisture-free leaves in each case.

¹ Analyses of Tea (percentage composition).	Unprepared Leaves.	Green Tea.	Black Tea.
Caffeine or Theine.....	3.30	3.20	3.30
Ether Extract.....	6.49	5.52	5.82
Hot-water Extract.....	50.97	53.74	47.23
Tannin (as Gallotannic Acid).....	12.91	10.64	4.89
Other Nitrogen Free Extract.....	27.86	31.43	35.39
Crude Protein.....	37.33	37.43	38.90
Crude Fiber.....	10.44	10.06	10.07
Ash.....	4.97	4.92	4.93
Albuminoid Nitrogen.....	4.11	3.94	4.11
Caffeine Nitrogen.....	0.96	0.93	0.96
Amido-nitrogen.....	0.91	1.13	1.16
Total Nitrogen.....	5.97	5.99	6.22

Rochleder found also a peculiar acid, which he calls *boheic acid*, $C_7H_{10}O_6$. According to Stenhouse, the tannin of tea, though always accompanied by a little gallic acid, differs essentially from that of galls; not being, like it, a glucoside, but yielding, under the influence of sulphuric acid, a dark brown substance, almost insoluble in water. (See *A. J. P.*, 1862, 254.) For article on the methods of analysis of tea and a series of analyses of different varieties, see *A. J. P.*, 1887, 626. The volatile oil is citron-yellow, lighter than water, has a strong odor of the tea plant, solidifies easily by cold, and resinifies on exposure to air. It is probably one of the principles upon which depend the effects of tea upon the nervous system. Hence old teas are less energetic than the recently imported; and it is said that the fresh leaves have often produced dangerous effects in China. Nevertheless, the tannic acid is not without influence upon the system; and it is not improbable that the extractive contributes to the peculiar influence of this valuable product. Of these active ingredients, the volatile oil, tannic acid, and extractive are found most largely, according to the analysis of Mulder, in the green tea. *Theine*, $C_8H_{10}N_4O_2$, is a crystallizable principle discovered by Oudry. It was afterwards proved by Jobst to have the same composition as caffeine (see page 247). Kossel discovered, in 1888, a related principle, *theophylline* (*dimethylxanthine*), but only in very small amounts. It is now made synthetically and is official.

The proportion of theine found in tea varies considerably, the general range being

from three to four per cent. India and Ceylon tea usually contain slightly more than four per cent.

Tea is astringent and gently excitant, and exerts a decided influence over the nervous system, evinced by the feelings of comfort and even exhilaration which it produces, and the unnatural wakefulness to which it gives rise when taken in unusual quantities or by those unaccustomed to its use. It is almost exclusively used as a beverage. Taken moderately, and by healthy individuals, it may be considered as practically harmless; but long continued in excessive quantity it is capable of inducing unpleasant nervous and dyspeptic symptoms. Green tea is decidedly more injurious in these respects than black, and should be avoided by dyspeptic individuals, and by those whose nervous systems are peculiarly excitable. It is rarely used as a medicine, but the infusion is popularly employed to relieve neuralgic headaches.

Telfairia Pedata Hook. (Fam. *Cucurbitaceae*.) —The seeds of this East African plant yield a deep yellow fragrant oil, of specific gravity 0.918, containing *telfairic acid*. (*Chem. Zeit. R.*, xxiv, 24.)

Tephrosia. *Tephrosiavirginiana* (L.) Pers. *Turkey Pea*. *Wild Pea*. *Catgut*. *Goat's Rue*. *Hoary Pea*. *Devil's Shoestring*. *Tephrosie*, Fr., G. (Fam. *Legummosae*.)—Several species of *Cracca* and *Tephrosia* are employed in different parts of the world, though unknown in general commerce. They are leguminous plants, shrubby or herbaceous, with odd-pinnate leaves and white or purplish racemed flowers. They are generally possessed of cathartic properties, their leaves or roots being employed. Plugge (*Proc. A. Ph. A.*, 1897, 560) examined the root of *T. macropoda* and found a poisonous active principle, not identical with cytosine.

Hanriot isolated from *T. vogellii*, a crystalline principle, *tephrosin*, which occurs in small glistening crystals which are almost insoluble in water, slightly soluble in alcohol or glycerin, more readily soluble in acetone, and freely soluble in chloroform. Its formula is $C_{34}H_{26}O_{10}$. *Tephrosal*, $C_{10}H_{16}O$. is a volatile, aromatic liquid, slightly soluble in water, more readily soluble in alcohol, ether, benzin, and chloroform. (*T. C.*, li, 302'.)

Tephrosiavirginiana L. grows in most parts of the Eastern United States. It is a foot or two high, with pubescent stems and leaves and handsome terminal flowers. (See Griffith's *Med. Bot.*, 237.) The roots, which are slender, long, and matted, are tonic and aperient, and are said to have been used by the Indians as a vermifuge, given in the form of decoction.

According to Holmes (P. J., 1910, Ixxxiv) the *T. vogellii* is used in Africa as a fish poison. Its toxicity seems to be due to the neutral principle, *tephrosin*. There is no evidence as to its noxiousness for human beings.

TEREBINTHINA CANADENSIS. Br.

CANADA TURPENTINE

"Canada Turpentine is the oleo-resin obtained from *Abies balsamea*, Mill." Br.

Canada Balsam, Balsam of Fir; Balsamum Canadense; Baume du Canada, Fr. Cod.: Terebenthine du Canada, Fr.; Canadischer Terpentin, G.

The term *turpentine* is usually applied to certain vegetable juices, liquid or concrete, which consist of resin combined with a peculiar volatile oil, called *oil of turpentine*. They are generally procured from different species of pine, fir, or larch, though other trees afford products which are known by the same general title, as, for instance, *Pistacia Terebinthinus* L., which yields the Chian turpentine. Some French writers extend the name of turpentine to other juices consisting of resin and essential oil, without benzoic or cinnamic acid, as copaiba, balm of Gilead, etc. We shall describe particularly, in this place, the turpentines which are either now official or have recently ceased to be so. A brief botanical view of the plants from which they are respectively derived will be in accordance with the plan of this work. It is proper to observe first that the family Coniferae includes about three hundred and fifty species. These may be divided into two sub-orders, as Engler and Pranti suggest—viz., *Pinoideae* and *Taxoideae*. Lindley had previously recommended a similar sub-division, but considered each subgroup as deserving of family rank, and gave them the names Pinaceae and Taxaceae, which is commonly followed by the authors of Manuals of Botany. The *Pinoideae* may be further subdivided into the (A) *Abietineae*, including *Araucaria*, *Pinus*, *Cedrus*, *Larix*, *Picea*, *Tsuga*, *Abies*, *Sequoia*, *Taxodium*, etc.; and (B) *Cupressineae*, which include *Thuja*, *Juniperus*, etc. The *Taxoideae* include *Ginkgo*, *Taxus*, etc.

The genus *Pinus* is represented by about seventy species, which are widely distributed throughout the northern hemisphere of both continents. The principal centers of distribution of the species of this genus are in the Western United States (twenty-five species), Eastern United States (thirteen species), and the highlands of Mexico. It is one of the most important genera from an economic standpoint. The following species yield valuable timber: *P. palustris*, *P. Strobus*, *P. echinata*, *P. Lambertiana*, *P. ponderosa*, *P. monticola*, *P. heterophylla*,

P. sylvestris, *P. Laricio*, *P. nepalensis*, *P. Thunbergii*, and *P. densiflora*. Turpentine is obtained chiefly from the Eastern American *P. palustris* and *P. heterophylla*; it is also obtained from *P. Pinaster* and *P. halepensis* of the Mediterranean basin, and from the Himalayan *P. Roxburghii*. The edible seeds (*Pine Nuts*) of several species yield important articles of human food, the best being produced by the nut pines of Western North America, by *P. pinea* of the Mediterranean, *P. Cembra* of Europe and Asia, and *P. gerardiana* of Northwestern India. Pine wool, a coarse fiber manufactured from the leaves of *P. Laricio*, *P. sylvestris*, and other European species, is used to stuff mattresses and cushions, and woven with animal wool, is made into hospital and military blankets and into underclothing which are reputed to possess medicinal properties. In the Southern United States carpets are woven from the leaves of *P. palustris*. The bark of several species contains sufficient tannin to make them valuable for tanning leather.

1.—*Pinus palustris* Mill. (*P. australis* Michx. f.).—The names by which the tree is known in in the Southern States are *long-leaved pine*, *yellow pine*, *Southern pine*, *hard pine*, *Virginia pine*, and *pitch pine*; but the first is the most appropriate. The leaves occur three in a group, being from ten to fifteen inches long, subtended at the base by a conspicuous scaly sheath from one to one and a half inches long. The leaves are crowded at the ends of the branches. The cones are terminal, conical, and armed with a short recurved spine.

This pine is a very large indigenous tree, growing in dry, sandy soils, from the southern part of Virginia to the Gulf of Mexico. Its mean elevation is sixty or seventy feet, and the diameter of its trunk about fifteen or eighteen inches for two-thirds of its height. The leaves are about a foot in length, of a brilliant green color, and united in bunches at the ends of the branches. This tree furnishes by far the greater proportion of the turpentine, tar, etc., consumed in or exported from the United States. (See *Pix Liquida*.)

2.—*Pinus Taeda* L.—This is the *loblolly* or *old field pine* of the Southern States. "Leaves in threes, elongated, with elongated sheaths; strobiles oblong-conical, deflexed, shorter than the leaf; spines inflexed."

It is abundant in Virginia, where it occupies the lands exhausted by cultivation. It exceeds eighty feet in height, has a trunk two or three feet in diameter, and expands into a wide spreading top. The leaves are

about six inches long, and of a light green color. It yields turpentine in abundance, but the quantity is less than that which flows from the preceding species.

3.—*Pinus sylvestris* L. *Scotch Pine, Norway Pine, Scotch Fir*.—Leaves in pairs, rigid; stro-biles ovate-conical, of the length of the leaves; scales linear-oblong, the ends much thickened, their exposed parts (apophysis) oblique, rhomboidal, with a transverse ridge and central tubercle.

This tree, when of full size, is eighty feet high, with a trunk four or five feet in diameter. It inhabits Scotland and the northern and mountainous parts of Europe. It yields a considerable proportion of the common European turpentine.

4.—*Pinus Pumilio* Haenke (*P. montana* Mill.).—This pine is known in gardens under several names which are given to the forms occurring in the different mountain ranges over which it is spread. Beissner, in his *Handbuch der Nadelholzkunde*, considers *P. Pumilio* Haenke, a synonym of *P. montana*, Mill., whereas in the *Index Kewensis* the latter is brought under the former. Most authors agree with De Candolle and Beissner in bringing *P. Pumilio* Haenke, under *P. montana* Mill. The latter is a small tree, with decumbent or knee-like more or less erect branches, which are covered with a dark colored persistent bark. The leaves occur two in a sheath, each of which is from one to two inches long, straight, or scythe-shaped, with obtuse apex; both sides are dull green and slightly glaucous. The cones are ovoid, about one and a half inches long, with a pyramidal protuberance on each scale on the outer or exposed side. It is found in the sub-alpine regions of Central Europe at elevations between 4000 and 8000 feet; also on the Carpathian Mountains at from 4000 to 5500 feet. From its branches by spontaneous exudation or by cutting off their ends, *Hungarian balsam* is obtained. A volatile oil is obtained from its leaves (see *Oleum Pini Pumilionis*).

Pinus Pinaster Solander (*P. maritima* Poir.), which is found in the southern and maritime parts of Europe, yields much of the turpentine, pitch, and tar consumed in France, and is admitted among the official plants in the French Codex. *Pinus Lambertiana* of California, produces by exudation a saccharine matter which has been found to contain a peculiar sweet principle called *pinite*. (*C. R. A. S.*, Sept., 1855.) *Pinus Sabiniana* Dougl., known as *nut-pine* or *digger-pine* (because the nut is largely consumed by the Digger Indians), yields, on being notched, a

turpentine whose volatile oil is extensively used in California under the name of *abietene*. The *Pinus rigida*, or *pitch pine* of this country, and probably others besides those mentioned, are sometimes employed in the preparation of tar. *Pinus Teocoty* Cham. et Schlecht., yields a turpentine known as *Mexican* or *Brea turpentine*, which is used in Mexico.

ABIES.—The genus *Abies* is represented by about twenty-three species, which are distributed in the New World from Labrador and the valley of the Athabasca River to the mountains of North Carolina and from the mountains of Alaska to the highlands of Guatemala, and in the Old World from Siberia and the mountains of Central Europe to Southern Japan, the Himalayas, Asia Minor, and the mountains of Northern Africa. The species of this genus yield soft, perishable woods and balsamic exudations, which are employed in medicine and the arts.

Abies balsamea (L.) Mill., (*A. balsamifera* Michaux).—"Leaves solitary, flat, emarginate or entire, glaucous beneath, somewhat pectinate, sub-erect above, recurved spreading; cones cylindrical, erect; bracts abbreviate, obovate, conspicuously mucronate, sub-serrulate."

This is the *American silver fir*, or *balm of Gilead tree*, inhabiting Canada, Nova Scotia, Maine, and the mountainous regions farther south. It is an elegant tree, seldom rising more than forty feet, with a tapering trunk, and numerous branches, which diminish in length in proportion to their height and form an almost perfect cone. The leaves are six or eight lines long, inserted in rows on the sides and tops of the branches, narrow, flat, rigid, bright green on their upper surface, and of a silvery whiteness beneath. The cones are large, erect, nearly cylindrical, of a purplish color, and covered with a resinous exudation, which gives them a glossy, rich, and beautiful appearance. It is from this tree that the *Canada balsam* is obtained.

Several other species of *Abies* are important. The *A. Picea* Lindl. (*Abies pectinata* of De Candolle, *Pinus picea* of Linnaeus), or *European silver fir*, growing in the mountainous regions of Switzerland, Germany, and Siberia, yields the *Strassburg turpentine* (*Terebenthine d'Alsace* or *des Vosges*), which is much used in some parts of Europe. By the distillation of its cones with water it also affords a variety of oil of turpentine called in France *essence de templine*. By boiling the young branches of the allied *Picea Mariana* (Mill.), B. S. P. (*Pinus nigra* Link.), or *blade* or *bog spruce* of this country, and evaporating the decoction, the essence of

spruce is prepared. It is a thick, molasses-like liquid, with a bitterish, acidulous, astringent taste, and is used for making spruce beer. (See *U. S. D.*, 19th edition, page 1244.)

Abies Fraseri Lindley.—This species, commonly called *double fir*, occurs at high elevations in the mountains of Tennessee and North Carolina. The tree is noted for its hardiness, and is used for ornamental purposes. It is also said to have been used to furnish a balsam of fir similar to that obtained from *A. balsamea*, but the data concerning this are obscure.

Russian White Pitch, "belji var," "Sos nowaja Smold," which probably derived from the Siberian Fir, *Abies Pichta* Forb. (*Picea obovata* Ledeb.), contains, according to A. Tschirch, two free resin acids, the amorphous, *beljiabiennic acid*, $C_{13}H_{20}O_2$, and the crystalline, *belpiabetinic acid* besides *belpiresene*, $C_{13}H_{36}O$ and an essential oil. (*A. Pharm.*, Nov., 1902.)

LARIX.—The genus *Larix* has eight recognized species, which are now widely distributed over the sub-arctic and mountainous regions of the northern hemisphere, ranging from the Arctic Circle to the mountains of Pennsylvania in the New World and to latitude 30° in the Old World. The species produce hard, durable, valuable timber; turpentine, which is sometimes used in medicine; tar; bark rich in tannin; and a peculiar manna-like substance.

Larix decidua Mill. (*Larix europaea* De Cand.).—"Leaves fascicled, deciduous; cones ovate-oblong; margins of the scales reflexed, lacerated; bracts panduriform." The *European larch* is a large tree inhabiting the mountains of Siberia, Switzerland, Germany, and the east of France. It yields the Venice turpentine of commerce, and a peculiar sweetish substance called in France *Briancon manna*, which exudes spontaneously and concretes upon its bark. When the larch forests of Russia take fire, a juice exudes from the trunk during their combustion, which concretes and is called *Orenburg gum*. It is wholly soluble in water.

Coniferin is a term which has been given to a principle discovered by Hartig in the cambium of several of the Coniferae. The species in which it has been found are *Pinus Strobus* and *P. Cembra*, *Picea Abies* and *A. pectinata*, and *Larix Europaea*, and it probably exists in many others. It is obtained by removing the outer bark, scraping the cambium from the

surface of the "wood, subjecting this to pressure, boiling the viscid juice to coagulate the albuminous substances, filtering, and evaporating the filtered liquid to one-fifth of its volume. The coniferin is deposited in crystals. The mother-water is very sweet, and contains a saccharine substance closely allied to cane sugar. The crystals are purified by dissolving them in water, decolorizing by animal charcoal, and finally crystallizing from weak alcohol. Coniferin was chemically examined by M. W. Kubel, and later by Tiemann and Haarmann, who proved that it is a glucoside and as crystallized from the juice has the composition $C_{16}H_{22}O_8 + 2H_2O$. When treated with dilute acids or ferments it is decomposed as follows: $C_{16}H_{22}O_8 + H_2O = C_6H_{12}O_6 + C_{10}H_{12}O_3$. When this latter compound is oxidized (or coniferin itself) by potassium dichromate and sulphuric acid, *vanillin* is obtained, $C_6H_3(OH) \left\{ \begin{array}{l} OCH_3 \\ CHO \end{array} \right.$. Vanillin has been thus made commercially, but is now made preferably from the eugenol of oil of cloves or from benzoin.

In Japan, the exudation from the *Pinus densiflora* Sieb. et Zucc., and that from the *Pinus Thunbergii* Parl. are used under the respective names of *akamatsu* and *kuromatsu*. They are said to contain about 18 per cent. of oil and 81 per cent. of resin. The distilled oil is bright and colorless, having an odor somewhat different from that of the European oil of turpentine. It boils at from 155° to 156° C. (311° - 312.8° F.), and has a specific gravity of a little under 0.87. Its index of polarization is from 55° to 61° (dextrogyrate). The resin cannot be distinguished from the European. A turpentine closely resembling the French oil is produced in Burmah from the *Pinus Khasya* Royler, and *Pinus Merkusii* Jungh. et De Vries. (See *P. J.*, lvi, 1896, 370.)

PISTACIA.—See Mastiche.

Pistacia Terebinthus L. is a small tree of the family Anacardiaceae, with numerous spreading branches, bearing alternate, pinnate leaves, which consist of three or four pairs of ovate-lanceolate, entire, acute, smooth, and shining leaflets, with an odd one at the end. The male and female flowers are dioecious, small, and in branching racemes. It is a native of Barbary and Greece, and flourishes in the islands of Cyprus and Chio, the latter of which has given its name to the *Chian turpentine* obtained from the tree. A gall produced upon tills plant by the puncture of an insect has been used in Eastern Europe in pectoral affections.

We shall treat of the several varieties of turpentine under distinct heads.

1. WHITE TURPENTINE.

Terebinthina, *N. F. IV*; Thus Americanum, *Br.*; Common Frankincense; Terebenthine de Boston, *Fr.*; Terebinthina communis; Terebenthine de Bordeaux ou Terebenthine commune, *Fr. Cod.*; Terebinthina, *P.G.*; Terpentin, Gemeiner Terpentin, *G.*; Trementina comune. *It.*; Trementina de pina, *Sp.*

"A concrete oleoresin obtained from *Pinus palustris* Miller, and from other species of *Pinus* (Fam. *Pinaceae*)."*N. F. IV.*

Turpentine, or as it is more frequently called, white turpentine, was deleted from the U. S. VIII and the Br. Pharm., 1914. It was introduced in the N. F. IV as an ingredient in *compound rosin cerate*, or Deshler's salve, which was official in the U. S. VIII.

This variety of turpentine is derived chiefly from the *Pinus Palustris* and the *P. Taeda*. It occurs in the sap wood and is obtained by making incisions through the bark and wood and collecting the exudation in cavities or boxes made lower down on the trunk, from which it is dipped into barrels or other receptacles. It gradually thickens and ultimately acquires a soft solid consistence. White turpentine as found in commerce "occurs in yellowish, opaque masses, lighter internally, sticky and more or less glossy, brittle in the cold. Odor and taste characteristic. It is freely soluble in alcohol, ether, chloroform, or glacial acetic acid. Its alcoholic solution is acid to litmus." *N. F.* The following test is of value in testing the purity of turpentine:

"Dissolve about 1 Gm. of Turpentine, accurately weighed, in 25 mils of alcohol and collect the insoluble residue, if any, on a filter which has been dried at 100° C. (212° F.) and weighed. Then wash the residue and filter with about 25 mils of alcohol and dry at 100° C. (212° F.). The weight of the residue does not exceed 2 per cent. (mechanical impurities)." *N. F.*

In former times, large quantities were collected in New England, but the turpentine trees of that section have long been entirely exhausted, and our commerce has been until recently almost exclusively supplied from North Carolina and the southeastern parts of Virginia. Latterly

attention was turned to the collection of this valuable product of Georgia and Florida, and now an abundant supply is derived from the vast pine forests which occupy the southern portion of our country bordering on the Gulf of Mexico.

During the winter, deep notches or excavations of the capacity of about three pints are made in the trunk of the tree three or four inches from the ground, and for about three feet above these so-called "boxes" the tree is deprived of its bark and some of the wood scraped off. Into these the turpentine or "crude" begins to flow about the middle of March, and continues to flow throughout the warm season, slowly at first, rapidly in the middle of summer, and more slowly again in the autumn, the tree being scraped every eight or ten days to prevent clogging. The liquid is removed from the "boxes" as they fill, and transferred into casks, where, if left, it gradually thickens, and ultimately acquires a soft solid consistence, but most of it is separated at once by distillation into the rosin and the volatile oil of turpentine.

When a tree is boxed, it is weakened and falls easily before the wind. To obviate the former destructive method, Herty has devised "the cup and gutter system." (See *Bulletin No. 40, Bureau of Forestry.*) By this method a small incision is made through the bark and a strip of galvanized iron is inserted. The turpentine flows along this strip and is caught in an earthenware receptacle much resembling a medium-sized flower pot inserted upon the tree. While this method increases the yield of turpentine, it has not been generally adopted. Large quantities of turpentine are prepared directly from the wood of the trees which have been destroyed by the older or box method of collecting the oleoresin. "Wood" turpentine is not recognized as equivalent to "turpentine" by the Pure Food and Drugs Act, and must be labelled as "Wood Turpentine." The latter has a peculiar odor and is not used in medicine but is widely used in the arts.

White turpentine, as found in commerce, is yellowish white, of a peculiar somewhat aromatic odor, and a warm, pungent, bitterish taste. It is somewhat translucent, and of a consistence varying with the temperature. In the middle of summer it is almost semi-fluid and very adhesive; though brittle in the winter it is often so firm and hard as to be incapable of being made into pills without heat. "In yellowish, opaque masses, brittle in the cold; lighter internally, sticky and more or less glossy; odor and taste terebinthinatc. The alcoholic solution of

Turpentine has an acid reaction." *U. S. VIII.*

Exposed to the air it ultimately becomes perfectly hard and dry. In the recent state it affords about 17 per cent. of volatile oil. (See *Oleum Terebinthinae*.) It is likely to contain small pieces of bark, wood, or other impurity. Tschirch and Koritschoner found the following constituents in white turpentine: *palabiennic acid*, $C_{13}H_{20}O_2$, 5 per cent.; *palabietinic acid*, $C_{20}H_{30}O_2$, which is crystalline, 6 to 7 per cent.; α - and β -*palabietinolic acids*, together 53 to 57 per cent. Both the latter are amorphous and are separated by the differing solubility of their lead salts. All the acids are soluble in sodium hydroxide solution. The portion of the resin insoluble in NaOH solution consists of essential oil, 20 to 22 per cent., and *paloresene*, 10 per cent., with traces of a bitter principle. The essential oil has a characteristic turpentine-like odor. The sp. gr. is 0.864. (See *Oleum Terebinthinae*.) It is dextrogyrate, while the resin itself and palabietinic acid are leevogyrate. The authors have furthermore examined *Russian white pitch*, a product known as "belji var," and probably derived from the Siberian fir. (*A. Pharm.*, Nov., 1902.)

2. COMMON EUROPEAN TURPENTINE.

Terebenthine de Bordeaux, *Fr. Cod.*; Terebenthine commune, *Fr.*; Gemeiner Terpentin, *G.*; Trementina comune, *It.*; Trementina comun, *Sp.*

This is the *Terebinthina vulgaris* of the old London Pharmacopoeia. It is furnished by several species of pine, but chiefly by *P. sylvestris* L. and *P. Pinaster* Soland. For details as to the varieties of European turpentine and the methods of procuring them, consult *A. J. P.*, 1878, 69, 479; *Proc. A. Ph. A.*, xxiv, 203; *P. J.*, viii, 283; x, 447. From the latter tree it is obtained largely in the maritime districts of the Southwest of France, especially in the department of the Landes, and is exported from Bordeaux. Hence it is called in commerce *Bordeaux turpentine*. It is procured by making incisions into the trunk, or removing portions of the bark, and receiving the juice which flows out, in small troughs, or in holes dug at the foot of the tree. It is purified by heating, and filtering it through straw, or by exposing it to the sun in a barrel, through holes in the bottom of which the melted turpentine escapes. Thus prepared, it is whitish, turbid, thickish, and separates, upon standing, into two parts, one liquid and transparent, the other of a consistence and appearance like that of thickened honey. As found in European commerce, it often

consists wholly of this latter portion. It speedily hardens on exposure in thin layers to the air. The most liquid specimens are completely solidified by the addition of one part of magnesia to thirty-two parts of the turpentine. (J. P. C., xxv, 499.) Tschirch and Bruening (*A. Pharm.*, 1900, ccxxxvii, 630) find this oleoresin to have the following composition: 6 to 7 per cent. of *pimarinic acid*, $C_{14}H_{22}O_2$; 8 to 10 per cent. of *pimaric acid*, $C_{20}H_{30}O_2$; 48 to 50 per cent. of *alpha- and beta-pimarobic acids*, $C_{18}H_{26}O_2$; 5 to 6 per cent. of *bordoresin*, together with traces of *succinic acid*. The acid resins are soluble in sodium hydroxide solution, the pimarinic acid being separable from the other two by its property of forming with ammonium carbonate a water-soluble double salt. The volatile oil consists of two fractions, the larger fraction, amounting to about 85 per cent. of the whole, distilling easily. It is scarcely ever given internally, but furnishes large quantities of oil of turpentine and rosin. We do not import it into this country. The substance which the French call *galipot*, or *barras*, is that portion of the turpentine which concretes upon the trunk of the tree when wounded, and is removed during the winter. (Thenard.) This, when purified by melting with water and straining, takes the name of *yellow* or *white pitch*, or *Burgundy pitch*. When turpentine, whether the European or the American, has been deprived of its oil by distillation, the resin which remains is called *rosin*, and sometimes *colophony*, from the Ionian city of Colophon, where it was formerly prepared. It is the official rosin (*resina*), and is sometimes called yellow rosin (*resina flava*). White rosin (*resina alba*) is prepared by incorporating this, while in fusion, with a certain proportion of water. (See *Resina*.) Tar (*pix liquida*) is the product extracted from the wood by slow combustion and chemically altered by heat. Common pitch (*pix nigra*, or *resina nigra*) is the solid residue left after the evaporation by boiling of the liquid parts of tar.

3. CANADA TURPENTINE.

Baume du Canada, *Fr. Cod.*; Canadischer Balsam, Canadischer Terpentin, *G.*; Trementina del Canada, *It.*

Terebinthina Canadensis, U. S., Br., is collected in Canada and the State of Maine from the *Abies balsamea*, by breaking the vesicles which naturally form upon the trunk and branches, and receiving their liquid contents in a bottle. "Pale yellow or greenish-yellow, transparent, viscous. Agreeable terebinthinate odor; taste feebly bitter and acrid. Dries very slowly to a transparent varnish when exposed to the air.

Solidifies when mixed with about one-sixth of its weight of heavy magnesia moistened with a little water." *Br.*

"It is completely soluble in ether, chloroform, or benzene." *U. S. VIII.*

For a paper on its miscibility in alcohol, by J. E. Morrison, see *Proc. A. Ph. A.*, 1894, 309. By time and exposure it becomes thicker and more yellow, and finally solid. It is usually brought into market in bottles under the name of *Canada balsam* or *balsam of fir*. Under the microscope the hard balsam is found to be entirely free from any granular or crystalline structure. In Europe it is sometimes called *balm of Gilead*, from its supposed resemblance to that celebrated medicine. The term *balsam*, as at present understood, is improperly applied to it, as it contains no benzoic or cinnamic acid, and is in fact a true turpentine, consisting chiefly of resin and volatile oil. Bonastre obtained from 100 parts of Canada turpentine 18.6 parts of volatile oil, 40.0 of resin easily dissolved by alcohol, 33.4 of sub-resin of difficult solubility in that fluid, 4.0 of caoutchouc similar to sub-resin, and 4.9 of bitter extractive and salts, besides traces of acetic acid. Fluckiger found in 100 parts 24 parts of an essential oil, $C_{10}H_{16}$, with a very small proportion of an oxygenated oil, 60 parts of a resin soluble in boiling alcohol, and 16 parts of a resin soluble only in ether. (*Pharmacographia*, 2d ed., 614.) Emmerich obtained by fractional distillation of the oil, *bornyl* or *terpinyl acetate*, *pinene*, and a fragrant liquid resembling oil of lemon. (A. J. P., 1895, 135. See also a paper by Hunkel, A. J. P., 1895, 9.) The chief distinction between it and *Strassburg turpentine*, which is sometimes sold for it in commerce, is in the odor.

According to Tschirch, Wiegel and Bruening, Canada turpentine contains about 63 per cent. of acid resins, from 23 to 24 per cent. of volatile oil, and from 11 to 12 per cent. of indifferent resin. The acid portion consists of four acids, of which one—*canadinic acid*, $C_{19}H_{34}O_2$ —obtained by treating the oleoresin with ammonium carbonate, with which it combines; a small amount of crystalline *canadolic acid*, $C_{19}H_{28}O_2$, and two amorphous isomeric acids—*a-* and *β-canadinolic acids*, $C_{19}H_{30}O_2$ —which constitute the main portion of the acid resins. The indifferent resin has the formula $C_{21}H_{40}O$. The greater part of the volatile oil boils between 160° and 167° C. (320° and 332.6° F.). (A. Pharm., 1900, Aug. and Sept., 401, 411 and 487.)

Abies Menziesii Lind.—From this a *Balsam of Fir* of the Pacific Slope, has been obtained; it is a turpentine similar to Canada balsam and is extensively sold under the names *Oregon Balsam* or *Oregon Balsam of Fir*. Roberts and Becker (*Proc. P. P. A.*, 1913, p. 328) state that Canada balsam is thicker than Oregon balsam, dries to a solid, transparent film, while Oregon balsam remains sticky, has a lower acid value than Oregon balsam, and solidifies when mixed with 20 per cent. of magnesium oxide, which Oregon balsam does not.

4. VENICE TURPENTINE.

Terebinthina Laricis, N. P. IV; Larch Turpentine; Terebenthine de Venise, *Fr. Cod.*, Terebenthine de Meleze, *Fr.*; Venetianischer Terpentin, *G.*; Trementina di Venezia, *It.*; Trementina de alerce, Trementina de Venecia, *Sp.*

"A viscid oleoresin obtained from *Larix europoea* De Candolle (Fam. *Pinaceae*)." *N. F.*

"*Venice turpentine* is a nearly transparent, yellowish or yellowish-green, thick liquid, heavier than water, and having a distinctive odor and a bitter characteristic taste. Completely soluble in alcohol, glacial acetic acid, acetone, or chloroform. Almost entirely soluble in petroleum benzin with the separation of a light flocculent deposit. One part of Venice turpentine dissolves completely and forms a clear solution in 3 parts of 80 per cent. alcohol. It may possess a slight, greenish fluorescence when viewed by reflected light but exhibits no violet or purple fluorescence (*rosin oil*). Dissolve 5 Gm. of Venice turpentine in 25 mils of alcohol, add a few drops of phenolphthalein T.S. and render the solution slightly alkaline by the addition of a 10 per cent. solution of potassium hydroxide. The resulting solution is clear and transparent and no separation of oily drops occurs (*rosin oil*). Its acid number is not more than 80 when determined as directed in the U. S. Pharmacopoeia IX." *N. F.*

This turpentine was named from the circumstance that it was formerly an extensive article of Venetian commerce. It is procured in Switzerland, and in the French province of Dauphiny, from the *Larix decidua* (*L. europoea*), which grows abundantly upon the Alps and the Jura Mountains. The peasants bore holes into the trunk about two feet from the ground, and conduct the juice by means of wooden gutters into small tubs placed at a convenient distance. It is afterwards purified by filtration through a leather sieve. Genuine Venice turpentine is a viscid

liquid, the consistence of honey, flowing with difficulty, cloudy or imperfectly transparent, yellowish or slightly greenish, of a strong not disagreeable odor, and a warm bitterish, and acrid taste. It does not readily concrete on exposure, is not solidified by one-sixteenth of magnesia, and is entirely soluble in alcohol. (Guibourt, *J. P. C.*, xxv, 500.) H. Beckurts and W. Brueche found the specific gravity at 15° C. (59° F.) from 1.060 to 1.190; acid number from 76 to 101 (Kremel found from 68 to 70.3); ester number from nothing to 6; saponification number from 81 to 101, and the iodine number from 137 to 149. (*A. Pharm.*, 1892, ccxxx, 83.) It yields on an average 15 per cent. of essential oil, of the composition $C_{10}H_{16}$, which has been found to be nearly pure *pinene*. The residual resin is soluble in two parts of warm alcohol of 57 per cent., and more copiously in absolute alcohol.

Tschirch and Wiegel investigated the constituents of Larch Turpentine. According to these investigators, this oleoresin contains from 60 to 64 per cent. of acid resins soluble in soda, from 20 to 22 per cent. of volatile oil, and from 14 to 15 per cent. of indifferent resin. The acid resins consist mainly of two isomeric amorphous bodies, *a*- and *b*-larinolic acid, $C_{17}H_{26}O_2$, and a smaller quantity of the crystalline *laricinolic acid*, $C_{20}H_{30}O_2$. The greater portion of the volatile oil boils between 155° and 170° C. (311° and 338° F.); a smaller quantity of higher boiling sesquiterpene commencing to boil at 190° C. (374° F.). The recently distilled oil has the sp. gr. 0.872, and possesses a characteristic turpentine odor. It is soluble in all proportions in alcohol and other solvents. (*A. Pharm.*, 1900, Aug. and Sept., 401, and 411, 487.) What is sold under the name of Venice turpentine, in commerce, is usually quite brown, and is a factitious substance, prepared by dissolving rosin in oil of turpentine. According to G. Fabris the nature of these spurious Venice turpentines can readily be detected by dissolving 5 Gm. of the sample in 20 mls of 95 per cent. alcohol, adding a few drops of phenolphthalein and sufficient of a 10 per cent. solution of potassium hydroxide to render it alkaline. With genuine Venetian turpentine a clear solution is obtained, while the spurious drug yields a turbid solution, from which, on standing, drops of oily resin separate.

5. CHIAN TURPENTINE.

Terebenthine de Chio, *Fr. Cod.*; Cyprischer Terpentin, *G.*; Trementina Cipria, *It.*

This variety of turpentine is collected chiefly in the island of Chio, or Scio, from the *Pistacia Terebinthus*, and it is said that the whole annual product of the island is only about two hundred and twenty-four pounds. During the summer the juice flowing spontaneously, or from incisions in the bark, falls upon smooth stones, or bundles of twigs, placed at the foot of the tree, from which it is procured by boiling and straining. After straining it is again boiled with a little water until all the water is evaporated, when it is finally poured into a vessel of cold water and kneaded. At first it is of a dirty yellow color, but after kneading it becomes quite white. (*P. J.*, xvi, 385.) The annual product of each tree is very small, and the turpentine, therefore, commands a high price even in the place where it is procured. Very little of it reaches this country. It is said to be frequently adulterated with the other turpentines. It is a thick, tenacious liquid, of a greenish-yellow color, or it occurs as a viscid opaque mass. The odor is peculiar, penetrating, and more agreeable than that of the other substances of the same class. The taste is mild, without bitterness or acrimony. Fluckiger found nearly 14¹/₂ per cent. of essential oil, which contained a small quantity of an oxygenated oil. It leaves a glutinous residue when treated with strong alcohol. (Guibourt.) Its alcoholic solution does not redden litmus paper. (Martindale.) On exposure, liquid Chian turpentine speedily thickens, and ultimately concretes into a translucent solid, yellowish or yellowish-brown when in small pieces, greenish-brown in mass.

The odor of Chian turpentine is variously described. As the only tests we now have of the purity of the drug are its physical characteristics, and of these the odor is the most important, we give the following description by Wm. Martindale. (*P. J.*, April, 1880.) Chian turpentine " has when fresh a distinctive odor, slightly like the pinaceous turpentines, but much more agreeable and aromatic, according to some* resembling citron and jasmine; but there is always a background smell like that of mastic, which becomes more developed and distinct with age, when it has lost the more volatile portion, the essential oil. According to Pereira, the turpentine-like odor is combined with the odor of fennel, and Guibourt says, when kept in a covered glass vessel the odor is strong and agreeable, analogous to that of fennel or the resin of elemi. It probably loses this rapidly. A specimen, bearing Guibourt's name, in the Ph. Society's Museum, has now no trace of it, but the mastic odor is very persistent. If the fennel odor be very evident in it I should fear the sample was not genuine, as in a statement made in the *Lancet* the writer says what is sold as Chian turpentine (is either greatly

adulterated or a wholly factitious article, manufactured from black resin, Canada balsam, and the essential oils of fennel and juniper. The taste of genuine Chian turpentine resembles that of mastic; it is agreeable and free from the characteristic bitterness and acidity of the pinaceous turpentines."

Besides the turpentines mentioned, various others are noticed in books on *Materia Medica*, though not found in commerce in this country. There are the *Strassburg turpentine*, much used in France, and obtained from the *Abies Picea* (*Abies pectinata* of De Candolle), or European silver fir, which grows on the mountains of Switzerland and Germany and bears a close resemblance, as well in its appearance as in its product, to *Abies balsamea* of Canada; the *Russian turpentine*, from *Pinus sylvestris*; the *Damara turpentine*, which speedily concretes into a very hard rosin, and is derived from *Pinus Damaris* Lam., the *Agathis damara* of Richard, growing in the East India islands; the *cowrie* or *cowdie* resin, procured by incision from another species of *Agathis*, *A. australis*, in New Zealand; and the *Dombeya turpentine*, a glutinous, milky-looking fluid, of a strong odor and taste, derived from the *Araucaria Dombeyi* of Richard, also called *Dombeya excelsa*, which inhabits Chili.

Finnan Turpentine, the oleoresin of *Pinus sylvestris*, is found by Tschirch and Niederstadt to consist of: 1.5 per cent. *silveolic acid*, $C_{14}H_{20}O_2$; 58 to 60 per cent. of *a-silvinolic acid*, $C_{15}H_{26}O_2$, and *β-silvinolic acid* ($C_{14}H_{24}O_2$); 20 to 21 per cent. of resene; 15 per cent. of volatile oil; and traces of bitter principle and suceinic acid. Silveolic acid is crystalline; *a*- and *β*-silvinolic acids are both amorphous. The volatile oil has the sp. gr. 0.840 at 15° C. (59° F.), is soluble in all proportions in alcohol, ether, and chloroform, and is neutral when recently distilled, but becomes acid when exposed to the air. (*A. Pharm.*, 1901, ccxxxix, 167.)

Jura Turpentine.—A. Tschirch and E. Bruening have determined the following constituents of the oleoresin of *Picea vulgaris*: From 2 to 3 per cent. of *picea-pimarinic acid*, $C_{18}H_{20}O_2$; from 1.5 to 2 per cent. of *picea-pimaric acid*, $C_{20}H_{30}O_2$; from 48 to 50 per cent. of *a*- and *β*-*picea-pimarolic acid*, $C_{25}H_{44}O_2$; from 32 to 33 per cent. of volatile oil; from 10 to 12 per cent. of resene, $C_{21}H_{36}O$; and traces of suceinic acid, coloring matter and bitter principle. (*A. Pharm.*, 238, Nov. 10, 1900, 616.)

Tschirch and Weigel (*A. Pharm.*, 1900, Aug. and Sept., 401, 411, 487) investigated Strassburg turpentine—the oleoresin of *Abies Picea*; it contains from 8 to 10 per cent. of an acid resin, *abieninic acid*, $C_{13}H_{20}O_2$; from 1.5 to 2 per cent. of a crystalline acid resin, *abietolic acid*, $C_{20}H_{28}O_2$; from 46 to 50 per cent. of two amorphous isomeric acid resins, *a-* and *β-abietinolic acid*, $C_{16}H_{24}O_2$; from 12 to 16 per cent. of a neutral resin, *abiето-resin*; and from 28 to 30 per cent. of volatile oil, together with traces of succinic acid, bitter principle, coloring matter, moisture and impurities. The oil when recently distilled has the sp. gr. 0.860, boiling between 148° and 165° C. (298.4° and 329° F.); the major fraction distils between 162° and 163° C. (323.6° and 325.4° F.). It has a greenish fluorescence and a lemon-like odor. When the oleoresin is distilled with potassium hydroxide a pleasant rose or orange-flower odor is developed, possibly due to the liberation of a fragrant alcohol.

Properties.—The turpentines resemble one another in odor and taste, though distinguished by shades of difference. Liquid at first, they become thick and gradually solid by exposure, in consequence partly of the volatilization, partly of the oxidation of their essential oil. They are rendered more liquid or softened by heat, and at a high temperature take fire, burning with a white flame and much smoke. Water extracts only a minute proportion of their volatile oil. They are almost wholly soluble in alcohol and ether, and readily unite with the fixed oils. They yield by distillation a volatile oil, called *oil of turpentine*, the composition of which is essentially uniform, it being composed of several terpenes (pinene, dipentene, and sylvestrene) of the formula $C_{10}H_{16}$, the residue consisting exclusively of rosin. (See *Oleum Terebinthinae* and *Resina*.) Both the cones and leaves of *Abies Picea* yield oils known respectively as *pine cone oil* and *pine needle oil*. According to *Schimmel's Report* for April, 1897, they both contain pinene, limonene, and bornyl acetate. The oil from *Pinus sylvestris*, known as *fir oil*, also contains bornyl acetate to the amount of 12 per cent., according to *Schimmel's Report* for October, 1897, 47. On the other hand, the oil from *Larix Europoea*, known as *larch needle oil*, contains 8.1 per cent. of bornyl acetate and 6.14 per cent. of free borneol. (*Ibid.*, 61.)

Schiff affirms that the odor of turpentine is due to the presence of a product of oxidation, probably a camphoric aldehyde, $C_{10}H_{16}O_2$, which, with the odor, may be removed by shaking the turpentine with sodium

bisulphite. A non-odorless turpentine may also be obtained by washing with solution of sodium hydroxide and distilling in an atmosphere of carbon dioxide. From the experiments of Faure, of Bordeaux, it appears that some of the liquid turpentines, like copaiba, may be solidified by the addition of magnesia. (*Journ. de Chim. Med.*, 1830, 94.) According to Thierry, the same result is obtained by the addition of one part of calcium hydroxide to thirty-two parts of common European turpentine. (*J. P. C.*, 3e ser., i, 315.) Crouzel (P. J., 1892, 11) found tannin in the bark of *P. Pinaster*, associated with a peculiar reddish-yellow coloring matter, representing tannin in the process of formation.

Ed. Hirschsohn made experiments with the object of determining a reliable method for distinguishing artificial turpentine from the common, natural turpentine and larch turpentine, this becomes possible by the difference in the solvent effect of official ammonia water and alcohol, sp. gr. 0.863 at 15.6° C. (60° F.), upon them, under the conditions indicated in the following table:

Kind of Turpentine	Ammonia Solution (sp. gr. 0.960), 1 p. turpentine and 5 p. ammonia solution.	Alcohol (sp. gr. 0.863), 1 p. turpentine and 3 p. alcohol.
Venice turpentine	Is not disintegrated; produces a milky fluid in the water-bath.	Yields a nearly clear solution.
Common turpentine	Easily disintegrated, forming a milky mixture, then gelatinous; becomes clear in the water-bath.	Large quantities are deposited, but the mixture becomes clear in the water-bath.
Artificial turpentine	Is disintegrated, becomes clear in the water-bath for a moment, then turbid.	Turbid solution and precipitation; turbid in the water-bath with precipitation.

A mixture of common turpentine with larch (Venice) turpentine is recognized by the turbidity of, and precipitate from, the solution of 1 Gm. of the sample in 3 Gm. of alcohol sp. gr. 0.863. The same occurs if the common is replaced by artificial turpentine, but the latter is differentiated by ammonia, from the fact that in the presence of 20 to 30 per cent. of common turpentine the sample is easily disintegrated, and the solution becomes clear in the water bath, while in the presence of artificial turpentine the behavior is the same as with the pure Venice turpentine. (*Ph. Centralh.*, Nov. 26, 1903, 825 to 828.)

Uses.—The physiological activities of turpentines depend upon their volatile oils. They are so inconvenient of administration, and so variable in their activity that at present they are very rarely, if ever, used internally by regular practitioners of medicine. For an account of their

physiological and therapeutic properties, see *Oleum Terebinthinae*. If given at all they should be administered in emulsion. Chian turpentine has been recommended as a specific in cancer, given in emulsion in doses of five grains (0.32 Gm.), increased pro re nata, and also applied locally. It is probably without value. Turpentine vapor baths have been found useful in the treatment of *chronic rheumatism*; they may be given by simply evaporating oil of turpentine in the ordinary cabinet or other vapor bath, or by driving the vapor through the fine branches and leaves of a terebinthinate plant. They probably differ in their action from the simple hot vapor bath by the stimulation of the skin due to the local action of the turpentine, and by the copious sweating which they produce. The bath should always be so arranged that the terebinthinate vapor is not inhaled by the patient.

Dose, twenty to thirty grains (1.3-2.0 Gm.).

Tetragastris. *Tetragastrispanamensis* (Engl.) O. Kuntze. *Bois Cochon*, or *Sucrier de Montagne*, Fr. (Fam. *Burseraceae*).—This native of Panama has been examined by Gaucher, Combemale and Marestang (*FranceMed.*, October, 1888), who find in it an alkaloid and a resin. The extract of the root and sterna produces in the guinea pig rapid and considerable lowering of temperature, progressive paralysis, general convulsions, dilatation of the pupils, respiratory irregularity and cardiac paresis. The alkaloid was found to be a convulsive agent, acting upon the spinal cord. The resin, which seemed much more active than the alkaloid, acted as a paralyzant.

Tetranthera.—From the bark of the lauraceous plant, *T. citrata* Nees (now *Litsea citrata* Blume), J. D. Filippo has extracted an alkaloid, *laurotetanine*. (See *A. Pharm.*, 1898, 601.)

Charabot and Lalone examined the volatile oils from various parts of *Tetranthera* (*Litsea citrata*). The oil from the bark has the sp. gr. 0.8673 at 15° C. (59° F.), that from the leaves 0.9013 at 15° C. (59° F.) and that from the fruits 0.8872 at 15° C. (59° F.). (P. J., 1908, 351.)

Teucrium. *Teucrium Chamaedrys* L. *Germander*. *Chamaedrys*. *Petit Chene*, Fr. *Edlar*, *Gamanderlein*, *Frauenbiss*, G.—A small European labiate, which has been employed as a mild corroborant in *uterine*, *rheumatic*, *gouty* and *scrofulous affections* and *intermittent fevers*. Germander was an ingredient in the *Portland powder*, noted as a remedy in gout. This powder, according to the original prescription, consisted of equal parts of the roots of *Aristolochia rotunda* L. and *Gentiana lutea* L. of the tops and leaves of *Teucrium Chamaedrys* and *Erythraea Centaurium* (L.) Pers. and of the leaves of *Ajuga Chamaepitys* Schreb., or ground pine. The dose was a drachm every morning before breakfast for three months, then forty grains for three months, afterwards half a drachm for six months, and finally half a drachm every other day for a year. (Parr.)

Two other species of *Teucrium* have been used in medicine,—*T. Marum* L., *cat thyme*, or *Syrian herb mastich*, indigenous in the south of Europe, and *T. Scordium* L., or *watergermander*, growing in the higher latitudes of the same continent. The former is a warm, stimulating, aromatic bitter, and has been recommended in *hysteria*, *amenorrhoea* and *nervous debility*; the latter has the odor of garlic and a bitter, somewhat pungent taste, and was formerly highly esteemed as a corroborant in *low forms of disease*; but neither of them is now much employed. *T. Marum* is an errhine, and was formerly an ingredient of the *Pulvis Asari Compositus*.

A plant said to have been used advantageously in *cholera* in the Levant, a specimen of which was sent to Paris, proved to be *Teucrium Polium* L. (*J. P. C.*, xv, 352.) Moorhof (*Ph. Cent.*, 1893, 89) prepared a purified liquid extract from *T. Scordium*, and named it *teucrin*, which he recommends in the treatment of fungoid diseases and abscesses.

The dose of either of the three species is about half a drachm (2.0 Gm.).

Thalictrum.—It appears probable that many species of this genus (Fam. *Ranunculaceae*) have active medicinal or toxic properties. In 1879 Henriot and Doassans asserted that they had separated from the roots of the *Thalictrum macrocarpum* Gren., a shrub of the Pyrenees, a crystalline yellow substance, having very pronounced toxic principles, analogous to those of curare; and subsequently stated (*C. R. S. B.*, 1880) that this substance really consists of two principles,—an alkaloid, *thalictrine*, obtained in the form of prismatic needles, insoluble in water, soluble in alcohol, forming crystalline salts with acids, and macrocarpin, a yellow crystalline body, soluble in water, representing the coloring principle of thalictrum. Subsequently *berberine* was found by Doassans and Mousset in *Thalictrum flavum* L., Fen Rue or *Monk's Rhubarb*, a shrub widely distributed in Europe and Asia, macrocarpin being, according to this authority, very closely allied to berberine, but differing in that its color is not affected by ammonia. Rochebrune (*Toxicolog. Africaine*, i) has found both thalictrine and macrocarpin in the roots of *Thalictrum glaucum* Pesf., of Spain. Thalictrine he states to be a very active cardiac poison, producing loss of power, convulsive movements, irregularity and depression of the heart's beat, and finally death in some cases in convulsions. According to Rochebrune, thalictrine also exists in the African species *Thalictrum rhynchocarpum* Q. Dillon and A. Rich.

Thapsia. *T. garganica* L. *Thapsie*, *Faux Fenouil*, Fr.—An umbelliferous plant, growing in Southeastern Europe, and well known to the ancients, named from the isle of Thapsos, where it was obtained. Theophrastus speaks of its root as emetic and purgative. After long neglect this plant has obtained a foothold in the French Codex, which recognizes a *Resina Thapsiae* prepared by exhausting the bark of the root with alcohol and evaporating to a soft extract. From this extract the Codex further directs that an *Emplastrum Thapsiae* shall be so prepared as to contain 7 per cent. of the resin combined with yellow wax, turpentine and colophony. The bark of the root and the resin are both objects of commerce. The bark is described by Stanislaus Martin

as almost always doubly quilled, unless where altogether in small fragments, exteriorly rugose with the epidermis here and there detached in patches larger or smaller, and of a deep brown color, interiorly smooth and whitish and of a fibrous fracture. The size of the pieces varies, the largest not exceeding 6 dm. in length and 2.5 in width. It is said that great care is necessary, in removing the root from the bales, not to be injured by the powder which escapes, and which causes itching and swelling of the face and hands. By submitting thapsia to the successive action of alcohol and ether Pressoir obtained two resins. (*J. P. C.*, 4e ser., xi, 328.) Canzoneri finds that the ethereal extract is an amber-colored syrupy resin possessing vesicating properties. From it he has obtained two acids, *octoic* or *caprylic* acid, and *thapsic* acid, besides a neutral non-nitrogenous vesicating substance. (See *A. J. P.*, vol. xiv, 325.) Cazenave objects to the plaster prepared from the resin and kept in masses, as it deteriorates by time. He proposes the following method of preparing a plaster extemporaneously when wanted. Dissolve the resin in alcohol and with the aid of a brush spread it on a suitable recipient, which may be of ordinary plaster, waxed taffetas, or simply gummed paper. A single layer is sufficient for the purpose of an active revulsion, but the effect may be increased at pleasure by increasing the number of layers. (*J. P. C.*, 1868, 29.) The French thapsia, plaster is an exceedingly active counter-irritant, producing much inflammation of the skin with an eczematous eruption and intolerable itching and, if the application be maintained, finally an ulcerated and suppurated surface, which on healing leaves behind it pronounced scars. The therapeutic action of the plaster is that of a severe counter-irritant.

The resin from the root of *Thapsia Sylphium* St.-Laz., an Algerian plant, which most botanists believe to be a simple variety of *T. Garganica* L. is, according to Herlaut, more active than that of the official plant. (*Proc. A. Ph. A.*, xxvi, 250.) Heckel and Schlagdenhauffen (*N. R.*, June and July, 1887) find in the root of *Thapsia villosa* L. a vesicant resin, which acts more slowly and gently than does that of *T. Garganica*.

Thevetia. *Yccotli*.—Inhabiting the damp, hot valleys of the Mexican Cordilleras is a large tree belonging to the *Apocynaceae*, whose fruits are known by the natives as *huesos o codos de fraile*, or *friar's elbow bones*, and are used as a topical application in hemorrhoids. The tree is the *Thevetia Jccotii* A. DC. In the seeds Herrera found a glucoside, *thevetin*. (*A. J. P.*, 1877, 145.) Closely allied to *T. Yccotli* is *T. nereifolia* Juss., a tree which probably grows also in Mexico, but has been found by botanists chiefly, if not solely, in the West Indian Islands, Colombia, Peru and other parts of South America. De Vrij very many years ago discovered in its seeds a glucoside which was closely studied by Bias. (*Neues Jahrb. f. Pharmacie*, Bd. xxxiv, 1854, 1.) He gave it the name of *thevetin* and the formula $C_{54}H_{84}O_{24}$ and believed it to be identical with *cerberin*, previously found by Oudemann in *Cerbera Odallam* Ham., also an apocynaceous plant, but Plugge (*A Pharm.*, 1893, 10) after a thorough study found that cerberin was not identical with either tan-gihinin or thevetin. With the former it is isomeric, showing the same percentage composition, but has different crystalline form and melting point—cerberin 192° C. (377.6° P.), tanghinin 182° 0. (359.6° F.). From thevetin it differs not only in composition, but in the nature of the decomposition products. *Cerberin*, $C_{27}H_{40}O_8$, is decomposed into *cerberetin*, $C_{19}H_{26}O_4$, a citron-yellow amorphous powder melting at 85.5° C. (186° F.), and

glucose, while thevetin, $C_{54}H_{84}O_{24}$, is split into theveresin, $C_{48}H_{70}O_{17}$, a white powder, and glucose.

Merck (*Jahresb. fur*, 1892, 57) described a glucoside *cerberin* to which he gives the formula $C_{25}H_{38}O_{12}$, which name he changed to *cerberid* in 1911. He states that it was obtained from a Mexican plant, probably *Thevetia Yccotli*. Whether this glucoside is identical with the thevetin of Bias cannot be definitely stated. Bias found that the thevetin of De Vrij boiled in diluted sulphuric acid splits into glucose and *theveresin*, which has the formula $C_{48}H_{70}O_{17}$. Thevetin occurs in minute crystals, odorless, of a bitter taste, slightly soluble in cold water (twelve parts), freely so in boiling water, diluted and strong alcohol, acetic acid, insoluble in ether. Its most characteristic reaction appears to be its dissolving in concentrated sulphuric acid, with the production of a reddish-brown color, changing to a cherry-red, and after some hours to a violet color. In commerce it occurs as a yellowish-white, amorphous bitter powder, easily soluble in water and alcohol. Theveresin is only slightly soluble in boiling water. These substances are active poisons. *Thevetosin*, a crystalline glucoside, was made by Herrera from the seeds of *T. Yccotli*. It is a cardiac poison. (*M. R.*, 1911.) A number of cases of poisoning by the seeds of the East Indian thevetia has occurred; the symptoms have been repeated vomiting, a slow, very feeble pulse, delirium, convulsive movements and coma. The physiological action of the thevetin from *T. nereifolia* has been investigated chiefly by König. (*A. E. P. P.*, Bd. v, 228.)

David Cerna finds that the glucoside of *T. Yccotli* (*P. M. T.*, ix, 396) with sulphuric acid affords a clear greenish-yellow solution gradually passing to brown and brownish-violet and finally becoming a permanent cherry-brown color, which changes on the addition of potassium bicarbonate to an emerald-green; also that it is in moderate doses stimulant both to the circulation and respiration, but finally paralyzes the heart muscle and the respiratory apparatus; that it causes cerebral convulsions and spinal paralysis, abolishing sensation and reflex activity before voluntary movement by an influence upon the sensory nerves or spinal tract. Zotos N. Zotos (*In. Dis.*, Dorpat, 1892) states that cerberin belongs physiologically to the digitalin group.

Thuja. N. F. IV. *Arbor Vitae. White Cedar* — "The recently dried, leafy young twigs of *Thuja occidentalis* Linne (Fam. *Pinaceae*), with stems not over 4 mm. in diameter, and without the presence of more than 1 per cent. of foreign substances." It is specifically characterized by the appressed-imbricated leaves, the pointless cone-scales, and the broad wings extending all around the seeds. It attains a height of 20 m., and grows in swampy grounds from Pennsylvania northward and westward, often forming extensive "cedar swamps." In Canada and the extreme northern parts of the United States it is commonly called *white cedar*, a name sometimes applied to *Chamaecyparis thyoides* (L.) B. S. P., which latter is more properly called *Southern white cedar*. The wood is reddish, soft, fine-grained, and very durable. The leaves, or small twigs invested with the leaves, have an agreeable, balsamic odor, specially when rubbed, and a strong, balsamic, camphoraceous, bitter taste. The twigs are described as "fan-shaped, flattened, bearing the scale-like leaves appressed in four rows; leaves of the edges boat-shaped, the intermediate flat, those at the tips of the twigs very broad, the lower elongated, all bearing conspicuous glands on the back.

Odor strongly balsamic, aromatic and pungent; taste camphoraceous, terebinthinate and bitter. Thuja yields not more than 7 per cent. of ash." N. F. A. Kawalier, of Vienna, found in them volatile oil, a bitter principle called *pinipicrin*, $C_{22}H_{36}O_{11}$, which occurs also in *Pinussylvestris*, sugar, gelatinous matter, a variety of wax, resin, and tannic acid; also a peculiar crystallizable coloring principle, *thujin*, to which he gives the formula $C_{20}H_{22}O_{12}$. It is of a citron-yellow color and an astringent taste, soluble in alcohol, inflammable, and when its alcoholic solution is heated with diluted hydrochloric or sulphuric acid it splits up into glucose and *thujigenin*,

$C_{20}H_{22}O_{12} + H_2O = C_6H_{12}O_6 + C_{14}H_{12}O_7$ and by continuing the reaction another molecule of water is taken up by the latter and *thujetin*, $C_{14}H_{14}O_8$, is formed. Thujetin is possibly identical with quercetin. When thujin is heated with barium hydroxide, instead of thujetin is obtained another product, *thujetic acid*, $C_{28}H_{22}O_{13}$. The same chemist determined that the tannic acid of this plant is identical with *pinitannic acid*, which he had previously obtained from the leaves of *Pinus sylvestris* L. (See, for details, *Chem. Gas.*, Nos. 392, 393, 1859.) According to Hubschmann, the leaves and twigs of *Thujaoccidentalis* yield also 1 per cent. of an essential oil of sharp, camphor-like taste, sp. gr. 0.925, boiling point from 190° to 206° C. (374° - 402.8° F.), and easily soluble in alcohol. According to *Schim. Rep.*, April, 1897, thuja oil (*oil of white cedar*) contains pinene, fenchone, thujone, and probably carvone.

F. K. Bailey has reported a case of poisoning in a girl, aged fifteen, who took sixteen drops of the oil of white cedar, and directly afterwards fell unconscious, with clonic spasms followed by epileptiform convulsions lasting at intervals for several hours. Long-continued irritation of the stomach resulted. (*N. R.*, 1872.)

In the form of decoction, thuja has been used in *intermittent fever*, and, according to Schoepf, in coughs, fevers, scurvy, and rheumatism, and as an emmenagogue. Made into an ointment with lard or other animal fat, the leaves are said to form a useful local application in rheumatic complaints. Sicard and Larue (*Gaz. des. Hop.*, 1909) assert that the injection of the tincture of thuja into warts will cause their rapid disappearance. A yellowish-green volatile oil, which may be obtained from the leaves by distillation, has been used with success in *worms*. According to Hildebrand both fenchone and thujone act as stimulants to the heart muscle. (*A. E. P. P.*, xlviii.) According to Prochnow (*A. I. P. T.*, xxi, p. 314) the infusion of thuja has a stimulating effect upon the isolated uterus similar to that of hydrastis. The dose of the fluidextract made with alcohol is half a fluidrachm (2 mls) from three to six times a day.

Thyme. N. F. IV. *Thymus. Common or Garden Thyme.*—"The dried tops of *Thymus vulgaris* Linne (Fam. *Labiatae*), collected when the plant is in flower." N. F. It is extensively grown in the United States for flavoring purposes. It is also used to some extent in medicine. The N. F. description is as follows: "Stems quadrangular, about 0.5 mm. in diameter, grayish-brown or purplish in color, pubescent, nodes from 5 to 20 mm. apart, occasionally with the opposite leaves attached; leaves linear, linear-lanceolate, or ovate-oblong, from 0.5 to 4 mm. in length and from 0.5 to 2 mm. in breadth, summit acute, base obtuse tapering into a petiole from 0.5 to 2 mm. in

length, margin revolute, upper surface grayish-green, puberulent, with numerous one-celled, thick-walled, non-glandular hairs; lower surface grayish, pubescent, with non-glandular, one- to four-celled, thick-walled, rough simple hairs, up to 0.135 mm. in length and usually curved at the first joint in the bases; numerous compound glandular secreting hairs, with short one-celled stalk occurring chiefly on the upper surface and depressed in the cuticle, which give the leaf a glandular-punctate appearance; inflorescence in about twelve-flowered axillary whorls; flowers polygamous, calyx tubular, about 4 mm. in length, ovoid or slightly curved on the lower side near the base, from nine- to twelve-nerved, pubescent, the throat bearded with longitudinally striated, straight simple hairs up to 1 mm. in length, bilabiate, upper lip three-toothed, lower lip with two hairy, ascending, attenuate divisions, corolla about twice as long as the calyx, purplish, smooth within, slightly pubescent without, upper lip emarginate, lower spreading and three-lobed, stamens slightly didynamous and exserted, stigma bifid; nutlets about 0.5 mm. in diameter, spheroidal and finely tuberculate. Odor agreeable, aromatic; taste aromatic and warming. Thyme yields not more than 14 per cent. of ash." *N. F.*

Thyme owes its therapeutic virtues to its volatile oil. (See *Oleum Thymi*). It is occasionally used in domestic medicine, like other aromatic plants, in the form of a hot infusion as a diaphoretic. *Fluidextract of Thyme N. F. IV* is made with a menstruum of 10 volumes of glycerin, 25 volumes of alcohol and 65 volumes of water followed by 1 volume of alcohol and 3 volumes of water. The dose is one fluidrachm (4 mils).

Tilia. *Linden Tree.*—The dried flowers of *Tilia europaea* L., and of other species of *tilia* (Fam. *Tiliaceae*), are official in the German Pharmacopoeia under the head of *Flores Tiliae*. The flowers are yellowish or greenish-white having 5 sepals and 5 petals. The 5 original stamens, by chorisis have each developed a cluster and at the base occurs in addition, a spatulate petal-like body opposite each of the petals. The pistil has a, 5-locular ovary which is surmounted by a single style and a 5-toothed stigma. The flowers contain a colorless, fragrant, volatile oil. The bark has been said to contain a neutral body, *tiliadin*, and a glucoside, *tilicin*. (See *A. J. P.*, 1890; *P. J.*, 66, 105.) The infusion is used as a household remedy to relieve hysteria and indigestion.

Timbo.—This name is applied in Brazil to various sapindaceous plants, used as fish poisons. Among these is *Serjania curassavica*, Radlk. [*Paullinia pinnata* L.], in which Stanislaus Martin (*B. G. T.*, xcii) has found an alkaloid, *timbonine*; F. Pfaff have obtained from a *timbo* of unknown origin two alkaloids, *timboin* and *anhydrotimboin*, also an oily compound, *timbol*. (*A. J. P.*, Nov., 1891.)

TINCTURA ACONITI. U. S., Br.

TINCTURE OF ACONITE Tr. Aconit. [Aconiti tinctura P. I.]

"One hundred mils of Tincture of Aconite yields not less than 0.045 Gm.

nor more than 0.055 Gm. of the ether-soluble alkaloids of aconite. If assayed biologically the minimum lethal dose should not be greater than 0.0004 mil for each gramme of body weight of guinea-pig." *U. S.* "Tincture of Aconite contains in 100 millilitres 0.04 gramme of the ether-soluble alkaloids of Aconite Root." *Br.*

Tinctura Aconiti Radicis, U. S. 1870; Tincture of Aconite Root; Teinture de racine d'Aconit, Fr. Cod.; Tinctura Aconiti, P. G.; Akonittinktur, Eisenhuttinktur, G.; Tinctura di aconito, It.; Tintura alcoholica de aconito, Sp.

"Aconite, in No. 60 powder, one "hundred grammes [or 3 ounces av., 231 grains], to make about one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures, using a mixture of seven volumes of alcohol and three volumes of water as the menstruum and adjusting the volume of the finished Tincture so that each one hundred mils contains 0.05 Gm. of the ether-soluble alkaloids of aconite." *U. S.*

"Aconite Root, in No. 40 powder, 150 grammes; Alcohol (70 per cent.), a sufficient quantity. Moisten the powder with seventy-five millilitres of the Alcohol, and produce, by the percolation process, one thousand millilitres of a strong tincture. Determine the proportion of ether-soluble alkaloids present in this strong tincture, by evaporating one hundred millilitres to dryness in a shallow porcelain evaporating basin, and proceeding as directed under 'Aconiti Radix' Dilute the remainder of the strong tincture with sufficient of the Alcohol to produce a Tincture of Aconite containing 0.04 gramme of ether-soluble alkaloids in 100 millilitres of the Tincture. Examined by the foregoing process Tincture of Aconite is found to contain in 100 millilitres 0.04 gramme of the ether-soluble alkaloids of Aconite Root. *Limit of error* 0.002 gramme in excess or defect. This Tincture is of approximately the same strength as the *Tinctura Aconiti* of the International Agreement, and about twice as strong as the corresponding preparation of the British Pharmacopoeia, 1898." *Br.*

The old tincture of the *U. S. Pharmacopoeia*, 1890, had seven times the strength of the British, and the title was changed from *Tinctura Aconiti Radicis* to *Tinctura Aconiti* in the *U. S.*, 1880, revision. It was much stronger than the Tincture of Aconite Leaves, which is still used occasionally, and made of the strength of two troyounces of powdered aconite leaves in a pint of diluted alcohol, and too much caution cannot

be observed to avoid mistaking one tincture for the other. A very important change was made in the strength of Tincture of Aconite in the U. S. P. VIII. The former 35 per cent. tincture was replaced by a tincture of 10 per cent., which is now the strength of the official tincture, 1914. A chemical assay process was also appended and the U. S. P. IX further recommends a biological standard and assay. The latter is desirable because faulty manipulation or storage changes the aconitine to inert bodies, and this would not be detected by the chemical assay. In preparing it, each step of the process must be carefully attended to. The root should be thoroughly comminuted, and very carefully packed in the percolator, and the displacing menstruum very gradually added. Tartaric acid which was formerly used in accordance with the researches of Duquesnel in the U. S., 1880, tincture has been abandoned, as it was found to be unnecessary. For a paper on Tincture of Aconite, by M. I. Wilbert, see *Proc. A. Ph. A.*, 1902, 348. The external use of the tincture requires care, as serious symptoms have followed its too free employment. (Case, *B. M. S. J.*, Feb., 1872, 74.)

Fleming's Tincture of Aconite.—This should always be expressly designated when prescribed. It is considerably stronger than the official; and several deaths have occurred from the use of it. The following is Fleming's formula: Take of the root, carefully dried and finely powdered, sixteen (troy) ounces; Alcohol, sixteen fluidounces. Macerate for four days, put into a percolator, and add alcohol until twenty-four fluidounces are obtained. Not more than two drops of this should be given as a commencing dose, to be increased till its peculiar effects are experienced.

Dose, U. S. tincture, 3-10 min. (0.2-0.6 mil); Br. tincture, 5-15 min. (0.3-0.9 mil); if frequently repeated, 2-5 min. (0.12-0.3 mil).

TINCTURA ALOES. U.S.

TINCTURE OF ALOES Tr. Aloes

Teinture (alcoole) d'Aloes, *Fr. Cod.*; Tinctura Aloes, *P. G.*; Aloetinktur, *G.*; Tinctura alcoholica de acibar, *Sp.*

"Aloes, in No. 40 powder, one hundred grammes [or 3 ounces av., 231 grains]; Glycyrrhiza, in No. 40 powder, two hundred grammes [or 7

ounces av., 24 grains] to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process M, using diluted alcohol as the solvent." *U. S.*

Tincture of aloes was deleted from the Br. Pharm., 1914. The process of the previous British Pharmacopoeia is appended.

"Extract of Barbados Aloes, 1/2 ounce (Imperial) or 25 grammes; Liquid Extract of Liquorice, 3 fl. ounces (Imp. meas.) or 150 cubic centimetres; Alcohol (45 per cent.), a sufficient quantity. Place the Extract of Barbados Aloes in a closed vessel with sixteen fluid ounces (Imp. meas.) or eight hundred cubic centimetres of the Alcohol; set aside for forty-eight hours, occasionally shaking until dissolved; add the Liquid Extract of Liquorice; filter; pass sufficient of the Alcohol through the filter to produce one pint (Imp. meas.) or one thousand cubic centimetres of the Tincture." *Br., 1898.*

The strength of the British tincture, 1898, was only one-fourth that of the U. S. tincture. The formula of the U. S. (8th Rev.) directed glycyrrhiza instead of extract of licorice, but has returned to the process of maceration for its preparation. Meniere says of the tincture of aloes that it deposits crystals of aloin, which adhere to the sides of the bottle, and in the upper part of it a yellow resinous matter is seen.

Dose, as a purgative, from two to four fluidrachms (7.5-15.0 mils); as a laxative, from one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA ALSTONIAE. Br.

TINCTURE OF ALSTONIA

"Alstonia, in No. 20 powder, 125 grammes; Alcohol (60 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

This tincture represents whatever therapeutic properties alstonia bark may possess. It is used in malaria.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA ARNICA. U. S. (Br.)

TINCTURE OF ARNICA

Tr. Arnic. [Tinctura Amicce Florum, U. S. 1890]

Tinctura Arnicae Florum, Br., Tincture of Arnica Flowers;

Teinture (alcoole) de Fleur d'Arnica, Teinture d'Arnica, *Fr. Cod.*; Tinctura Arnicae, *P. G.*; Arnikatinktur, *G.*; Tintura di Arnica, *It.*; Tintura alcoholica de arnica, *Sp.*

"Arnica, in No. 20 powder, two hundred grammes [or 7 ounces av., 24 grains]; Diluted Alcohol, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Moisten the drug with five hundred mils [or 16 fluidounces, 435 minims] of diluted alcohol, transfer it to a percolator, and, without pressing the powder, allow it to stand well covered for twenty-four hours, then pack it with moderate pressure and allow the percolation to proceed slowly, pouring on additional diluted alcohol as needed. When the percolate measures two hundred and fifty mils [or 8 fluidounces, 218 minims] stop the flow, macerate the drug for an additional twenty-four hours, and then continue the percolation until the total percolate measures five hundred mils [or 16 fluid-ounces, 435 minims]. Again interrupt the percolation, macerate the drug for another twelve hours and afterwards collect an additional two hundred and fifty mils [or 8 fluidounces, 218 minims] of percolate. Again macerate the drug for twelve hours and then allow the percolation to proceed slowly, pouring on sufficient diluted alcohol to make one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms] of Tincture." U. S.

"Arnica Flowers, in No. 20 powder, 100 grammes; Alcohol (45 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with two hundred millilitres of the Alcohol, and complete the percolation process."
Br.

The U. S. IX and Br. Pharm., 1914, have dropped arnica root and tincture of arnica flowers alone represents arnica in both Pharmacopoeias. *Tincture of Arnica Root*, Br., 1898, was made by percolating 50 grammes powdered arnica rhizome with 70 per cent. alcohol, until one thousand mils were obtained. Tincture of arnica root was solely intended for internal administration and confusion arose from the similarity in names.

The U. S. P. tincture of arnica differs from that official in 1870 in the menstruum selected, which is now diluted alcohol in place of alcohol. The change was advocated by numerous pharmaceutical writers, and there is no question of the ability of the menstruum to exhaust the arnica flowers, if they are tightly packed in the percolator. The principal objection to the change is the greater difficulty that will be experienced in mixing the tincture with liniments containing oily and alcoholic liquids.

Either alone, or diluted with water, soap liniment, etc., tincture of arnica is often applied popularly to *bruises, sprains, tumors* and *local rheumatic pains*, under the impression that it has extraordinary healing powers. It probably acts merely as a counter-irritant. On some skins it produces a violent eczematous inflammation. If given internally, the dose would be from ten to thirty minims (0.6-1.8 mls), increased until some effect was produced.

Dose, of the British tincture of the root, twenty minims to half a fluidrachm (1.3-1.8 mls).

TINCTURA ASAFŒTIDÆ. U. S. (Br.)

TINCTURE OF ASAFETIDA Tr. Asafoet.

Tinctura Asafetidae, *Br.*; Teinture (alcoole) d'Asafoetida, *Fr. Cod.*; Asanttinktur, Stinkasanttinktur, *G.*; Tinctura alcoholica de asafetida, *Sp.*

"Asafetida, bruised, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mls [or 33 fluidounces, 6¹/₂ fluidrachms], Prepare a Tincture by Type Process M, using alcohol as the solvent." U. S.

"Asafetida, bruised, 200 grammes; Alcohol (70 per cent.), sufficient to produce 1000 millilitres. Macerate the Asafetida in a closed vessel with seven hundred and fifty millilitres of the Alcohol for seven days, shaking occasionally; filter; pass sufficient of the Alcohol through the filter to produce the required volume." **Br.**

This tincture becomes milky on the addition of water, in consequence of the separation of the resin.

Dose, thirty minims to a fluidrachm (1.8-3.75 mils).

Off. Prep.—Mistura Magnesii, Asafoetidae et Opii, *N. F.*

TINCTURA AURANTII AMARI. U. S. (Br.)

TINCTURE OF BITTER ORANGE PEEL Tr. Aurant. Amar.

Tinctura Aurantii, *Br.*; Tincture of Orange; Teinture (alcoole) d'Ecorce d'Orange amere, *Fr.*; Tinctura Aurantii, *P. G.*; Pomeranzentinktur, Pomeranzenschalentinktur, *G.*

*Bitter Orange Peel, in No. 40 powder, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluid-ounces, 6½ fluidrachms]. Prepare a Tincture by Type Process P, using a mixture of three volumes of alcohol and two volumes of water as the menstruum." *U. S.*

"Fresh Bitter-Orange Peel, cut small, 250 grammes; Alcohol (90 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

It is the peel of the Seville orange that is directed in this process, and the outer part only is active. The substitution of fresh for dried orange peel was proposed in England, and its propriety considerably discussed. (See *P. J.*, Nov. 9, 1872, also April 4, 1874.) Indeed, it met with so much favor as to be introduced in the 1885 revision of the British Pharmacopoeia, and was used in the *Tinctura Aurantii Recentis*, *Br.*; but in the *Br. Pharm.*, 1898, the name was changed to *Tinctura Aurantii*. The two tinctures differ also because of the fact that the *Br.* "orange peel" is only of the outer layer, while the *U. S.* includes also the inner, white, portion of the rind. The *U. S.* tincture has a greenish-brown color and a bitterish taste, the latter due to the presence of hesperidin from the inner layer of the rind. The *Br.* tincture of orange more closely resembles the *U. S. Tinctura Aurantii Dulcis* in sensible properties. The tincture of bitter orange peel is employed as a grateful addition to infusions, decoctions, and mixtures.

Dose, from one to two fluidrachms (3.75-7.5 mils).

Off. Prep.—Syrupus Aromaticus, *Br.*; Syrupus Aurantii, *Br.*; Elixir Aurantii Amari, *N. F.*

TINCTURA AURANTII DULCIS. U. S.

TINCTURE OF SWEET ORANGE PEEL Tr. Aurant. Dulc.

Teinture de Zeste d'Orange douce, *Fr.*; Apfelsinenschal-entinktur, *G.*

"Sweet Orange Peel, grated from the fresh fruit, five hundred grammes [or 17 ounces av., 279 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process M, macerating the drug in one thousand mils of alcohol and completing the preparation with alcohol. Use purified cotton as the filtering medium," *U. S.*

This tincture was designed to furnish a highly flavored alcoholic preparation of orange and has no medicinal properties. It is used as a pleasant adjuvant and flavoring agent.

Off. Prep.—Syrupus Aurantii, *U. S.*

TINCTURA BELLADONNA FOLIORUM. U. S. (Br.)

TINCTURE OF BELLADONNA LEAVES Tr. Bellad. Fol. [Belladonna tinctura P. I.]

"One hundred mils of Tincture of Belladonna Leaves yields not less than 0.027 Gm. nor more than 0.033 Gm. of the total alkaloids of belladonna leaves." *U. S.* "Tincture of Belladonna contains in 100 millilitres 0.035 gramme of the alkaloids of Belladonna Leaves." *Br.*

TincturaBelladonnae, *Br.*, *U. S. P. 1880*; Tincture of Belladonna; Teinture de feuille de Belladone, *Fr. Cod.*; Belladonnatinktur, *G.*; Tindura alcobolica de belladonna, *Sp.*

"Belladonna Leaves, in No. 60 powder, one hundred grammes [or 3 ounces av., 231 grains], to make about one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures, using diluted alcohol as the menstruum and adjusting the volume of the finished Tincture so that each one

hundred mls contains 0.03 Gm. of the total alkaloids of belladonna leaves." U. S.

"Belladonna Leaves, dried and in No. 20 powder, 100 grammes; Alcohol (70 per cent.) sufficient to produce 1000 millilitres.

"Moisten the Belladonna Leaves with one hundred millilitres of the Alcohol, and complete the percolation process. Determine the proportion of alkaloids contained in the tincture so prepared by the Br. process below." *Br.*

" Assay.—Evaporate 100 mls of Tinctura of Belladonna Leaves on a water bath until it measures about 10 mls, transfer the evaporated liquid to a separator, and proceed as directed in the assay under *Fluidextractum Belladonnae Radicis*, second line of the Assay, beginning with the words (add 10 mls, modifying the process there given by increasing the ammonia water to 5 mls which, with about 5 mls of distilled water, is to be used in divided portions to rinse out the dish in which the mixture was evaporated; before titrating treat the residue twice with 5 mls of ether, evaporating to dryness each time." *U. S.*

"Evaporate 100 millilitres in an evaporating basin on a water-bath until it measures about 10 millilitres, add, if necessary, sufficient alcohol (90 per cent.) to dissolve any separated substance and transfer to a separator, rinsing the dish with a little water. Add 10 millilitres of water, 20 millilitres of chloroform, and 2 millilitres of solution of ammonia. Shake well and separate the chloroformic layer. Repeat the extraction with two successive portions of 10 millilitres of chloroform. Mix the chloroformic solutions, and shake them with 10 millilitres of N/1 solution of sulphuric acid diluted with twice its volume of water. Separate the chloroformic solution. Repeat the shaking with a further 10 millilitres of the acidified water. Mix the acid solutions, add 20 millilitres of chloroform and 4 millilitres of solution of ammonia. Shake well, draw off the chloroformic solution into a beaker, and repeat the extraction with two further portions, each of 10 millilitres, of chloroform. Allow the mixed chloroformic solutions to evaporate, dry the residue on a water-bath for thirty minutes, dissolve it in 10 millilitres of N/20 solution of sulphuric acid and titrate with N/20 solution of sodium hydroxide, using tincture of coch'neal as indicator. Deduct the number of millilitres of alkaline solution required from 10, and multiply the difference by

0.01446; the product will be the weight in grammes of the alkaloids contained in 100 millilitres of the tincture. This quantity should be not less than 0.035 gramme. Should the tincture contain more than this proportion it must be diluted with the necessary quantity of Alcohol (70 per cent.).

"Examined by the foregoing process, Tincture of Belladonna is found to contain in 100 millilitres 0.035 gramme of the alkaloids of Belladonna Leaves. Limit of error 0.002 gramme in excess or defect. This Tincture contains seven-tenths of the proportion of alkaloids contained in the Tincture of Belladonna of the British Pharmacopoeia, 1898. It may be used when the Tinctura Belladonna of the International Agreement is required." Br.

In the U. S. P., 1890, the name of this tincture was changed to *Tinctura Belladonna Foliorum*, for the sake of greater precision. In the U. S. P. VIII its strength was reduced to 10 per cent. to conform to the International Protocol standard.

The tincture is an efficient preparation when made from the recently dried leaves and assayed by the official process.

Dose, from five to fifteen minims (0.3-0.9 mil).

TINCTURA BENZOINI. U. S.

TINCTURE OF BENZOIN Tr. Benz.

Teinture (alcoole) de Benjoin, *Fr. Cod.*; Tinctura Benzoës, *P. G.*; Benzoetinktur, *G.*; Tintura di benzoino, *It.*; Tintura alcoholica de benjui, *Sp.*

"Benzoin, in No. 40 powder, two hundred grammes [or 7 ounces av., 24 grains]; to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process M, using alcohol as the solvent." *U. S.*

This tincture was introduced into the Pharmacopoeia chiefly for the purpose of adding to ointments to prevent rancidity. This, however, is bad pharmaceutical practice and is hardly ever followed.

Dose, fifteen to thirty minims (0.9-1.8 mils).

TINCTURA BENZOINI COMPOSITA. U. S., Br.

COMPOUND TINCTURE OF BENZOIN Tr. Benz. Co.

Tinctura Balsamica, Balsamum Commendatoris, Elixir Traumaticum; Friars' Balsam; Teinture (alcoole) balsamique, *Fr. Cod.*; Baume du Commandeur Permes, *Fr.*; Persischer Wundbalaam, *G.*

"Benzoin, in No. 40 powder, one hundred grammes [or 3 ounces av., 231 grains]; Aloes, in No. 40 powder, twenty grammes [or 308.6 grains]; Storax, eighty grammes [or 2 ounces av., 360 grains]; Balsam of Tolu, forty grammes [or 1 ounce av., 180 grains]; to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process M, using alcohol as the solvent." *U. S.*

"Benzoin, in powder, 100 grammes; Prepared Storax, 75 grammes; Balsam of Tolu, 25 grammes; Aloes, 20 grammes; Alcohol (90 per cent.), sufficient to produce 1000 millilitres.

"Macerate the Benzoin, Storax, Balsam of Tolu, and Aloes with eight hundred millilitres of the Alcohol in a closed vessel for two days, shaking occasionally; filter; pass sufficient of the Alcohol through the filter to produce the required volume." *Br.*

Compound tincture of benzoin now contains 10 Gm. of benzoin to each 100 mils instead of 12 as in the *U. S. P.*, 1890.

Uses.—Compound tincture of benzoin is chiefly employed both for its antiseptic and protective effect as a local application to minor *wounds, chapped hands* or *nipples, indolent ulcers*, etc. It is the *balsamum traumaticum* of the older Pharmacopoeias, and may be considered as a simplified form of certain complex compositions, such as *baume du commandeur, Wade's balsam, Balsam de Maltha, Friar's balsam, Jesuit's drops, Turlington's balsam*, etc., which were formerly in great repute, and are still esteemed by the people, as pectorals and vulneraries. The compound tincture of benzoin is precipitated by water. A variety of *court plaster* is made by applying to black silk, by means of a brush, first a solution of isinglass, and afterwards an alcoholic solution of benzoin.

It is occasionally employed Internally as a stimulating expectorant in *chronic bronchitis*. More frequently it is used as an inhalant by adding a teaspoonful of the tincture to a pint of hot water and breathing the vapors; this mode of treatment is especially useful in the early stages of *acute bronchitis*. It has also been recommended in chronic dysentery with the idea that it would exercise its local action upon the ulcerated surface of the colon, but is of doubtful utility.

Dose, fifteen to sixty minims (0.9-3.75 mils).

TINCTURA BERBERIDIS. Br.

TINCTURE OF BERBERIS

"Berberis, in No. 60 powder, 100 grammes; Alcohol (60 per cent.), sufficient to produce 1000 millilitres,

" Moisten the powder with one hundred millilitres of the Alcohol, and complete the percolation process." Br. This tincture is used as a bitter tonic.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA BUCHU. Br.

TINCTURE OF BUCHU

Teinture (alcoole) de Buchu, *Fr. Cod*; Teinture de Bucco, *Fr.*; Buchutinktur, *G.*

"Buchu Leaves, in No. 20 powder, 200 grammes; Alcohol (60 per cent.) sufficient to produce, 1000 millilitres. Moisten the powder with two hundred millilitres of the Alcohol, and complete the percolation process." Br.

This tincture has the virtues of buchu leaves.

Dose, from one to two fluidrachms (3.75-7.5 mils), either simply diluted with water or as an addition to the infusion of the leaves.

TINCTURA CALUMBÆ. U. S.. Br.

TINCTURE OF CALUMBA Tr. Calumb.

Tinctura Colombo; Teinture (alcoole) de Colombo, *Fr. Cod.*; Kolombotmktur, *G.*, Tintura alcoholica de Colombo, *Sp.*

"Calumba, in No. 20 powder, two hundred grammes [or 7 ounces av., 24 grains]; to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, packing the moistened drug moderately, and using a mixture of three volumes of alcohol and two volumes of water as the menstruum." *U. S.*

"Calumba Root, in No. 20 powder, 100 grammes; Alcohol (60 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

This tincture was doubled in strength at the U. S. P. (VIII) in order to bring it into the class of 20 per cent. non-potent tinctures. The British tincture 1914 retains the strength of 10 Gm. of drug in each 100 mils.

Joseph Ince recommends that the tincture be prepared from the root as found in commerce, without further slicing or powdering it. Made as he proposes, the tincture is clear and bright; . while if the powdered root is used it will be very turbid, even after filtration. (*P. J.*, xiv, 491.) No. 20 powder is now directed instead of the No. 50 powder used in older Pharmacopoeias. Tincture of calumba may be added to tonic 'infusions or decoctions, to increase their stimulant power, but, like all the other bitter tinctures, should be used with caution.

Dose, of the U. S. tincture one-half to one fluidrachm (1.8-3.75 mils), of the Br. tincture one to two fluidrachms (3.75-7.5 mils).

TINCTURA CANNABIS. U. S. (Br.)

TINCTURE OF CANNABIS Tr. Cannab. [Tinctura Cannabis Indicae, U.S.P. VIII]

"When assayed biologically Tincture of Cannabis produces incoordination when administered to dogs in a dose of not more than 0.3 mil per kilogramme of body weight." *U. S.*

Tinctura Cannabis Indicae, Br.; Tincture of Indian Hemp; Tincture of Hemp; Teinture (alcoole) de Chanvre de l'Inde, *Fr. Cod.*; Indischhanftinktur, *G.*

"Cannabis, in No. 40 powder, one hundred grammes [or 3 ounces av., 231 grains]; to make about one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures, using alcohol as the menstruum, and adjusting the volume of the finished Tincture to conform with the above biological standard." *U. S.*

"Extract of Indian Hemp, 50 grammes; Alcohol (90 per cent.) sufficient to produce 1000 millilitres. Dissolve." *Br.*

"Assay.—Proceed as directed under Biological Assays." *U. S.* (Also see *Cannabis*).

Tincture of cannabis is assayed by tests upon dogs and it is generally advisable, for this purpose, to concentrate the tincture to about one-fourth its bulk. Care should be observed in the process of evaporation that the temperature does not rise above 60° C. (140° F.).

The American reader must take care not to confound the Indian Hemp here referred to with *Apocynum cannabinum*, known by the same name in this country. The term "Indian Hemp" should be dropped entirely, as its continued use has been the cause of at least one fatal mistake. The strength of the present tincture is about 33 per cent. less than that of the 1890 tincture.

Dose, ten to thirty minims (0.6-1.8 mils), to be gradually increased until some effects are experienced.

Off. Prep.—Tinctura Chloroformi et Morphinae Composita, *Br.* Mistura Chloroformi et Morphinae Composita. *N. F.*

TINCTURA CAPSICI. U. S., Br.

TINCTURE OF CAPSICUM Tr. Capsic.

Tincture of Cayenne Pepper; Teinture (alcoole) de Piment des Jardins, *Fr.*; Tinctura capsici, *P. G.*; Spanischpfeffertinktur, *G.*

"Capsicum, in No. 50 powder, one hundred grammes [or 3 ounces av., 231 grains]; to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] . Prepare a Tincture by Type Process P, using a mixture of ninety-five volumes of alcohol and five volumes of water as the menstruum." *U. S.* "Capsicum, in No. 20 powder, 50 grammes; Alcohol (60 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

The U. S. P. tincture is double the strength of the British. The alcoholic strength of the menstruum is of unusual proportions, 19 volumes of alcohol to 1 volume of water, the reason for this is that, on account of oleoresinous constituents of capsicum, alcohol is required and on account of a small quantity of a constituent soluble in water and insoluble in alcohol a little water must be added to the menstruum to prevent cloudiness. It is used in atonic conditions of the stomach, especially in *alcoholic gastritis*. It may also be used locally in various sluggish conditions of the throat and for the various purposes for which red pepper is applicable. (See *Capsicum*.) Applied by means of camel's-hair pencil to the relaxed *uvula*, it sometimes produces contraction and relieves prolapsus of that part.

Dose, of the U S. tincture, five to ten minims (0.3-0.6 mil); of the Br. preparation, ten to twenty minims (0.6-1.3 mils).

Off. Prep.—Tinctura Chloroformi et Morphinae Composita, *Br.*; Mistura Chloroformi et Morphinae Composita, *N. F.*; Mistura Opii et Chloroformi Composita, *N. F.*; Mistura Opii et Rhei Composita, *N. F.*

TINCTURA CARDAMOMI. U. S.

TINCTURE OF CARDAMOM Tr. Cardam.

Teinture (alcoole) de Cardamome, *Fr.*; Kardamomentink-ur, *G.*

*"Cardamom Seed, in No. 40 powder, one hundred and fifty grammes [or 5 ounces av., 127 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, using diluted alcohol as the menstruum." *U. S.*

The strength of this tincture was doubled in the U. S. P. (VIII) in order to bring it into the 20 per cent. class; it is an agreeable but strong

aromatic, and may be advantageously added to tonic and purgative infusions.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA CARDAMOMI COMPOSITA. U. S., Br.

COMPOUND TINCTURE OF CARDAMOM Tr. Cardam. Co.

Teinture de Cardamome composee, Fr.; Zusammengesetzte Kardamomentinktur, G.

"Cardamom Seed, in No. 40 powder, twenty grammes [or 308.6 grains]; Saigon Cinnamon, in No. 60 powder, twenty-five grammes [or 386 grains]; Caraway, in No. 40 powder, twelve grammes [or 185 grains]; Cochineal, in No. 60 powder, five grammes [or 77 grains]. To make one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms], Prepare a Tincture by Type Process M, macerating the mixed powders in seven hundred and fifty mils [or 25 fluid-ounces, 173 minims] of a mixture of fifty mils [or 1 fluidounce, 331 minims] of glycerin and nine hundred and fifty mils [or 32 fluidounces, 59 minims] of diluted alcohol and completing the preparation by using first the remainder of the mixture prepared as directed above and then diluted alcohol." U. S. " Cardamom Seeds, in No. 20 powder, 14 grammes; Caraway Fruit, in No. 20 powder, 14 grammes; Cinnamon Bark, in No. 20 powder, 28 grammes; Cochineal, in No. 20 powder, 7 grammes; Glycerin, 100 milli-litres; Alcohol (45 per cent.) sufficient to produce 1000 millilitres. Moisten the mixed powders with fifty millilitres of the Alcohol, and prepare, by the percolation process, eight hundred and fifty millilitres of tincture. Add the Glycerin and sufficient of the Alcohol to produce the required volume." *Br.*

In this tincture and the one immediately preceding, the proportion of cardamom seems to be reduced, but official cardamom seed now means the seed recently removed from the capsules.

This is a very agreeable aromatic tincture, occasionally used as a carminative, but more frequently as an addition to mixtures, infusions, etc., which it renders pleasant to the taste and acceptable to the stomach. It is one of the most highly prized vehicles, not merely because of its pleasant flavor, but also on account of its beautiful color. The substitution of glycerin in the U. S. formula of 1880 for the honey

formerly used was an improvement, as it increases the stability of the preparation.

Dose, one to two fluidrachms (3.75-7.5 mils).

TINCTURA CASCARILLÆ. Br.

TINCTURE OF CASCARILLA

Teinture (alooole) de Cascaïlle, *Fr. Cod.*; Kaskarilltinktur, *G.*

"Cascarilla, in No. 40 powder, 200 grammes; Alcohol (70 per cent.) sufficient to produce 1000 millilitres. Moisten the powder with one hundred and fifty millilitres of the Alcohol, and complete the percolation process." *Br.*

This tincture has the properties of cascarilla, but is seldom, if ever, used in this country.

Dose, from thirty minims to two fluidrachms (1.8-7.5 mils).

TINCTURA CHIRATÆ. Br.

TINCTURE OF CHIRETTA

Tincture of Chirata; Teinture (alcoole) de Chirette, *Fr.*; Chirettatinktur, *G.*

"Chiretta, in No. 40 powder, 100 grammes; Alcohol (60 per cent.) sufficient to produce 1000 millilitres. Moisten the powder with one hundred millilitres of the Alcohol, and complete the percolation process." *Br.*

This tincture is used as a bitter tonic; Although no longer recognized by the U. S. P., it is still prescribed in this country. The tincture of the U. S. 1890 was of twenty per cent. strength.

Dose, from one to two fluidrachms (3.75-7.5 mils), three or four times a day.

TINCTURA CINCHONA. U. S., Br.

TINCTURE OF CINCHONA Tr. Cinch.

"One hundred mls of Tincture of Cinchona yields not less than 0.8 Gm. nor more than 1 Gm. of the alkaloids of cinchona." *U. S.* "Tincture of Cinchona contains in 100 millilitres 1 gramme of the alkaloids of Red Cinchona Bark." *Br.*

Tinctura Cinchonsae Flavae; Tincture of Yellow Cinchona; Tincture of Peruvian Bark; Teinture (alcoole) de Quinquina jaune, *Fr. Cod.*; Tinctura Chinae, *P. G.*; Chinatinktur, *G.*; Tintura di china, *It.*

"Cinchona, in No. 40 powder, two hundred grammes [or 7 ounces av., 24 grains]; to make about one thousand mls [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures, using as the first menstruum a mixture of seventy-five mls [or 2 fluidounces, 257 minims] of glycerin, six hundred and seventy-five mls (or 22 fluidounces, 396 minims) of alcohol, and two hundred and fifty mls [or 8 fluidounces, 218 minims] of water and completing the percolation with a mixture of two volumes of alcohol and one volume of water. Then adjust the volume of the finished Tincture so that each one hundred mls contains 0.9 Gm. of the alkaloids of cinchona." *U. S.*

"Red Cinchona Bark, in No. 40 powder, 200 grammes; Alcohol (70 per cent.), a sufficient quantity. Moisten the powder with two hundred millilitres of the Alcohol; set aside for seven days in a closed vessel; percolate with more of the Alcohol, until seven hundred millilitres of percolate have been collected; press the marc; add the expressed liquid to the percolate; set aside for twenty-four hours; filter.

"Take ten millilitres of the strong tincture so prepared, and determine the proportion of alkaloids contained in it by the process described under 'Extractum Cinchona Liquidum/ Add to the bulk of the strong tincture such a quantity of the Alcohol that 100 millilitres of the resulting Tincture contain 1 gramme of the alkaloids of Red Cinchona Bark. Examined by the process described under 'Extractum Cinchonas Liquidum' Tincture of Cinchona is found to contain in 100 millilitres 1 gramme of the alkaloids of Red Cinchona Bark. *Limit of error* 0.05 gramme in excess or defect." *Br.*

This tincture is very properly made with a large proportion of bark, as in the bitter tinctures it is important that the alcohol should bear as small a proportion to the tonic principle as possible. Even when strongest, however, it cannot, in ordinary cases, be given in doses sufficiently large to obtain the full effect of the bark, without stimulating too highly. The tincture of the Br. Pharm. 1898 and 1914 is now made from 70 per cent. alcohol instead of the old menstruum 50 per cent., and is assayed so that it has a definite strength (100 mls containing 1 Gm. of alkaloids); these are undoubted improvements. A deposit is apt to form in the tincture when kept, consisting chiefly of cinchonic red holding probably a portion of the alkaloids in combination. This was found by J. Adams to be perfectly dissolved by heat, though it uniformly reappeared on the cooling of the tincture. The addition of diluted sulphuric acid did not cause its solution, and, even though it was removed by filtering the tincture, the deposition was afterwards renewed. (*P. J.*, April, 1868, 470.) In reference to a mode of obviating in some measure this tendency to deposition, the reader is referred to the statements of M. Vaublart on the subject of deposition in the tinctures prepared by percolation. A. B. Taylor, in experimenting on this subject, prepared a tincture in which the menstruum consisted of two parts of alcohol, one part of water, and one part of glycerin, and which was kept three months without undergoing deposition. (*A. J. P.*, Jan. 1865, 50.) This suggested the addition of glycerin to the official formula, and there can be no doubt that the tincture has been thereby improved, experience having demonstrated the utility of glycerin in liquid preparations of cinchona. Tincture of cinchona is rarely employed, but may be used as a tonic.

Dose, from one to two fluidrachms (3.75-7.5 mls).

Off. Prep.—Tinctura Cinchonae Composita, *Br.*

TINCTURA CINCHONA COMPOSITA. U. S., Br.

COMPOUND TINCTURE OF CINCHONA Tr. Cinch. Co.

"One hundred mls of Compound Tincture of Cinchona yields not less than 0.4 Gm. nor more than 0.5 Gm. of the alkaloids of cinchona." *U. S.*
"Compound Tincture of Cinchona contains in 100 millilitres 0.5 gramme of the alkaloids of Red Cinchona Bark." *Br.*

Compound Tincture of Peruvian Bark; Huxham's Tincture of Bark; Teinture de Quinquina composee, Elixir febrifuge d'Huxam, *Fr.*; Tinctura Chinas Composita, *P. G.*; Zusammen-gesetzte Chinatinktur, *G.*

"Red Cinchona, in No. 40 powder, one hundred grammes [or 3 ounces av., 231 grains]; Bitter Orange Peel, in No. 40 powder, eighty grammes [or 2 ounces av., 360 grains]; Serpentina, in No. 60 powder, twenty grammes [or 308.6 grains], to make about one thousand mils [or 33 fluidounces, 6¹/₂ fluidraehms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures, using as the first menstruum a mixture of seventy-five mils [or 2 fluidounces, 257 minims] of glycerin, six hundred and seventy-five mils [or 22 fluidounces, 396 minims] of alcohol and two hundred and fifty mils [or 8 fluidounces, 218 minims] of water and completing the percolation with a mixture of two volumes of alcohol and one volume of water. Then adjust the volume of the finished Tincture so that each one hundred mils contains 0.45 Gm. of the alkaloids of cinchona." *U. S.*

" Dried Bitter-Orange Peel, bruised, 50 grammes; Serpentina Rhizome, in No. 40 powder, 25 grammes; Cochineal, in powder, 3 grammes; Tincture of Cinchona, 500 millilitres; Alcohol (70 per cent.), sufficient to produce 1000 millilitres. Mix the solid ingredients with five hundred millilitres of the Alcohol; set aside in a closed vessel for seven days, shaking frequently; strain, and then press; mix the two liquids thus obtained; add the Tincture of Cinchona, and sufficient of the Alcohol to produce the required volume; set aside for twenty-four hours; filter. Examined by the process described under (Extractum Cinchona Liquidum ' Compound Tincture of Cinchona is found to contain in 100 millilitres 0.5 gramme of the alkaloids of Red Cinchona Bark. *Limit of error* 0.05 gramme in excess or defect." *Br.*

This is the preparation commonly known by the name of *Huxham's tincture of bark*. It differs from that official in the U. S. P., 1890, only in the alcoholic strength of the menstruum, which is now about in the proportion of 2.7 volumes of alcohol to 1 volume of water; it was formerly 3 volumes of alcohol to 1 volume of water. The use of glycerin is an improvement, precipitation being thus largely prevented. In the U. S. P. VIII the drugs are not directed in the powdered state, the intention being to mix the drugs together and then to reduce the mixture to a uniform powder; in this way the volatile principles in the Serpentina

and Orange Peel are retained, and thorough exhaustion by percolation is secured. In the U. S. P. IX this principle was omitted probably on account of the difficulty of its execution. The process for the British tincture (1898) presents some novel features. Half of the quantity of the tincture is first made from four of the ingredients; this is then mixed with an equal bulk of tincture of cinchona. The reason for this was probably to avoid assaying a mixed product during the process ; but the final test has to deal with the finished tincture, and the utility of the whole method is doubtful. Compound tincture of cinchona is an excellent bitter tonic, useful for its local effect on the stomach but too feeble in the principles of cinchona to serve when the systemic action of the drug is required.

Dose, one to two fluidrachms (3.75-7.5 mils).

Off Prep.—Gargarisma Guaiaci Composita, *N. F.*

TINCTURA CINNAMOMI. U. S., Br.

TINCTURE OF CINNAMON Tr. Cinnam.

Teinture (alcoole) de Cannelle, *Fr. Cod*; Tinctura Cinnamomi, *P. G.*; Zimmtinktur, *G.*; Tinctura alcoholica de canela, *Sp.*

*"Saigon Cinnamon, in No. 50 powder, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluidounces, 6½ fluidraehms]. Prepare a Tincture by Type Process P, using a mixture of seventy-five volumes of glycerin, six hundred and seventy-five volumes of alcohol, and two hundred and fifty volumes of water as the menstruum." *U. S.*

"Cinnamon Bark, in No. 40 powder, 200 grammes; Alcohol (70 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with two hundred millilitres of the Alcohol, and complete the percolation process." *Br.*

The British and the U. S. tinctures are now of the same strength. This tincture has the aromatic and astringent properties of cinnamon, and may be used as an adjuvant to cretaceous mixtures and astringent infusions or decoctions. By long keeping it is prone to gelatinize and become unfit for use. According to Greenish, thia can be prevented by

using a menstruum composed of six parts of alcohol and two parts of water. (*P. J.*, Feb. 1872, 641). Glycerin is now used in the menstruum for this purpose. It is an agreeable flavoring to other tinctures and because of its astringent powers is especially used in diarrhea mixtures.

Dose, one to two fluidrachms (3.75-7.5 mils).

Off. Prep.—Elixir Taraxaci Compositum, *N. F.*; Mistura Rhei Alkalina, *N. F.*

TINCTURA COCCI. Br.

TINCTURE OF COCHINEAL

Teinture (alcoole) de Cochenille, *Fr. Cod.*; Cochenilletinktur, *G.*

"Cochineal, in powder, 100 grammes; Alcohol (45 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

This is valued chiefly for imparting color to liquid preparations; four or five per cent. of this tincture will give a deep red color. (See *Coccus*.)

Dose, from twenty minims to a fluidrachm (1.3-3.75 mils).

TINCTURA COLCHICI SEMINIS. U. S. (Br.)

TINCTURE OF COLCHICUM SEED Tr. Colch. Sem. [Colchici tinctura P. I.]

"One hundred mils of Tincture of Colchicum Seed yields not less than 0.036 Gm. nor more than 0.044 Gm. of colchicine." *U. S.*

Tinctura Colchici, *Br.*; Tincture of Colchicum; Tinctura Colchici, *U. S.* 1890; Teinture (alcoole) de semence de Colchique, *Fr. Cod.*; Tinctura Colchici, *P. G.*; Zeitlosetinktur, *G.*; Tintura alcoholica de colquico, *Sp.*

"Colchicum Seed, in No. 50 powder, one hundred grammes [or 3 ounces av., 231 grains], to make about one thousand mils [or 33 fluid-ounces, 6½ fluidrachms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures, using a mixture of three volumes of alcohol and two volumes of water as the menstruum and adjusting the volume of the

finished Tincture so that each one hundred mls contains 0.04 Gm. of colchicine." *U. S.*

"Colchicum Seeds, in No. 30 powder, 100 grammes; Alcohol (70 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with fifty millilitres of the Alcohol, and complete the percolation process. This Tincture is of approximately the same strength as the Tinctura Colchici of the International Agreement, and is of one-half the strength of the corresponding preparation of the British Pharmacopoeia, 1898." *Br.*

The strength of this tincture was lowered to 10 Gm. per 100 mls in the U. S. P. VIII and IX to comply with the rule adopted for potent tinctures. An assay process was also appended.

It was at one time supposed that the tincture was quite as effective made from the unbruised as from the bruised seeds, but the opinion has been shown to be erroneous. (*A. J. P.*, xxvi, 120.) See also a paper by N. Rosenwasser, *Ibid.*, 1877, 436. Subsequently L. I. Morris showed that if the whole seeds were digested with hot diluted alcohol they could be perfectly exhausted. (*A. J. P.*, 1881, p. 6.) Maiseh recommended, as a convenient method of comminuting the seeds, to macerate them for two or three days in a portion of the menstruum, then to remove them and bruise them in a clean iron mortar, taking care that none of the menstruum or of the seeds should be wasted. (*A. J. P.*, xxviii, 514.)

This tincture possesses the properties of colchicum, and may be given whenever that medicine is indicated, but the fluidextract, containing less alcohol, is generally preferred.

Dose, from fifteen to thirty minims (0.9-1.8 mls), to be repeated with caution.

TINCTURA CUBEBÆ. Br.

TINCTURE OF CUBEBS

Teinture (alcoole) de Cubebe, *Fr. Cod.*; Kubebentinktur, *G.*

"Cubebs, in No. 20 powder, 200 grammes; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with one hundred millilitres of the Alcohol, and complete the percolation process."

Br.

The U. S. P. has not recognized this tincture for many years, but it is official in the N. F.. While this tincture represents the therapeutic virtue of cubeb, it is an inelegant form of administering that drug.

Dose, one to two fluidrachms (3.75-7.5 mils).

TINCTURA DATURÆ SEMINUM. Br.

TINCTURE OF DATURA SEEDS

"Datura Seeds, in No. 20 powder, 250 grammes; Alcohol (70 per cent.), sufficient to produce 1000 millilitres. Moisten the bruised Datura Seeds with two hundred millilitres of the Alcohol, and complete the percolation process." *Br.*

This tincture well represents the activities of *datura*.

Dose, five to fifteen minims.

TINCTURA GAMBIR COMPOSITA. U. S. (Br.)

**COMPOUND TINCTURE OF GAMBIR Tr. Gambir; Co.
[Compound Tincture of Pale Catechu To replace Tincture
Catechu Composita, U. S. 1890, Compound Tincture of Catechu]**

Tincture Catechu, *Br.*; Tincture of Catechu; Teinture (alcoole) de Cachou, *Fr. Cod.*; Tinctura Catechu, *P. G.*; Katechutinktur, *G.*

"Gambir, in No. 50 powder, fifty grammes [or 1 ounce av., 334 grains]; Saigon Cinnamon, in No. 50 powder, twenty-five grammes [or 386 grains], to make one thousand mils [or 33 fluid-ounces, 6½ fluidrachms]. Prepare a Tincture by Type Process M, using diluted alcohol as the solvent." *U. S.*

"Catechu, in powder, 200 grammes; Cinnamon Bark, bruised, 50 grammes; Alcohol (45 per cent.), 1000 millilitres. Prepare by the maceration, process." *Br.*

The name of this tincture was changed at the 1880 revision, so that it

more accurately indicated its composition than did its former name. In the U. S. P. (8th Rev.) the name was again changed to *Tinctura Gambir Composita*. This was due to the introduction of gambir in place of catechu (see *Gambir*). The present tincture is one-half the strength of the U. S. P., 1890, compound tincture of catechu. Cinnamon has been present in the tincture of catechu of former Pharmacopoeias in the same relatively large proportion—2 parts of cinnamon to 3 parts of catechu—and this disproportion has been usually overlooked. The present tincture contains 2 parts of gambir to 1 part of cinnamon. The British tincture (1898) was increased to 20 per cent. in the proportion of catechu, and is now four times the strength of the U. S. tincture. This is a grateful astringent tincture, useful in all cases to which catechu is applicable and in which small quantities of spirit are not objectionable. It may often be advantageously added to cretaceous mixtures in diarrhea. It may be given with sweetened water or some mucilaginous liquid, or in port wine when this is not contra-indicated. It sometimes gelatinizes when kept, and becomes unfit for use.

Dose, of the U. S. tincture of gambir, two to four fluidrachms (7.5-15.0 mils); of the British tincture of catechu, one-half to two fluidrachms (1.8-7.5 mils).

Off. Prep.—*Tinctura Pectoralis, N. F.*

TINCTURA GELSEMI. U. S., Br.

TINCTURE OF GELSEMIUM Tr. Gelsem.

Teinture (alcoole) de Gelsemium, *F.*; Gelsemiumtinktur, *G.*

"Gelsemium, in No. 60 powder, one hundred grammes [or 3 ounces av., 231 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, using a mixture of sixty-five volumes of alcohol and thirty-five volumes of water as the menstruum." U. S.

"Gelsemium Root, in No. 40 powder, 100 grammes; Alcohol (60 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with fifty millilitres of the Alcohol, and complete the percolation process." *Br.*

This tincture has proven a valuable addition, and will be preferred to

the fluidextract for internal administration, as it is safer, and can be used more satisfactorily in extemporaneous combination. The menstruum of the U. S. P., 1890, and VIII and IX processes is weaker than that formerly official, alcohol having been replaced by alcohol diluted with water in the proportion of 65 to 35. For Farr and Wright's method of estimating this tincture, see *C. D.*, 1892, 263.

Dose, from five to twenty minims (0.3-1.3 mils).

TINCTURA GENTIANÆ COMPOSITA. U. S., Br.

COMPOUND TINCTURE OF GENTIAN Tr. Gentian. Co.

Teinture (alcoole) de Gentiane Composee, *Fr.*; Zusammengesetzte Enziantinktur, *G.*

*"Gentian, in No. 40 powder, one hundred grammes [or 3 ounces av., 231 grains]; Bitter Orange Peel, in No. 40 powder, forty grammes [or 1 ounce av., 180 grains]; Cardamom Seed, in No. 40 powder, ten grammes [or 154 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, packing it moderately and using as the first menstruum a mixture of one hundred mils [or 3 fluidounces, 183 minims] of glycerin, five hundred mils [or 16 fluidounces, 435 minims] of alcohol and four hundred mils [or 13 fluidounces, 252 minims] of water and completing the percolation with diluted alcohol." *U. S.*

"Gentian Root, cut small and bruised, 100.0 grammes; Dried Bitter-Orange Peel, bruised, 37.5 grammes; Cardamom iSeeds, in powder, 12.5 grammes; Alcohol (45 per cent.), 1000.0 millilitres. Prepare by the maceration process." *Br.*

There has always been difficulty from precipitation in this tincture; glycerin has been added to the menstruum to overcome this annoyance, but it is only partially successful. This is an elegant bitter, much used in dyspepsia, and as an addition to tonic mixtures in debilitated states of the digestive organs. There is, however, much danger of its abuse by alcoholics, especially in chronic cases.

Dose, one to two fluidrachms (3.75-7.5 mils).

TINCTURA GUAIIACI. U. S.

TINCTURE OF OUAIIAC Tr. Guaiac.

Tinctura Guajaci; Teinture (alcoole) de Resine de Gayac, *Fr.*; Guajaktinktur, *G.*

"Guaiac, in No. 40 powder, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process M, using alcohol as the solvent." *U. S.*

Although this tincture can be prepared by percolation if care and skill are used, maceration is doubtless preferable.

This tincture is given in *chronic rheumatism* and *gout*, in the dose of from one to three fluidrachms three or four times a day. As it is precipitated by water, it is most conveniently administered in mucilage, sweetened water, or milk, by which the separated guaiac is held in temporary suspension, although it is almost impossible, without actual emulsification, to prevent the resinous material from separating and forming a coating on the inner surface of the bottle. Schar recommends tincture of guaiac as a reagent to detect the presence of ozonizing bodies. (*Ph. Rund.*, 1894, 254.)

Dose, one fluidrachm (3.75 mils) three times a day.

Off. Prep.—Mistura Guaiaci, *N. F.*

TINCTURA GUAIIACI AMMONIATA. U. S., Br.

AMMONIATED TINCTURE OF GUAIIAC Tr. Guaiac. Ammon.

Ammoniated Tincture of Guaiacum; Tinctura Guaiaci Composita; Teinture (alcoole) de Gayac ammomacale, *Fr.*; Ammoniakalische Guajaktinktur, *G.*

* " Guaiac, in No. 40 powder, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process M, using aromatic spirit of ammonia as the solvent." *U. S.*

"Guaiacum Resin, in powder, 200 grammes; Oil of Nutmeg, 3 millilitres; Oil of Lemon, 2 millilitres; Strong Solution of Ammonia, 75 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Mix the Strong Solution of Ammonia with seven hundred millilitres of the Alcohol; add the Guaiacum Resin; set aside in a closed vessel for forty-eight hours, shaking frequently; filter; dissolve the Oil of Lemon and Oil of Nutmeg in the filtrate, and pass sufficient of the Alcohol through the filter to produce the required volume." *Br.*

The British Pharmacopoeia, 1898, improved the process for this tincture by abandoning the distilled aromatic spirit of ammonia used as a menstruum by the former British authority and substituting alcohol containing solution of ammonia and volatile oils, the proportion of oil of lemon having been reduced 60 per cent.

This tincture is celebrated in the treatment of *chronic rheumatism*, and is frequently also used in *amenorrhoea*. It is more stimulating, and is probably more effectual, than the preceding on account of the presence of the alkali. It is precipitated by water, and should be administered emulsified with gum, so that the guaiac may be held in suspension.

Dose, from one to two fluidrachms (3.75-7.5 mls).

Off. Prep.—Gargarisma Guaiaci Composita, *N. F.*

TINCTURA HAMAMELIDIS. Br.

TINCTURE OF HAMAMELIS

Teinture (alcoole) de Hamamelis, *Fr.*; Hamamelistinktur, *G.*; Tinctura alcoholica de hamamelis, *Sp.*

"Hamamelis Bark, in No. 20 powder, 100 grammes; Alcohol 45 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with fifty millilitres of the Alcohol, and complete the percolation process." *Br.*

Dose, from thirty to sixty minims (1.8-3.75 mls).

TINCTURA HYDRASTIS. U. S., Br.

TINCTURE OF HYDRASTIS Tr. Hydrast. [Tincture of Golden Seal]

"One hundred mils of Tincture of Hydrastis yields not less than 0.36 Gm. nor more than 0.44 Gm. of the ether-soluble alkaloids of hydrastis." U. S.

Teinture (alcoole) de Hydrastis, *Fr.*; Hydrastistinktur, *G.*; Tintura alcoholica de hydrastis, *Sp.*

"Hydrastis, in No. 60 powder, two hundred grammes [or 7 ounces av., 24 grains], to make about one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures, using a mixture of two volumes of alcohol and one volume of water as the menstruum and adjusting the volume of the finished Tincture so that each one hundred mils contains 0.4 Gm. of the ether-soluble alkaloids of hydrastis." *U. S.*

"Assay.—Evaporate 50 mils of Tincture of Hydrastis on a water bath until it measures about 10 mils, transfer the evaporated liquid to a separator, and proceed as directed in the assay under *Fluidextractum Belladonnae Radicis*, second line of the Assay, beginning with the words "add 10 mils," modifying the process there given by using the ammonia water with about 5 mils of distilled water, in divided portions, to rinse out the dish in which the Tincture was evaporated. Use only ether as the immiscible solvent throughout the assay and dry the residue at 100° C. (212° F.) to constant weight, instead of titrating it. The weight of the residue represents the amount of ether-soluble alkaloids in 50 mils of Tincture of Hydrastis." *U. S.*

"Liquid Extract of Hydrastis, 100 millilitres; Alcohol (60 per cent.), sufficient to produce 1000 millilitres. Mix." *Br.*

The British tincture is half the strength of that of the *U. S. P. IX.*

This tincture is useful in combination with other tinctures, or as an addition to extemporaneous mixtures where the fluidextract would not be so eligible.

Dose, from one to two fluidrachms (3.75-7.5 mils).

TINCTURA HYOSCYAMI. U. S., Br.

TINCTURE OF HYOSCYAMUS Tr. Hyosc. [Tincture of Henbane Hyoscyami tinctura P. I.]

"One hundred mils of Tincture of Hyoscyamus yields not less than 0.0055 Gm. nor more than 0.0075 Gm. of the alkaloids of hyoscyamus." U. S.

Teinture (alcoole) de Jusquiame, *Fr.*; Bilsenkrauttinktur, *G.*; Tintura alcoholica de beleno, *Sp.*

"Hyoscyamus, in No. 60 powder one hundred gramme's [or 3 ounces av., 231 grains], to make about one thousand mils [or 33 fluid-ounaes, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures, using diluted alcohol as the menstruum and adjusting the volume of the finished Tincture so that each one hundred mils contains 0.0065 Gm. of the alkaloids of hyoscyamus." *U. S.*

"Hyoscyamus Leaves, in No. 20 powder, 100 grammes; Alcohol (70 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with one hundred millilitres of the Alcohol, and complete the percolation process." *Br.*

The strength of the British tincture (1898) was slightly reduced (20 per cent.) in order to bring it into the class of tinctures having the maximum dose of a fluidrachm. The strength was also reduced in the U. S. P. VIII and IX from 15 to 10 Gm. per 100 mils, and an assay process appended. The Br. and U. S. tinctures are now of the same strength.

This tincture possesses the activities of hyoscyamus. When it purges, as it sometimes does, it may be united with a very small proportion of tincture of opium.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA JALAPÆ. Br.

TINCTURE OF JALAP

Teinture (alcoole) de Jalap, *Fr. Cod.*; Jalapentinktur, *G.*

“Jalap, in No. 40 powder, 200 grammes; Alcohol (70 per cent.), a sufficient quantity. Moisten the powder with one hundred millilitres of the Alcohol; pack in a percolator; gradually add more of the Alcohol until six hundred millilitres of percolate have been collected; press the marc; add the expressed liquid to the percolate; set aside for twenty-four hours; filter. Determine the amount of Jalap Resin present in ten millilitres of the strong tincture so prepared by the process described under 'Jalapae Resina' and dilute the remainder of the strong tincture with sufficient of the Alcohol to produce a Tincture of Jalap containing 1.5 grammes of the Resin in 100 millilitres. When 10 millilitres of the Tincture, concentrated by evaporation, are mixed with eight times their volume of water, the resin thus separated, washed with water and dried at a gentle heat, weighs not less than 0.145 or more than 0.155 gramme." *Br.*

This tincture is no longer official in the U. S. Pharmacopoeia, but is in the N. F. IV (see Part III). The tincture of jalap of the U. S. P. 1870 was made by percolating six troy-ounces of powdered jalap with a mixture of two measures of alcohol and one of water, until two pints of tincture were obtained.

This tincture is now prepared on the basis of proportion of resin, not of crude drug, as formerly. It possesses the medicinal virtues of jalap, and is sometimes added to cathartic mixtures.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA JALAPÆ COMPOSITA. Br.

COMPOUND TINCTURE OF JALAP

“Jalap, in No. 40 powder, 80 grammes; Scammony Resin, in powder, 15 grammes; Turpeth, in No. 40 powder, 10 grammes; Alcohol (60 per cent.), sufficient to produce 1000 millilitres. Moisten the mixed powders with one hundred millilitres of the Alcohol, and complete the percolation

process." *Br.*

This tincture is also official in the N. V. IV. It is a harsh but active purgative, capable of producing serious effects if given in over-dose.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA KALADANÆ. Br.

TINCTURE OF KALADANA

"Kaladana, in No. 40 powder, 200 grammes; Alcohol (70 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with one hundred millilitres of the Alcohol, and complete the percolation process." *Br.*

This is a new tincture of the British Pharmacopoeia 1914. It is used as a cathartic in doses of one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA KINO. U. S., Br.

TINCTURE OF KINO Tr. Kino

Teinture (alcoole) de Kino, *Fr. Cod*; Kinotinktur, *G.*

"Kino, one "hundred grammes [or 3 ounces av., 231 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Place the kino in a capacious flask and pour on it five hundred mils [or 16 fluidounces, 435 minims] of boiling water. Agitate the mixture thoroughly, then heat it on a water bath, containing boiling water, for one hour, shaking it frequently. Allow the liquid to cool, add enough recently boiled water to make the product measure five hundred mils [or 16 fluidounces, 435 minims] and then add five hundred mils [or 16 fluid-ounces, 435 minims] of alcohol. Stopper the flask, set it aside in a cool place for twenty-four hours and then decant the mixture through cheese cloth. Preserve it in a cool and dark place, in small bottles, tightly corked." *U. S.*

"Kino, in powder, 100 grammes; Glycerin, 150 millilitres; Distilled

Water, 250 millilitres; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Mix the Glycerin and the Distilled Water; rub the Kino in a mortar with a sufficient quantity of the mixture to form a smooth paste, gradually adding the remainder of the mixture; transfer to a closed vessel; add five hundred millilitres of the Alcohol; set aside for twelve hours, shaking occasionally; filter; pass sufficient of the Alcohol through the filter to produce the required volume." *Br.*

Much inconvenience is caused by the tendency of this tincture to gelatinize and gradually lose its astringency. The present official formula is believed to furnish a tincture free from this objection. It is probable that different specimens of kino vary in their tendency to gelatinize. Groves states that fresh kino will not gelatinize, and Martindale that the Australian kino is much more prone to do so than the East India drug. The air has some effect, for if this be entirely excluded the tincture will keep for a long time without undergoing the change. It should be introduced, when prepared, into very small bottles, which should be kept well corked and be opened only when wanted for use. J. D. Wood obtains a handsome preparation, which he believes to keep well and not gelatinize, by using a menstruum of 2 parts of alcohol sp. gr. 0.835, and 1 part each of water and glycerin.

L. Meyers Connor gets rid of the gelatinizing property by using magnesium carbonate in making the tincture, but it is very probable that a large part of the kino-tannic acid is removed at the same time. (*A. J. P.*, xlv, 260.) P. F. Smith of Louisville, furnished the following formula: "Take of Kino one ounce and a half; Ground Logwood half an ounce; Diluted Alcohol a sufficient quantity. Moisten the Logwood with a portion of the Diluted Alcohol, and introduce it into a displacement apparatus. Dissolve the Kino by triturating with successive portions of Diluted Alcohol, and percolate the solution through the Logwood until a pint of tincture is obtained." We have used this process and have not noticed gelatinization to take place in any instance. Sugar added in equal proportions with the kino employed has been recommended as a preventive of gelatinization, and R. Bother claims permanence for the following formula: Powder one and a half troyounces of kino and half a troy-ounce of catechu, mix them, add ten fluidounces of water, heat for ten or fifteen minutes with constant stirring, and let the mixture cool. Add water to make the mixture twelve fluidounces, and then add four fluidounces of alcohol. Pour the mixture into a bottle containing sixty grains of filter-paper, shake the whole well at intervals, and strain the

tincture after twenty-four hours. (*A. J. P.*, 1886, 333.)

An important change in the process of the U. S. Pharmacopoeia VIII was the employment of heat. This was due to the researches of Edmund White (*P. J.*, 1903, May, 644, and Nov., 702), who with David Hooper believes that the gelatinization of tincture of kino is due to an enzyme or oxydase present in the kino; the activity of this is destroyed by heat. Tincture of kino is one of the most frequently prescribed astringents, especially in the treatment of *diarrhea*.

Dose. one to two fluidrachms (3.75-7.5 mils).

Off. Prep.—Tinctura Kino et Opii Composita, *N. F.*

TINCTURA KRAMERIÆ. Br.

TINCTURE OF KRAMERIA

Tincture of Rhatany; Teinture (alcoole) de Ratanhia, *Fr. Cod.*; Tinctura Ratanhiae, *P. G.*; Ratanhiatinktur, *G.*

Tincture of krameria was deleted from the U. S. P. IX, but retained in the Br. Pharm. 1914 and added to the N. F. IV. The British tincture closely resembles the former U. S. P. preparation.

"Krameria Root, in No. 40 powder, 200 grammes; Alcohol (60 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with one hundred millilitres of the Alcohol, and complete the percolation process."
Br.

It is stated that the tincture made from Para rhatany furnishes a clear solution on the addition of water, while that from Peruvian root yields a turbid mixture.

The same precaution should be observed in keeping this tincture as is recommended for tincture of kino. It is a good preparation in cases which admit of the use of small quantities of alcohol.

Dose, one or two fluidrachms (3.75 or 7.5 mils).

TINCTURA LACTUCARII. U. S.

TINCTURE OF LACTUCARIUM Tr. Lactucar.

Teinture (alcoole) de Lactucarium, *Fr.*; Lactucariumtinktur, *G.*

"Lactucarium, five hundred grammes [or 17 ounces av., 279 grains]; Glycerin, two hundred and fifty mils [or 8 fluidounces, 218 minims] ; Alcohol, Purified Petroleum Benzin, Diluted Alcohol, Water, each, a sufficient quantity, to make one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Beat the lactucarium with clean sand, in an iron mortar, to a coarse powder, and then transfer it to a bottle; add two thousand mils [or 67 fluidounces, 301 minims] of purified petroleum benzin, cork the bottle tightly, and set it aside for forty-eight hours, frequently agitating the mixture. Pour the mixture on a double filter, cover the funnel, and, when the liquid has passed through the filter, wash the residue gradually with fifteen hundred mils [or 50 fluidounces, 345 minims] of purified petroleum benzin, and allow the lactucarium to dry by exposing it to a current of air. When it is dry and free from the odor of benzin, reduce it to a powder, using more sand, if necessary, and pack it moderately in a conical percolator. Mix the glycerin with two hundred and fifty mils [or 8 fluidounces, 218 minims] of water, and five hundred mils [or 16 fluidounces, 435 minims] of alcohol, and gradually pour this mixture on the powder. When the liquid begins to drop from the percolator, close the lower orifice, and having closely covered the percolator, macerate for twenty-four hours. Then allow the percolation to proceed slowly, gradually adding first the remainder of the menstruum, and then diluted alcohol until the drug is exhausted. Reserve the first seven hundred and fifty mils [or 25 fluidounces, 173 minims] of the percolate, evaporate the remainder on a water bath, at a temperature not exceeding 70° C. (158° F.), until it measures two hundred and fifty mils [or 8 fluidounces, 218 minims], and mix this with the reserved portion. Filter the mixed liquids and wash the filter with sufficient diluted alcohol to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of Tincture." *U. S.*

This tincture was first official in the U. S. 1890. It is based on the formula of J. L. Lemberger, who recommended the extraction of the resinous inert lactucerin by treatment with petroleum benzin. Great

care must be observed to use purified petroleum benzin, as it is almost impossible to get rid of the odor and taste of petroleum in the finished preparation if the ordinary benzin be used. It is as useless as the other preparations of lactucarium.

Dose, half to one fluidrachm (1.8-3.75 mils).

Off. Prep.—Syrupus Lactucarii, U. S.

TINCTURA LAVANDULÆ COMPOSITA. U. S., Br.

COMPOUND TINCTURE OF LAVENDER Tr. Lavand. Co. [Compound Spirit of Lavender]

Spiritus Lavandulse Compositus, U. S. 1870; Lavender Drops; Teinture (alcoole) de Lavande composee, *Fr.*; Zusammengesetzte Lavendeltinktur, *G.*

"Oil of Lavender, eight mils [or 130 minims] ; Oil of Rosemary, two mils [or 32 minims] ; Saigon Cinnamon, in No. 50 powder, twenty grammes [or 308.6 grains]; Clove, in No. 50 powder, five grammes [or 77 grains]; Myristica, in No. 50 powder, ten grammes [or 154 grains], Red Saunders, in No. 50 powder, ten grammes [or 154 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process M, macerating the powders in a mixture of seven hundred and fifty mils [or 25 fluid-ounces, 173 minims] of alcohol, in which the oils have been dissolved, and two hundred and fifty mils [or 8 fluidounces, 218 minims] of water. Complete the preparation with a mixture of three volumes of alcohol and one volume of water." U. S.

"Oil of Lavender, 5.0 millilitres; Oil of Rosemary, 0.5 millilitre; Cinnamon Bark, bruised, 10.0 grammes; Nutmeg, bruised, 10.0 grammes; Red Saunders Wood, rasped, 20.0 grammes; Alcohol (90 per cent.), sufficient to produce 1000.0 millilitres. Macerate the solid ingredients and the Oils with nine hundred millilitres of the Alcohol for seven days, shaking occasionally; filter; pass sufficient of the Alcohol through the filter to produce the required volume." *Br.*

The compound tincture of lavender of the U. S. Pharmacopoeia is nearly twice the strength of the British preparation, although it is made with a menstruum weaker in alcohol. When properly prepared it is an excellent

preparation to be used for *gastric uneasiness, nausea, and flatulence.*

Dose, from thirty minims to a fluidrachm (1.8-3.75 mils).

TINCTURA LIMONIS CORTICIS. U. S. (Br.)

TINCTURE OF LEMON PEEL Tr. Limon. Cort.

Tinctura Limonis, *Br.*; Tincture of Lemon; Teinture (alcoole) de Zeste de Citron, *Fr.*; Citronenschalentinktur, *G.*

"Lemon Peel, grated from the fresh fruit, five hundred grammes [or 17 ounces av., 279 grains], to make one thousand mils [or 33 fluid-ounces, 6 $\frac{1}{2}$ fluidrachms]. Prepare a Tincture by Type Process M, macerating the drug in one thousand mils [or 33 fluid-ounces, 6 $\frac{1}{2}$ fluidrachms] of alcohol and completing the preparation with alcohol. Use purified cotton as the filtering medium." *U. S.*

"Lemon Peel, cut small, 250 grammes; Alcohol (90 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

Tincture of lemon peel was a new official preparation of the U. S. P. VIII. Spirit of lemon made from oil of lemon was abandoned, because the poor quality of the oil with which it was likely to be made caused it to have a terebinthinate flavor. The 50 per cent. tincture made by macerating fresh lemon peel in alcohol was proposed by Scoville and the present formula produces a very satisfactory preparation.

This tincture was doubled in strength at the 1898 revision of the *Br. Pharm.*, but is now only about one-half the strength of the *U. S.* tincture. It is made with strong alcohol instead of proof spirit formerly used. It forms a grateful aromatic addition to tonic infusions, etc.

Dose, from one to two fluidrachms (3.75-7.5 mils).

Off. Prep.—Syrupus Acidi Citrici, *U. S.*

TINCTURA LOBELIÆ. U. S.

TINCTURE OF LOBELIA Tr. Lobel. [Lobeliae tinctura P. I.]

Teinture (alcoole) de Lobelie enflée, *Fr. Cod.*; Tinctura Lobeliae, *P. G.*; Lobelientinktur, *G.*; Tintura di lobelia, *It.*; Tintura alcoholica de lobelia, *Sp.*

"Lobelia, in No. 50 powder, one hundred grammes [or 3 ounces av., 231 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] .Prepare a Tincture by Type Process P, using diluted alcohol as the menstruum." U. S.

The strength of this tincture is the same as that of the U. S. P. VIII, which is one-half that of the U. S. 1890. For method of assay, see *C. D.*, 1893, 454; also *P. J.*, 1895, 141. It possesses the emetic and narcotic properties of lobelia, and is much used in *asthma*. A saturated tincture is strongly recommended by A. Livezey as a local application in *erysipelas*, and in the *eczematous eruption of Rhus poisoning*. (*B. M. S. J.*, lv, 262.)

Dose, as an expectorant, fifteen to thirty minims (0.9-1.8 mils).

TINCTURA MOSCHI. U. S.

TINCTURE OF MUSK Tr. Mosch.

Teinture (alcoolée) de Muse, *Fr. Cod.*; Moschustinktur, *G.*; Tintura di muschio, *It.*; Tintura alcoholica de almizcle, *Sp.*

"Musk, five grammes [or 77 grains]; Alcohol, forty-five mils [or 1 fluidounce, 250 minims]; Water, forty-five mils [or 1 fluidounce, 250 minims]; Diluted Alcohol, a sufficient quantity, to make one hundred mils [or 3 fluidounces, 183 minims]. Triturate the musk with the water gradually added until a smooth mixture is obtained; transfer this to a bottle and allow the mixture to macerate for twenty-four hours; then add the alcohol and macerate the mixture for six days, with occasional agitation. Transfer this mixture to a plain paper filter, and, when the liquid has drained off completely, wash the residue on the filter with sufficient diluted alcohol to make one hundred mils [or 3 fluidounces, 183 minims] of Tincture." U. S.

This tincture was reduced in strength about one-half in the U. S. P.

1890, on account of the greatly increased cost of musk. This change, in our opinion, was ill-advised, and does not secure the main object, as the patient will have to take double the dose, even if the alcohol be therapeutically contraindicated. The process has been arranged so as to make the end-product 100 mils, as very few pharmacists will require 1000 mils of tincture of musk. Musk will yield its virtues to the above menstruum if the process be followed; if wanted for its odor it will be economy to add a minim of solution of sodium hydroxide to the water used to rub the musk into a smooth paste. Care should be especially taken to use pure grain musk in this preparation.

Dose, from thirty minims to two fluidrachms (1.8-7.5 mils).

TINCTURA MYRRHÆ. U. S., Br.

TINCTURE OF MYRRH Tr. Myrrh.

Teinture (alcoole) de Myrrhe, *Fr. Cod.*; Tinctura Myrrhæ, *P. G.*; Myrrhentinktur, *G.*; Tintura di mirra. *It.*; Tintura alcoholica de mirra, *Sp.*

"Myrrh, in moderately coarse powder, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluidounces, 6½ fluidrachms]. Prepare a Tincture by Type Process M, using alcohol as the solvent." *U. S.*

"Myrrh, in coarse powder, 200 grammes; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Macerate the Myrrh with eight hundred millilitres of the Alcohol in a closed vessel for seven days, shaking occasionally; filter; pass sufficient of the Alcohol through the filter to produce the required volume." *Br.*

The strength of this tincture was increased 60 per cent. at the revision of the British Pharmacopoeia (1898) and is now equivalent to the *U. S.* preparation.

Official alcohol is preferable to diluted alcohol as a solvent of myrrh, because it forms a perfectly clear tincture, which is not attainable with the latter menstruum. The addition of water to the tincture renders it turbid. According to E. B. Shuttleworth (*A. J. P.*, xliii, 369), the gum which is left behind in making the tincture may be utilized for making mucilage. The tincture of myrrh is used solely as a local application to

stimulate *indolent and foul ulcers, spongy gums, aphthous sore mouth, and ulcerations of the throat.*

Dose, from fifteen to thirty minims (0.9-1.8 mils).

TINCTURA NUCIS VOMICÆ. U. S., Br.

**TINCTURE OF NUX VOMICA Tr. Nuc. Vom.
[Strychni tinctura P. I.]**

"One hundred mils of Tincture of Nux Vomica yields not less than 0.237 Gm. nor more than 0.263 Gm. of the alkaloids of nux vomica." U. S. "Tincture of Nux Vomica contains in 100 millilitres 0.125 gramme of strychnine." Br.

Teinture (alcoole) de Noix vomique, *Fr. Cod.*; Tinctura Strychni, *P. G.*; Brechnusstinktur, Krahenaugentinktur, *G.*; Tintura di noce vomica, *It.*; Tintura alcoholica de nuez vomica, *Sp.*

"Nux Vomica, in No. 40 powder, one hundred grammes [or 3 ounces av., 231 grains], to make about one thousand millilitres [or 33 fluid-ounces, 6 $\frac{1}{2}$ fluidrachms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures), using a mixture of three volumes of alcohol and one volume of water as the menstruum and adjusting the volume of the finished Tincture so that each one hundred mils contains 0.25 Gm. of the alkaloids of nux vomica. The rate of flow for the percolate should not exceed ten drops per minute." *U. S.*

"Liquid Extract of Nux Vomica, 50 millilitres; Distilled Water, 150 millilitres; Alcohol (90 per cent.), sufficient to produce 600 milli-litres. Mix; filter if necessary. Examined by the process described under 'Extractum Nucis Vomicae Liquidum' Tincture of Nux Vomica is found to contain in 100 millilitres 0.125 gramme of strychnine. Limit of error 0.005 gramme in excess or defect. This Tincture contains in each millilitre 1.25 milligrams of strychnine; each fluidrachm contains about 1/16 grain. It contains approximately the same proportion of strychnine as the Tinctura Nucis Vomica of the International Agreement, and one-half of that contained in the corresponding preparation of the British Pharmacopoeia, 1898." *Br.*

In the U. S. VIII this tincture was made from the extract, the object

being to secure a more reliable and definite tincture than was possible under the process official prior to 1890; for this reason 2 per cent. of the standardized extract was directed to be dissolved in a mixture of 3 volumes of alcohol and 1 volume of water. On account of the very tough structure of nux vomica, percolation was accomplished usually with varying results. The amount of extract present in the percolate was to some extent a measure of its activity; hence, if a weighed portion of the percolate was evaporated to dryness, and the percentage of dry extract noted, it was easy to calculate the amount present in the whole quantity. The standard for Tincture of Nux Vomica was changed in the U. S. P. IX from 0.1 Gm. of strychnine in 100 mils to 0.25 Gm. in 100 mils of the alkaloids of nux vomica and instead of making the tincture from a definite quantity of extract of nux vomica percolation of the powdered drug is used. It is true that the tincture must be assayed, and the pharmacist, for this reason, must depend on the manufacturer for his supply, as it is unprofitable to assay small quantities of the tincture. We believe that more uniform results were obtained for the U. S. P. VIII tincture than will be for that of the U. S. P. IX, although the U. S. P. IX process is supposed to give a product of a more uniform color, which was the principal defect in the U. S. P. VIII product.

The British Pharmacopoeia standardizes the liquid extract, and makes its tincture from it of such strength that 100 mils shall contain 0.125 Gm. of strychnine. R. Rother (*A. J. P.*, Jan., 1883), after experimenting with various substances, found that sodium chloride aided greatly in softening the bassorin-like substance in which the alkaloidal principles of nux vomica are embedded, and he proposes its use by adding it to the menstruum of diluted alcohol in the proportion of 120 grains to the pint (see *U. S. D.*, 16th ed., p. 1527).

The amount of strychnine in this tincture is so small that it is not to be recommended for producing the systemic effects of that alkaloid. Its most important use is as a bitter tonic in gastric atony.

Dose, of the tincture, ten to thirty minims (0.6-1.8 mils), to be increased if necessary.

Off. Prep.—Elixir Phosphori et Nucis Vomicae, *N. F.*

TINCTURA OLIVERI CORTICIS. Br.

TINCTURE OF OLIVER'S BARK

"Oliver's Bark, in No. 40 powder, 100 grammes; Alcohol (60 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with fifty millilitres of the Alcohol, and complete the percolation process." *Br.*

This tincture has been used in Australia for a number of years and is now official in the Br. Pharm. 1914. It possesses the properties of an aromatic like cinnamon.

The dose is from one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA PHYSOSTIGMATIS. U. S.

TINCTURE OF PHYSOSTIGMA Tr. Physostig. [Tincture of Calabar Bean]

"One hundred mils of Tincture of Physostigma yields not less than 0.013 Gm. nor more than 0.017 Gm. of the alkaloids of physostigma." *U.S.*

Teinture (alcoole) de feve du Calabar, *Fr.*; Kalabarbohntinktur, *G.*

"Physostigma, in No. 50 powder, one hundred grammes [or 3 ounces av., 231 grains], to make about one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Prepare a tincture by Type Process P, as modified for assayed tinctures, using alcohol as the menstruum and adjusting the volume of the finished tincture so that each one hundred mils contains 0.015 Gm. of the alkaloids of physostigma,

This tincture was reduced from 15 Gm. (U. S. P., 1890) to 10 Gm. of drug per 100 mils in the U. S. P. VIII and an assay process appended; the U. S. P. IX has retained this strength. This tincture of Calabar Bean is much weaker than that proposed by Fraser, which was nearly as strong as a fluidextract— five minims representing three grains of the drug.

Dose, of the official tincture, from ten to thirty minims (0.6-1.8 mils).

TINCTURA PICRORHIZÆ. Br.

TINCTURE OF PICRORHIZA

"Picrorhiza, cut small and bruised, 250 grammes; Alcohol (45 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

Although "this Tincture is of twice the strength of the *corresponding* preparation of the Indian and Colonial Addendum, 1900," *Br.*, the proportion of alcohol in this tincture is too large for it to be available as an antiperiodic; it is used as a bitter tonic.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA PODOPHYLLI. Br.

TINCTURE OF PODOPHYLLUM

Teinture (alcoole) de Resine de Podophyllum, *Fr.*; Podophyllintinktur, *G.*

" Podophyllum Resin, 36.5 grammes; Alcohol (90 per cent.), sufficient to produce 1000 milli-litres. Add the Podophyllum Resin to nine hundred millilitres of the Alcohol, and set aside for twenty-four hours, shaking occasionally; filter; pass sufficient of the Alcohol through the filter to produce the required volume." *Br.*

The introduction of this tincture is of doubtful utility.

Dose, five to fifteen minims (0.3-0.9 mil).

TINCTURA PODOPHYLLI INDICI. Br.

TINCTURE OF INDIAN PODOPHYLLUM

"Indian Podophyllum Resin, 36.5 grammes; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Add the Indian Podophyllum Resin to nine hundred millilitres of the Alcohol, and set aside for twenty-four hours, shaking occasionally; filter; pass sufficient of the Alcohol through the filter to produce the required volume." *Br.*

This has been introduced to afford a substitute in the Asiatic provinces

for the tincture of Podophyllum.

Dose, five to fifteen minims (0.3-0.9 mil).

TINCTURA PRUNI VIRGINIANÆ. Br.

TINCTURE OF WILD CHERRY

Tincture of Virginian Prune; Teinture (alcoole) d'Ecorce de Cerisier, *Fr.*; Wildkirschenrindentinktur, *G.*

"Wild Cherry Bark, in No. 20 powder, 200 grammes; Alcohol (90 per cent.), 565 millilitres; Distilled Water, 365 millilitres; Glycerin, 100 millilitres. Mix the powder with the Distilled Water; set aside in a closed vessel for twenty-four hours; add the Alcohol, and complete the maceration process; add the Glycerin to the product." *Br.*

This was a new official tincture of the Br. Pharm., 1898; its utility is doubtful. The English name has been changed from Virginian Prune to Wild Cherry in the Br. Pharm., 1914. The use of the glycerin serves to retard precipitation.

Dose, from one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA PYRETHRI. U. S., Br.

TINCTURE OF PYRETHRUM Tr. Pyreth. [Tincture of Pellitory]

Teinture (alcoole) de Pyrethre (racine), *Fr. Cod.*; Bertramwurzeltinktur, *G.*

"Pyrethrum, in No. 50 powder, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluidounces, 6½ fluidrachms]. Prepare a Tincture by Type Process P. using alcohol as the menstruum." *U. S.*

"Pyrethrum Root, in No. 40 powder, 200 grammes; Alcohol (70 per cent.), sufficient to produce, 1000 millilitres. Moisten the powder with one hundred and fifty millilitres of the Alcohol, and complete the percolation process." *Br.*

This tincture is a powerful local irritant, and is an ingredient in several well-known mouth and tooth washes. For its uses, which are purely external, see *Pyrethrum*.

TINCTURA QUASSIÆ. U. S. Br.

TINCTURE OF QUASSIA Tr. Quass.

Teinture (alcoole) de Quassie Amere, *Fr.*; Quaasiatinktur, *G.*

"Quassia, in No. 50 powder, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] Prepare a Tincture by Type Process P, using a mixture of one volume of alcohol and two volumes of water as the menstruum." *U. S.*

"Quassia Wood, rasped, 100 grammes; Alcohol (45 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

The strength of this tincture was doubled in the U. S. P. VIII and is twice that of the present British tincture. It may be employed as an addition to tonic infusions or mixtures. It has the advantage that, being free from tannin, it may be given in conjunction with salts of iron.

Dose, one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA QUILLAÆ. Br.

TINCTURE OF QUILLAIA

Teinture (alcoole) d'Ecorce de Quillaja, *Fr.*; Seifenrindeitinktur, *G.*

Tincture of quillaja was deleted from the U, S. P. IX, but is now official in the N. F. IV..

"Quillaia Bark, in No. 20 powder, 50 grammes; Alcohol (60 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with twenty-five millilitres of the Alcohol, and complete the percolation process." *Br.*

This tincture is almost exclusively used as an emulsifying agent. Its medicinal activity, however, limits its use. (See *Quillaja*) The British tincture is only one-fourth the strength of the preparation.

Dose, from one-half to one fluidrachm (1.8-3.75 mils).

TINCTURA RHEI. U. S. (Br.)

TINCTURE OF RHUBARB Tr. Rhei

Tinctura Rhei Composita, *Br.*, Compound Tincture of Rhubarb; Teinture (alcoole) de Rhubarbe, *Fr. Cod.*; Rhabarbertinktur, *G.*; Tintura di rabarbaro, *It.*

*"Rhubarb, in No. 40 powder, two hundred grammes [or 7 ounces av., 24 grains], Cardamom Seed, in No. 40 powder, thirty grammes [or 1 ounce av., 25.5 grains], to make one thousand mils [or 33 fluidounces, 6 $\frac{1}{2}$ fluidrachms]. Prepare a Tincture by Type Process P, using a mixture of one hundred mils [or 3 fluidounces, 183 minims] of glycerin, five hundred mils [or 16 fluidounces, 435 minims] of alcohol and four hundred mils [or 13 fluidounces, 252 minims] of water as the first menstruum and completing the percolation with diluted alcohol." *U. S.*

"Rhubarb, in No. 20 powder, 100.0 grammes; Cardamom .Seeds, in No. 20 powder, 12.5 grammes; Coriander Fruit, in No. 20 powder, 12.5 grammes; Glycerin, 100.0 millilitres; Alcohol (45 per cent.) sufficient to produce 1000.0 millilitres. Moisten the solid ingredients with one hundred millilitres of the Alcohol, and prepare, by the percolation process, eight hundred and fifty millilitres of tincture. Add the Glycerin, and sufficient of the Alcohol to produce the required volume." *Br.*

This tincture was doubled in rhubarb and cardamom strength in the U. S. P. (8th Rev.). The tincture of rhubarb on standing deposits a yellow precipitate. This has been shown by James T. King (*A. J. P.*, xlii) to be in most cases largely composed of chrysophanic acid. He proposed to remedy this by the use of a stronger alcohol, or, as recommended by J. B. Moore (*A. J. P.*, xlv, 306), by the substitution of glycerin for a portion of the alcohol. We have not found that either of these plans entirely prevents precipitation, although glycerin is an aid in this direction.

Dose, from one to two fluidrachms (3.75-7.5 mils).

Off. Prep.—Mistura Opii et Rhei Composita, *N.F.*

TINCTURA RHEI AROMATICA. U. S.

AROMATIC TINCTURE OF RHUBARB Tr. Rhei Arom.

Teinture (alcoole) de Rhubarbe aromatique, *Fr.*; Aromatische Rhabarbertinktur, *G.*

"Rhubarb, in No. 40 powder, two hundred grammes [or 7 ounces av., 24 grains]; Saigon Cinnamon, in No. 40 powder, forty grammes [or 1 ounce av., 180 grains]; Clove, in No. 40 powder, forty grammes [or 1 ounce av., 180 grains]; Myristica, in No. 40 powder, twenty grammes [or 308.6 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, using a mixture of one hundred mils [or 3 fluidounces, 183 minims] of glycerin, five hundred mils [or 16 fluidounces, 435 minims] of alcohol and four hundred mils [or 13 fluidounces, 252 minims] of water as the first menstruum and completing the percolation with diluted alcohol." U. S:

This is the tincture which is used in making the aromatic syrup of rhubarb. It is preferable to separate the preparations, as it is occasionally desirable to prescribe the tincture without the admixture with syrup, while the pharmacist will always prefer to make the tincture in quantity and keep it on hand, since it is permanent, and add to it syrup to make the aromatic syrup when needed.

Dose, for an adult, from one-half to one fluidrachm (1.8-3.75 mils).

Off. Prep.—Syrupus Rhei Aromaticus, U. S.

TINCTURA SANGUINARIÆ. U. S.

TINCTURE OF SANGUINARIA Tr. Sanguin. [Tincture of Blood Root]

Teinture (alcoole) de Sanguinaire, *Fr.*; Blutwurzeltinktur, *G.*

"Sanguinaria, in No. 60 powder, one hundred grammes [or 3 ounces av., 231 grains]; Hydrochloric Acid, ten mils [or 162 minims]; Alcohol, Water, each, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Mix six hundred mils [or 20 fluidounces, 138 minims] of alcohol with four hundred mils [or 13 fluidounces, 252 minims] of water. Moisten the drug with a mixture of the hydrochloric

acid and thirty mils [or 1 fluid-ounce, 7 minims] of this menstruum, transfer it to a percolator, and, without pressing the powder, allow it to stand, well covered, for six hours; then pack it firmly and pour on enough menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for twenty-four hours. Then allow the percolation to proceed slowly, pouring on sufficient menstruum made of alcohol and water, in the same proportion as before, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of Tincture." *U. S.*

This tincture was reduced from 15 Gm. (*U. S. P.*, 1890) to 10 Gm. of drug, per 100 mils, in the *U. S. P.* VIII and IX.

A precipitate will generally be found deposited upon the sides and bottoms of bottles containing this tincture. W. J. McConn (*A. J. P.*, 1884, p. 505) recommended the addition of an alkaline citrate, preferably potassium citrate, as a preventive. He found sanguinarine in the precipitate. See also Homerberg and Beringer (*A. J. P.*, 1913, lxxxv, p. 394). The official menstruum now contains hydrochloric acid, with a view of preventing precipitation. This tincture is emetic in the dose of from three to four fluidrachms (11.25-15 mils); but it is rather intended to act as an expectorant or an alterative, for which purpose from fifteen to sixty minims (0.9-3.75 mils) may be given.

TINCTURA SCILLÆ. U. S., Br.

TINCTURE OF SQUILL Tr. Scill.

"If assayed biologically the minimum lethal dose should not be greater than 0.006 mil of Tincture, or the equivalent in Tincture of 0.0000005 Gm. of ouabain, for each gramme of body weight of frog." *U. S.*

Teinture (alcoole) de Scille, *Fr. Cod.*; Meerzwiebeltinktur, *G.*; Tintura alcoholica de escila, *Sp.*

"Squill, in No. 20 powder, one hundred grammes [or 3 ounces av., 231 grains]; Alcohol, Water, each, a sufficient quantity, to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Moisten the drug with sufficient menstruum, prepared by mixing three volumes of alcohol and one volume of water, and macerate it in a closed vessel in a

moderately warm place for twenty-four hours, stirring occasionally. Then transfer it to a percolator, shake it down evenly without packing and pour on enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for twenty-four hours. Then allow the percolation to proceed slowly, gradually adding sufficient of the same menstruum to make one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms] of Tincture.

"Squill, bruised, 200 grammes; Alcohol (60 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

Tincture of Squill was reduced from the strength of 15 Gm. (U. S. P. 1890) to 10 Gm. of drug, per 100 mils, U. S. P. VIII and IX). This tincture yields a grayish, rose-colored, very bitter and acrid deposit, consisting of silky tufts. (Meniere.) The tincture represents the virtues of squill probably better than any other official preparation.

Dose, from ten to twenty minims (0.6-1.3 mils) (from twenty to forty drops).

TINCTURA SENEGÆ. Br.

TINCTURE OF SENEGA

Teinture (alcoole) de Polygala de Virginie, *Fr.*; Senegatinktur. *G.*

"Senega Root, in No. 40 powder, 200 grammes; Alcohol (60 per cent.), sufficient to produce, 1000 millilitres. Moisten the powder with two hundred millilitres of the Alcohol, and complete the percolation process." *Br.*

The Br. Pharm. 1898 increased the strength of this preparation 60 per cent. The tincture is efficient, but it is hardly needed while recourse can be had to the fluidextract or the syrup.

Dose, from thirty minims to two fluidrachms (1.8-7.5mils).

TINCTURA SENNÆ COMPOSITA. Br.

COMPOUND TINCTURE OF SENNA

Elixir Salutis; Teinture (alcoole) de Sene composee, Teinture de Sene aromatique, Elixir de Salut, *Fr.*; Zusammengesetzte Sennatinktur, *G.*

"Senna Leaves, in No. 20 powder, 200 grammes; Caraway Fruit, in No. 20 powder, 25 grammes; Coriander Fruit, in No. 20 powder, 25 grammes; Glycerin, 100 millilitres; Alcohol (45 per cent.), sufficient to produce 1000 millilitres. Moisten the solid ingredients with two hundred and fifty millilitres of the Alcohol, and prepare, by the percolation process, eight hundred and fifty millilitres of tincture. Add the Glycerin and sufficient of the Alcohol to produce the required volume." *Br.*

The Br. Pharm. 1898 increased the proportion of senna in this preparation 60 per cent.

This tincture is the elixir salutis of the old Pharmacopoeias. It is a warm cordial purgative, useful in *costiveness* attended with flatulence, and in *atonic gout*, especially when occurring in intemperate persons. It is also added to cathartic infusions and mixtures. Tincture of senna yields a yellow scaly deposit, containing white crystals of calcareous salts. (Meniere.)

Dose, from two to four fluidrachms (7.5-15 mils).

TINCTURA SERPENTARIÆ. Br.

TINCTURE OF SERPENTARY

Teinture (alcoole) de Serpentaire de Virginie, *Fr.*; Schlangenwurzeltinktur, *G.*

"Serpentary Rhizome, in No. 40 powder, 200 grammes; Alcohol (60 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with two hundred millilitres of the Alcohol, and complete the percolation process." *Br.*

Tincture of Serpentaria was doubled in strength in the U. S. P. VIII, but is now transferred to the N. F. (see Part III). This tincture is little other

than a feebly aromatic, alcoholic stimulant. The Br. Pharm. 1898 increased the strength of this preparation 60 per cent.

Dose, thirty minims to two fluidrachms (1.8-7.5 mils).

TINCTURA STRAMONII. U. S., Br.

TINCTURE OF STRAMONIUM Tr. Stramon.

"One hundred mils of Tincture of Stramonium yields not less than 0.0225 Gm. nor more than 0.0275 Gm. of the total alkaloids of stramonium." U. S.

Tincture of Stramonium Leaves; Teinture (alcoole) de Stramoine (feuille), *Fr. Cod.*; Stechapfelblattertinktur. *G.*

"Stramonium, in No. 60 powder, one hundred grammes [or 3 ounces av., 231 grains], to make about one thousand mils [or 33 fluid-ounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, as modified for assayed tinctures, using- diluted alcohol as the menstruum and adjusting the volume of the finished Tincture so that each one hundred mils contains 0.025 Gm. of the total alkaloids of stramonium.

" Stramonium Leaves, in No. 20 powder, 200 grammes; Alcohol (45 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with two hundred millilitres of the Alcohol, and complete the percolation process." *Br.*

This tincture is now made from Stramonium leaves instead of the seeds as directed by the U. S. P. 1890, and the strength made 10 Gm. of drug, per 100 mils, instead of 15 Gm., as in the U. S. P. 1890, and an assay has been appended. The Br. Pharm. 1898 increased the strength of this preparation 60 per cent., but changed the form of the drug from seeds to leaves. The British tincture is now double the strength of the U. S. P. tincture.

Dose, from ten to twenty minims (0.6-1.3 mils); of the British tincture, five to ten minims (0.3-0.6 mil).

TINCTURA TOLUTANA. U. S., Br.

TINCTURE OF TOLU Tr. Tola. [Tolu Tincture]

Tincture of Balsam of Tolu; Teinture (alcoole) de Baume de Tolu, *Fr. Cod.*; Tolubalsamtinktnr, *G.*

"Balsam of Tolu, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] . Prepare a Tincture by Type Process M, using alcohol as the solvent." *U. S.*

"Balsam of Tolu, 100 grammes; Alcohol (90 per cent.), sufficient to produce, 1000 millilitres. Dissolve the Balsam of Tolu in eight hundred millilitres of the Alcohol; filter; pass sufficient of the Alcohol through the filter to produce the required volume." *Br.*

This tincture was doubled in strength in the U. S. P. VIII. The British tincture (1914) is half the strength of the U. S. P. tincture.

The tincture of tolu has the properties of the balsam, and may be employed as an addition to expectorant mixtures in chronic bronchitis, but the proportion of alcohol is too large to allow of its advantageous use in some cases. It is used in preparing the syrup of tolu. In smaller quantities it is often employed to flavor cough mixtures. It is precipitated by aqueous liquids.

Dose, one-half to two fluidrachms (1.8-7.5 mils).

Off. Prep.—Syrupus Tolutanus, U. S.

TINCTURA URGINEÆ. Br.

TINCTURE OF URGINEA

"Urginea, bruised, 200 grammes; Alcohol (60 per cent.), 1000 millilitres. Prepare by the maceration process." *Br.*

This tincture was introduced into India and is intended to be used in place of squill.

The dose is five to fifteen minims (0.3-0.9 mil).

TINCTURA VALERIANÆ. U. S.

TINCTURE OF VALERIAN Tr. Valer.

Teinture (alcoole) de Valeriane, *Fr. Cod.*; Tinctura Valerianae, *P. G.*; Baldriantinktur, *G.*; Tinturo di valeriana, *It.*

"Valerian, in No. 40 powder, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, using a mixture of three volumes of alcohol and one volume of water as the menstruum." *U. S.*

The proportion of alcohol was increased in the U. S. 1890 tincture, to prevent precipitation, and this strength has been retained in the present revision. It is now three parts of alcohol to one part of water. The tincture possesses the properties of valerian, but cannot be given in some cases, so as to produce the full effects of the root, without stimulating too highly, in consequence of the large proportion of spirit. It deposits on standing a black, very cohesive precipitate, with starch, and a yellow extractive matter. (Meniere.)

Dose, one to four fluidrachms (3.75-15.0 mils).

TINCTURA VERATRI VIRIDIS. U. S.

TINCTURE OF VERATRUMVIRIDE Tr. Verat. Vir. [Tinctura Veratri, U. S. VIII]

Tincture of Green Hellebore; Tincture of American Hellebore; Teinture (alcoole) de Veratre, *Fr.*; Tinctura Veratri, *P. G.*; Nieswurzeltinktur, *G.*

"Veratrum Viride in No. 60 powder, one hundred grammes [or 3 ounces av., 231 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, using alcohol 'as the menstruum." *U. S.*

The U. S. tincture of American hellebore of 1890 was of the same strength as Norwood's tincture, which was prepared by its author from fresh drug (240 grains for each fluidounce of alcohol), and was supposed to be saturated. The U. S. P. 1890 tincture was made from

dried and powdered veratrum (40 Gm. in 100 mils strength) but was reduced by the U. S. P. VIII from 40 per cent. to 10 per cent. in order that it might conform with the recommendations of the Brussels Congress concerning potent tinctures (see Tinctures). This action has resulted in increasing the use of the fluid-extract, which is a better preparation. The U. S. P. IX has returned to the exclusive use of veratrum viride. Veratrum album was also recognized in the U. S. P. VIII.

Dose, of U. S. tincture, ten to thirty minims (0.6-1.8 mils).

TINCTURA ZINGIBERIS. U. S., Br.

TINCTURE OF GINGER Tr. Zingib. [Tincture of Jamaica Ginger]

Teinture (alcoole) de Gingembre, *Fr. Cod.*; Tinctura Zingiberis, *P. G.*; Ingwertinktur, *G.*

"Jamaica Ginger, in No. 30 powder, two hundred grammes [or 7 ounces av., 24 grains], to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Prepare a Tincture by Type Process P, using alcohol as the menstruum. Evaporate 10 Gm. of Tincture of Ginger to dryness in a tared dish on a water bath; the yield of residue does not exceed 2 per cent. When treated with 20 mils of cold distilled water, not more than 15 per cent. of this residue dissolves. Evaporate 10 mils of Tincture of Ginger to dryness in a small flask. Add 5 mils of half-normal alcoholic potassium hydroxide V.S. and boil the mixture gently for thirty minutes under a reflux condenser. Remove the condenser and evaporate the alcohol on a water bath. Then add 50 mils of distilled water to the residue, agitate the mixture, filter it and transfer the aqueous filtrate to a sep-aratory funnel and shake it out with 25 mils of ether. Evaporate the separated ether solution spontaneously by adding it, a few drops at a time, to the center of a watch glass. Cautiously apply the tip of the tongue to the dry residue; the taste should be slightly camph-oraceous but not sharp or biting-pungent (*capsicum or similar pungent substitute*). It contains about 90 per cent. of C₂H₅.OH by volume." *U. S.*

"Ginger, in No. 40 powder, 100 grammes; Alcohol (90 per cent.), sufficient to produce 1000 millilitres. Moisten the powder with one hundred millilitres of the Alcohol, and complete the percolation process." *Br.*

The strength of this tincture was reduced at the 1880 revision one-third, to bring it into the 20 per cent. class; this is not a disadvantage, however, in view of the introduction of the fluidextract, and the dose is not now inconveniently large.

The tincture of the British Pharmacopoeia is still too weak in the proportion of ginger. In consequence of the mucilaginous matter contained in ginger, the tincture made with diluted alcohol or proof spirit is apt to be turbid, and the drug is incompletely exhausted of its resinous and oily constituents. Alcohol or rectified spirit is, therefore, properly preferred. Official Jamaica ginger only should be used; for, while a darker-colored preparation is made when the inferior varieties are substituted, the apparent increase in strength is due to coloring matter, and not to the presence of a larger amount of volatile oil or resin.

The tincture of ginger is a useful carminative, and may often be beneficially added to tonic and purgative infusions or mixtures in debilitated states of the alimentary canal. It is in this country largely used for the preparation of a syrup of ginger, for which purpose, however, the fluidextract is official, and is better even than the strong tincture of the Br. Pharmacopoeia 1885, which was dropped at the 1898 revision.

Dose, eight to forty minims (0.5-2.5 mils).

Off. Prep.—Acidum Sulphuricum Aromaticum, *U. S.*, *Br.*

TINCTURÆ.

TINCTURES

Teintures (Alcooliques) Alcooles, *Fr.*; Tinkturen, *G.*; Tinture alcooliche, *It.*; Tinturas alcoholicas, *Sp.*

Tinctures, in the pharmaceutical sense of the term, are alcoholic solutions of medicinal substances, prepared by maceration, digestion, or percolation. Solutions in spirit of ammonia and ethereal spirit are embraced under the same denomination, but are severally distinguished by the titles of ammoniated tinctures and ethereal tinctures. The

advantages of alcohol as a menstruum are that it dissolves principles which are sparingly, or not at all, soluble in water, and contributes to their preservation. when dissolved, while it leaves behind some inert substances which are dissolved by water. In no instance, however, is dehydrated alcohol employed. Because of the slight amount of water in it, official alcohol dissolves more or less of substances which are insoluble in dehydrated alcohol, while its solvent power in relation to bodies soluble in that fluid is sufficient for all practical purposes. Diluted alcohol or proof spirit is often preferable to official alcohol, as it is capable of extracting a larger proportion of those active principles of plants which require an aqueous menstruum, while at the same time it is strong enough to prevent spontaneous decomposition, and has the advantages of being cheaper and less stimulating, although a few tinctures when prepared with weak alcoholic menstrua undergo some deterioration in time, in consequence of acetous fermentation taking place in the alcoholic fluid. The best preventive is to keep them in full and well-closed bottles, at a low temperature. The diluted alcohol of the different Pharmacopoeias is not of the same strength; that of the United States consists of equal volumes of official alcohol and water, and has the sp. gr. of about 0.936 at 15.56 C. (60° F.), while the British has four official diluted alcohols—70, 60, 45, and 20 per cent. Alcohol, or rectified spirit, is preferred as a solvent when the substance to be extracted or dissolved is nearly or quite insoluble in water, as in the instances of resins, guaiac, camphor, and the essential oils. The presence of water is here injurious, not only by diluting the menstruum, but also by exercising an affinity for the alcohol which interferes with its solvent power. Thus, water added to an alcoholic solution of one of these bodies produces a precipitate by abstracting the alcohol from it. Diluted alcohol, or proof spirit, is employed when the substance is a soluble both in alcohol and in water; or when one or more of the ingredients are soluble in the one fluid and one or more in the other, as in the case of vegetable bodies which contain extractive or tannin, or the natural salts of the alkaloids, or gum united with resin or volatile oil. As these include the greater number of medicine's from which tinctures are prepared, diluted alcohol is most frequently used. In the preparation of the tinctures, the drug should be dry, and properly comminuted by being bruised, sliced, or pulverized. It is usually better in a moderately fine than in a very fine powder; the proper degree depends, however, upon the ease with which the menstruum extracts the soluble principles. The recommendations of the International Protocol included the use of 70 per cent. alcohol for the various tinctures, but as this has not proven to

be the best menstruum for some drugs, the U. S. P. has not always followed the suggestion.

In the U. S. P. IX the general article on tinctures is as follows:

“Tinctures are alcoholic preparations made by extracting the valuable principles from drugs by the use of appropriate menstrua or solvents. Tincture of ferric chloride and tincture of iodine are exceptional, not being made by extraction; they are alcoholic solutions of chemical substances. Tinctures of potent drugs are made of the strength of ten grammes [or 154 grains] of drug in one hundred mils [or 3 fluidounces, 183 minims 1 of tincture. The other tinctures vary in the proportion of drug in the finished tincture. Tinctures are made by percolation with few exceptions. Maceration or solution is preferred when from its physical character the drug is not suitable for percolation. The majority of official tinctures are prepared under one or the other of the two type processes described, and in each formula directions are given as to the process to be followed with such modifications as may be necessary. A number of drugs require special manipulation for the preparation of satisfactory tinctures, and for these the formulas in full will be found in the text. Where it has been found possible and desirable to standardize the tinctures a rubric and assay have been added. Tinctures should be stored in tightly-stoppered bottles, kept in a cool place, and protected from light.

Type Process P—Percolation.

"Moisten the powdered drug or mixed drugs designated in the formula with a sufficient quantity of the prescribed menstruum to render it evenly and distinctly damp, transfer it to a percolator, and, without pressing the powder, allow it to stand well-covered for six hours; then pack it firmly, unless otherwise directed, and pour on enough of the menstruum to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for twenty-four hours. Then allow the percolation to proceed slowly, gradually adding sufficient of the menstruum to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of finished tincture.

"Modification for Assayed Tinctures.—In Tinctures that are directed to be assayed, allow the percolation to proceed until the percolate measures

nine hundred and fifty mils [or 32 fluidounces, 59 minims]. Assay a sample of this percolate as directed and from the alka-loidal content thus determined, ascertain by calculation the amount of alkaloids in the remainder of the liquid and add to this enough of the menstruum to make the finished Tincture conform to the required alkaloidal standard.

Type Process M—Maceration.

"Macerate the drug or mixed drugs designated in the formula in a stoppered container, in a moderately warm place, with seven hundred and fifty mils [or 25 fluidounces, 173 minims] of the prescribed solvent (unless a different amount is specified in the formula). Continue the maceration with frequent agitation during three days or until the drug is practically extracted, transfer the mixture to a filter and, when the liquid has drained off completely, gradually wash the residue on the filter with enough of the solvent to make one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms] of finished tincture." *U. S.*

The British Pharmacopoeia in the Appendix IX. (see Part III) has provided detailed instruction for both percolation and maceration processes.

Tinctures were at one time universally prepared by maceration or digestion. Our own Pharmacopoeia formerly directed maceration at ordinary temperatures, and extended the period to two weeks. In several instances in which maceration is ordered in the U. S. Pharmacopoeia, maceration for three days is directed, but the Br. process requires seven days. When circumstances require that the tincture should be speedily prepared, digestion may be resorted to. Care should always be taken to keep the vessels well stoppered, in order to prevent the evaporation of the alcohol. The materials should be frequently shaken during the digestion or maceration, and this caution is especially necessary when the substance acted on is in the state of powder. The tincture should not be used until the maceration is completed, when it should be separated from the dregs either by simply filtering it through paper, or, when force is requisite, by expressing it through linen, and filtering.

The plan of preparing tinctures by percolation has been extensively adopted, and has been found to answer well when skilfully executed. In the present edition of our Pharmacopoeia, percolation has been adopted

as the rule, maceration being directed in some instances in which it was deemed preferable. The method of making tinctures by diluting fluidextracts, except in a few special cases, is not to be recommended. The menstruum directed for the fluidextract is most frequently not identical with that used for the tincture, and precipitation of active constituents often ensues when this easy method is employed. Owing to the larger dose of the tinctures, and consequently less degree of concentration, a larger proportion of water can be used in their menstrua than in fluidextracts, and this is a distinct advantage, as tinctures are frequently prescribed in combination with aqueous solutions.

Another mode of exhausting medicines by spirit has been proposed by H. Burton. It consists in suspending in the solvent, immediately under its surface, the solid matter contained loosely in a bag. The liquid in contact with the bag, becoming heavier by impregnation with the matters dissolved, sinks to the bottom; its place is supplied with a fresh portion, which in its turn sinks, and thus a current is established, which continues until the solid substance is exhausted or the liquid saturated. During the maceration the bag should be occasionally raised above the surface of the liquor in the bottle, allowed to drain, and then again immersed. It is asserted that the period of maceration is much shortened in this way. For this mode of preparing tinctures Samuel Gale has proposed the use of a cylindrical stoneware vessel with a diaphragm capable of being supported at different heights by projections from the inner surface of the jar, with corresponding notches in the diaphragm, to permit its easy passage to the lower ledges. The material is to be placed upon the diaphragm and kept covered with the menstruum.

Tinctures prepared by adding alcohol to the expressed juices of plants have been long in use on the continent of Europe, and have been brought into notice in Great Britain. They are sometimes called in England preserved vegetable juices. This method of preparing tinctures has, however, been abandoned by both the U. S. and Br. Pharmacopoeias. Preserved juices are often energetic, yet it is obvious that tinctures prepared from the fresh plant must be still more so, as they contain necessarily not only the soluble active matter of the juice, but also that which, when the juice is expressed, is left in the solid residue of the plant. For further information see U. S. D., 19th ed., p. 1293.

A process for making tinctures from fresh drugs was official in the U. S. P. VIII. It was deleted from the U. S. P. IX, but introduced into the National Formulary IV under the heading *Tincturæ Medicamentorum Recentium* as follows :

"Tinctures of fresh drugs, when not otherwise directed, are to be prepared according to the following general formula: The Fresh Drug, cut, bruised, or crushed, five hundred grammes [or 17 ounces av., 279 grains]; Alcohol, one thousand mils [or 33 fluidounces, 6¹/₂ fluidrachms]. Macerate the drug with the alcohol in a closed vessel in a moderately warm place during fourteen days, with occasional stirring; then strongly express the liquid and filter it through paper." N. F.

Tinctures should be kept in bottles accurately stoppered, in order to prevent evaporation, which might in some instances be attended with serious inconvenience, by increasing their strength beyond the official standard.

Medicines which act in small doses are most conveniently administered in tinctures, as the proportion of alcohol in which they are dissolved is insufficient to produce an appreciable effect. Those which must be given in large doses should be cautiously employed in this form, lest the injury done by the menstruum should more than counterbalance their beneficial operation. This remark is particularly applicable to chronic cases, in which the use of tinctures is apt to lead to the formation of habits of intemperance. The tinctures of the weaker medicines are more frequently given as adjuvants of other remedies than with the view of obtaining their own full effects upon the system.

In the revision of the Pharmacopoeia of 1890, wherever practicable, the proportion of drug to finished tincture was made either 20, 15, 10, or 5 Gm. per 100 mils. Progressive pharmacy demands greater uniformity and simplicity in the processes, and hence in the U. S. P. VIII and IX practically all of the tinctures have been brought into two classes, 20 and 10 Gm. of drug per 100 mils. The potent tinctures, which contained mainly 15 Gm. of drug per 100 mils in the U. S. P. 1890, were reduced to 10 Gm. per 100 mils in order to comply with the recommendations of the Brussels Conference of 1902 for the unification of the strength of Potent Remedies.

A tabulated comparison of the tinctures of the P. G. IV and P. G. V as to

sp. gr., extractive percentage and alkaloidal content, is available for those to whom it would be of value in the Yearbook of the *A. Ph. A.*, 1913, p. 84.

Tinospora. *Br. Add. 1900.*—"The dried stem of *Tinospora cordifolia* Miera (Fam. *Menispermaceae*), collected in the hot season." *Br. Add., 1900.* *Tinospora* has long been used in India as a medicine and in the preparation of a starch known as *gilae-kasat* or as *palo*. It is said to be a tonic, antiperiodic, and a diuretic. Fluckiger obtained from it traces of an alkaloid and a bitter glucoside. *The Br. Add., 1900,* recognized an infusion (*Infusum Tinosporae* *Br. Add., 1900,* two ounces to the pint), dose one-half to one fluidounce (15-30 mils); a tincture (*Tinctura Tinosporae* *Br. Add., 1900,* four ounces to the pint), dose, one-half to one fluidrachm (1.8-3.75 mils); and a concentrated solution [*Liquor Tinosporae Concentratus* *Br. Add., 1900,* dose, one-half to one fluidrachm (1.8-3.75 mils)]. *Tinospora crispa* Miers, which is abundant in the Philippines, is used freely by the natives under the name of *makabuhay* (that is, "You may live"), as a panacea, especially valuable in *general debility*, in chronic *rheumatism*, and in *malarial fevers*. It may be prepared in the same way and given in the same doses as *Tinospora cordifolia*.

Tissa. *Tissa rubra* (L.) Brit. [now *Spergularia rubra* (L.) J. and C. Presl.], is a native of Malta, Sicily, and Algiers, and is found growing in dry, sandy soil from Quebec to Virginia. It has long been used as a popular remedy in diseases of the bladder. It was shown by F. Vigier (*J. P. C.*, 1879, ii, p. 371) to contain a resinous aromatic substance which is probably its active principle. It is strongly recommended by Bertherand in *calculous diseases* and acute and chronic *cystitis*. The aqueous extract may be given in doses of thirty grains (2.0 Gm.); or the fluidextract, dose, a fluidrachm (3.75 mils), three or four times a day.

Tobacco. *Tabacum.* *U. S. 1890.* *Nicotiana Tabacum* L.—The Virginia tobacco plant is an annual with a large, fibrous root, and an erect, round, hairy, viscid stem, which branches near the top, and rises from three to six feet in height. The leaves are numerous, alternate, sessile, and somewhat decurrent, very large, ovate-lanceolate, pointed, entire, slightly viscid, of a pale green color, and have a narcotic odor. The seeds, examined by F. M. Brandt, yielded no narcotic principle, though a protein-like substance contained in them was thought by its decomposition to produce nicotine. (*Neues, Jahrb. fur Pharm.*, xxi, 42.) William Procter also failed to find nicotine in the seeds, (*Proc. A. Ph. A.*, 1858, 296.)

There is good reason to believe that this plant is a native of tropical America, where it was found by the Spaniards upon their arrival. It is at present cultivated in most parts of the world, and nowhere more abundantly than within the limits of the United States. Virginia is, perhaps, the region most celebrated for its culture. The young shoots, produced from seeds thickly sown in beds, are transplanted into the fields during the month of May, and set in rows with an interval of three or four feet between the plants. Through the whole period of its growth the crop requires constant attention. The development of the leaves is promoted by removing the top of each plant and thus preventing it from running into flower and seed. The harvest is in

August. The ripe plants, having been cut off above their roots, are dried under cover, and then stripped of their leaves, which are tied in bundles and packed in hogsheads. While hung up in the drying houses, they undergo a curing process, consisting in exposure to a considerable degree of heat, through which they become moist, or, in other words, are said to sweat, after which they are dried for packing.

Other species also of *Nicotiana* are said to be cultivated, especially *N. rustica* L., which yields the Turkish tobacco and is said to have been the first introduced into Europe, and is thought to have been cultivated by the aborigines of this country, as it is naturalized near the borders of some of our small Northern lakes. The *N. quadrivalvis* of Pursh affords tobacco to the Indians of the Missouri and Columbia Rivers; and *N. fruti-cosa*, a native of China, was probably cultivated in Asia before the discovery of this continent by Columbus. Besides these there are *N. Persica* L., cultivated in Persia, and is the source of Persian tobacco; *N. repanda* Willd., cultivated in Central and Southern North America; *N. Bigelovii* Wats., of North America. It is very doubtful, however, whether these plants furnish any large part of the commercial tobacco. Latakia tobacco seems to be the product of the *N. Tabacum*, and Senator Vidal asserts that *N. repanda* is not found in Cuba, *N. Tabacum* being the only species there cultivated. (*P. J.*, viii, 710.) Again, the Persian and Turkish tobacco sold under the name of *tumbeki*, which has been variously attributed to *N. Persica* and to *N. rustica*, is in all probability the product of *N. Tabacum*. [*Kew Bulletin*, April, 1891.]

The total annual production of tobacco throughout the world at present is estimated at 1,000,000 tons, of which Asia furnishes 350,000, America 300,000, Europe 250,000, and the rest of the world 100,000 tons. (*Zeit. fur Angew. Chem.*, 1905, p. 1623.)

Tobacco, as it occurs in commerce, is of a yellowish-brown color, a strong narcotic penetrating odor which is wanting in the fresh leaves, and a bitter, nauseous, and acrid taste. These properties are imparted to water and alcohol. They are injured by long boiling, and the extract is, therefore, relatively feeble. An elaborate analysis of tobacco was made by Vauquelin, who discovered in it among other ingredients, an acrid, volatile, colorless liquid, slightly soluble in water, very soluble in alcohol, and supposed to be the active principle. It was separated by a complicated process, of which, however, the most important step was the distillation of tobacco juice with potassium hydroxide. In the results of this distillation Vauquelin recognized alkaline properties, which he ascribed to ammonia, but which were, in part at least, dependent upon the acrid principle above mentioned. To this principle the name of nicotine was given; but its alkalinity was ascertained by two German chemists, Posselt and Reimann. The nicotine obtained by Vauquelin and by Posselt and Reimann was a colorless, volatile liquid, and, as subsequently ascertained by Henry and Boutron, was in fact an aqueous solution of the alkaline principle in connection with ammonia. It was reserved for these chemists to obtain nicotine in a state of purity. It exists in tobacco combined with an acid in excess, and in this state is not volatile. It is easily extracted from tobacco by means of alcohol or water as a malate, from which the alkaloid can be separated by shaking it with caustic soda solution and ether. The ether is then expelled by warming the liquid, which finally has to be mixed with slaked

lime and distilled in a stream of hydrogen, when the nicotine begins to come over at about 200° C. (392° P.). The percentage of nicotine in tobacco varies considerably—from 1.62 per cent. in Havana tobacco and 2 per cent. in Maryland tobacco to 6 per cent. in Virginia tobacco and 8 per cent. in Kentucky tobacco. For a mode of estimating the proportion of nicotine in tobacco, see Harrison and Self, *P. J.*, June 1, 1912. For an analysis of the ashes of Virginia tobacco, by McD. Irby, of New Orleans, and J. A. Cabell, of Virginia, see *Chem. News* (Sept. 4, 1874, 117). For Liecke's and Schloessing's methods of estimating nicotine, see 17th edition, *U. S. D.*, p. 1346. For Kosutany's method, see *Z. An. Chem.*, 1893, 277.

Nicotine. (*Nicotina* or *Nicotia*.) β -pyridyl-*a-n*-methyl-pymolidine.—This is a colorless or nearly colorless fluid, of the sp. gr. 1.027, boiling at 247° C. (476.6° F.), and not solidifying at -10° C. (14° F.) ; having a faint odor when cold; of an exceedingly acrid, burning taste, even when largely diluted; entirely volatilizable, and, in the state of vapor, very irritant to the nostrils, with an odor recalling that of tobacco; inflammable; very soluble in water, alcohol, ether, the fixed oils, and oil of turpentine; strongly alkaline in its reaction, and capable of forming crystallizable salts with the acids. These salts are deliquescent, having a burning and acrid taste, and, like the salts of ammonia, lose a portion of their base by heat. While nicotine has not been prepared synthetically as yet, two isomeric bases, *isonicotine* and *nicotidine*, have been prepared. On treatment with oxidizing agents, nicotine yields *nicotinic* or β -pyridinecarboxylic acid, $C_5H_4N.COOH$. In its action on the animal system it is one of the most virulent poisons known. A drop of it, in the state of concentrated solution, is sufficient to destroy a dog, and small birds perish at the approach of a tube containing it. Tannin forms with it a compound of but slight solubility, and might be employed as an antidote. Nicotine exists in tobacco in small proportion; it has been found in the seeds, and, in very small proportion, in the root. There can be little doubt that tobacco owes its activity to this alkaloid, which has also been criminally employed as a poison. (*N. Y. Jour. of Med.*, N. S., ix.) Nicotine has the remarkable property of resisting decomposition amid the decaying tissues of the body, and was detected by Orfila in the bodies of animals destroyed by it two or three months after their death. Mayor concluded from his experiments that nicotine is the active principle in all parts of the plant both before and after curing. (*Proc. A. Ph. A.*, 1865.)

Although Thorns (*A. J. P.*, 1900, p. 227) was unable to detect any nicotine in tobacco smoke, there is no room for doubt that it is present in sufficient amount to be injurious. Lehmann (*P. J.*, Sept. 18, 1909) finds that about 95 per cent. of the nicotine in tobacco passes over into the smoke, and Toth (*Chem. Ztg.*, 1909, p. 866) has shown that the large proportion of nicotine exists in the smoke in uncombined state.

When distilled at a temperature above that of boiling water, tobacco affords an empyreumatic oil, which Brodie proved to be a most virulent poison. It was official in the U. S. P., 1870, under the name of *Oleum Tabaci: Oil of Tobacco*. A single drop, injected into the rectum of a cat, occasioned death in about five minutes, and double the quantity, administered in the same manner to a dog, was followed by the same result. This oil is of a dark brown color and an acrid taste, and has a very disagreeable odor exactly resembling that of tobacco pipes which have been much used. It has

been stated to contain nicotine. (*Ann. Ch. Phys.*, 3e ser., ix, 465.)

It is quite certain that tobacco leaves undergo considerable chemical changes during the processes of curing and preparation for use. Thus, the characteristic odor of ordinary tobacco is entirely different from that of the fresh leaves, and must be owing to the generation of a new volatile principle. The proportion of nicotine is probably slightly diminished by the process of "curing." (See Mayer, *Proc. A. Ph. A.*, 1865.)

Medicinal Properties and Uses.—Tobacco is locally irritant. Snuffed up the nostrils, it excites violent sneezing, and a copious secretion of mucus; chewed, it irritates the mucous membrane of the mouth and increases the flow of saliva; when injected into the rectum, it sometimes operates as a cathartic; and the alkaloid nicotine injected into the cellular tissue of animals evidently produces much pain. In large doses, or in persons unaccustomed to it, tobacco produces severe nausea, sometimes vomiting, accompanied with profuse perspiration, and great muscular weakness. The alkaloid nicotine is a virulent poison. It primarily excites, and secondarily paralyzes, the ganglia upon the sympathetic nerves, stimulates the intestinal muscles, and, in sufficient quantities, has a paralytic action upon the motor nerves. As a result of its action upon the sympathetic ganglia, it causes contraction of the blood-vessels with marked increase in the blood pressure, followed, after large doses, with vascular dilatation and fall, of pressure. The pulse rate is at first decreased, later becomes rapid. There is primary increase in the secretion of the salivary and probably of the other glands, followed, after large doses, by paralysis of secretions.

The use of tobacco was adopted by the Spaniards from the American Indians. In the year 1560 it was introduced into France by the ambassador of that country at the court of Lisbon, whose name—Nicot—has been perpetuated in the generic title of the plant. Sir Walter Raleigh is said to have introduced the practice of smoking into England. In the various modes of smoking, chewing, and snuffing, the drug is now largely consumed in every country on the globe. It must have properties peculiarly adapted to the propensities of our nature to have thus surmounted the first repugnance to its odor and taste and to have become the passion of so many millions. Whether or not nicotine plays any part in the pleasurable effects of tobacco is, despite considerable research and discussion, unsettled, but it is generally agreed that the evil effects of excessive indulgence are due to this alkaloid. The most important disturbances produced are in the digestive and circulatory organs. As a result of the disturbed innervation of the heart, palpitation and cardiac irregularities are common, and the vascular contraction is generally regarded as one of the causes of arterial degenerations.

Formerly much used as a relaxant, tobacco has been superseded by safer and more efficacious remedies, so that it is at present never employed in medicine, except occasionally in *chronic asthma*. It should always be borne in mind that its active principle is absorbed readily by the skin, and that serious or even fatal poisoning may result from its too free application to the surface of the body. A case of death is on record, occurring in a child eight years old, in consequence of the application of the expressed juice of the leaves to the head, for the cure of *tinea capitis*. Death has also been produced by the inhalation of the smoke.

From five to six grains (0.32-0.4 Gm.) of powdered tobacco will generally act as an emetic; but should never be used for this purpose.

Toddalia. *Br. Add. 1900.*—"The dried root-bark of *Toddalia aculeata* Lam." (Fam. *Rutaceae*.) This climbing shrub, known also as *Lopez root*, growing in East Africa, Madagascar, the subtropical Himalayas, Ceylon, and the Philippines, is a tonic stomachic, containing a resin and a volatile oil, which may be readily obtained from the leaves by distillation. This oil has the odor of citron peel, and a bitter, aromatic taste. See also *Schim. Rep.*, 1906, 82, and 1912, 121. The British Addendum recognized an infusion (*Infusum Toddaliae*, two ounces to a pint), dose, one to two fluidounces (30-60 mils); also a concentrated solution (*Liquor Toddaliae Concentratus*, *Br. Add.*, 1900), dose, from one-half to one fluidrachm (1.8-3.75 mils).

Tonga.—*Tonga Bark* is a composition of unknown barks compounded by the natives of the Feejee Islands for medicinal purposes. The plants from which this remedy is derived are believed to be *Premna taitensis* Schan. (Fam. *Verbenaceae*), and *Epipremnum mirabile* Schott. (Fam. *Araceae*.) According to Moeller (*Ph. Centr.*), the latter is not a source of tonga. (*A. J. P.*, 1881, 439.) It was introduced to the notice of the medical profession by Sydney Ringer and Wm. Murrell, of London, as a remedy for neuralgia. (*L. L.*, ii, 1880.) Merck reports the presence of tongine and a volatile oil in tonga. (*Merck's Index*, 1907.) The natives are said to steep the bundle as prepared by them for twenty minutes in half a tumberful of cold water, and then, squeezing it dry, drink the infusion, preserving the bundle in a dry place for further use. A fluidextract has been put upon the market, and evidence of its value brought forward, but we have known a fluidrachm of this extract to be given every two hours for two days without obvious effect; the dose usually recommended is half a fluidrachm (1.8 mils).

Tonka Bean. *Feve Tonka*, Fr. *Tonka-bohnen*, G.—The seeds of *Coumarouna odorata* of Aublet, a large tree growing in Guiana and Northern Brazil which yields the Dutch Tonka Bean; and of *C. appositifolia* (Aubl.) Tanb, which is the source of the English tonka bean. The fruit is an oblong-ovate pod, enclosing a single seed, from 3 to 4 cm. long and about 1 cm. wide, usually somewhat compressed, with a dark brown, wrinkled, shining, thin, and brittle skin, and a light brown, oily kernel. The seed has a strong, agreeable, aromatic odor, and a bitterish, aromatic taste. Its active constituent is a crystallizable, odorous substance, called *coumarin* or *cumarin*, $C_9H_6O_2$. It is the anhydride of *coumaric acid*, $C_9H_8O_2$. It is capable of sublimation; but, to obtain it in crystals in this way, a low temperature is necessary. (Waddington, *P. J.*, 1868, 410.) This substance is sometimes found in a crystalline state, between the two lobes of the kernel. Coumarin appears to be a widely spread substance which has been found in many species of plants, notably in species of *Melilotus* (fam. *Leguminosae*), sweet vernal grass (*Anthoxanthum odoratum* L.), and related grasses, and *Trilisa odoratissima* (Walt.), Cass. (*Liatris odoratissima* Willd.) (fam. *Compositae*), a plant sometimes used to protect woollens from moths. (*A. J. P.*, 1859, 556; also 1899, 133; see also *Chem. Gaz.*, 1852; *D. C.*, Nov., 1887.) Gossmann obtains coumarin in the following manner. The beans, cut finely, are heated for a long time with an equal bulk of alcohol of specific gravity 0.863, nearly to boiling, and, the

tincture being decanted, the residue is treated in the same manner. The tinctures are mixed, the alcohol distilled off until turbidness appears, when four times the bulk of water is added, which precipitates coumarin and fatty matter. The precipitate is then heated to boiling, and the liquid passed through a moistened filter. The fatty matter remains on the filter, and the hot solution which passes deposits the coumarin on cooling. More may be obtained by concentrating the liquid, and may be purified by animal charcoal. One pound of the beans yielded 108 grains of coumarin. Coumarin has been prepared synthetically by heating salicylic aldehyde with sodium acetate and acetic anhydride, whereby *acetocoumaric acid* is formed, which decomposes further into acetic acid and coumarin. It has also been obtained by the action of phenol upon the malic acid. Tonka bean is used to adulterate tincture and extract of vanilla and to flavor snuff, being either mixed with it in the state of powder or put entire into the snuff box. Coumarin adulterated with acetanilid has been found in the market. (*Schim. Rep.*, 1893, 67.) *Tonquinbutter* is an article of commerce in Holland. It is the fatty substance of tonka beans; it was analyzed by M. Duyk, it has the sp. gr. of 0.888, melting point is 28° C. (82.4° F.), saponification number 25.7. (*Rep. de Pharm.*, 1908.)

Ellinger (*A. E. P. P.*, 1908, Suppl.) found the fatal dose of coumarin for the rabbit to be 0.3 Gm. per kilo. He confirmed the statement of Kohler (*Cb. M. W.*, 18.75) that it acted as a narcotic, but could not find evidence of cardiac depression. The fluid extract of the bean has been used with asserted advantage in *whooping cough* in doses equivalent to from five to eight grains (0.32-0.5 Gm.) for children five years old. (*A. J. P.*, 1869, 27.)

Tormentil. *Rhizoma Tormentillae*, P. G. *Tormentille*, Fr. *Tormentillwurzel*, G. *Tormentilla*, It. *Tormentila*, Sp.—Various species of the rosaceous genus *Potentilla* have been employed in medicine. (See *A. J. P.*, 1875, 109.) It is asserted that our common *P. canadensis* L. is a valuable sudorific and diuretic.

Potentilla Tormentilla Neck. (*Tormentilla erecta* L., *T. officinalis* Curt.)—The tormentil, or *septfoil*, which was formerly in the Secondary List of the U. S. Pharmacopoeia, is a small perennial plant of Europe and Asia. All parts of the plant are astringent, especially the rhizome, which is the part employed. The rhizome of *tormentil* is cylindrical, somewhat fusiform, branching and more or less curved, from 2.5 to 8 cm. long, and from 0.5 to 1.5 cm. thick, brown or blackish externally, and reddish within. It has a slight aromatic odor and a very astringent taste. It contains a red coloring principle, soluble in alcohol, but insoluble in water, and considerable quantities of a peculiar tannin (*tormentil-tannic acid*, $C_{26}H_{22}O_{11}$). Rembold found that tormentilla red has the same composition as rhatany red, and yields the same products of decomposition when fused with potassium hydroxide. He also obtained *kinovic acid*, $C_{24}H_{38}O_4$, and small quantities of *ellagic acid*, $C_{14}H_6O_8$. (*A. J. P.*, 1868, 311; from *Ann. Chem.*, cxliv, 5.) The root is said to be used for tanning leather in the Orkneys and Western Islands of Scotland, and for staining leather red by the Laplanders. Tormentil is a simple and powerful astringent, applicable to all cases of disease in which this class of medicines is indicated. It may be given in substance, decoction, or extract. The dose of the powder is from thirty grains to a drachm (2.0-3.9

Gm.).

Toxicodendron Capense Thunb. (Fam. *Eurphorbiaceae*).—The fruits of this South African species are said to be used for the poisoning of hyenas. They have been investigated by von Engelhardt (*Kobert's Arbeiten*, 1892), who finds in them a neutral, bitter principle, *hyananchin*, which is a powerful poison, resembling strychnine in its physiological action, from which, however, it differs in that it powerfully affects, the cerebrum. The convulsions which it produces are of central origin, the poison having no action upon the nerve trunks or the muscles.

Toxylon. *Maclura pomifera* (Raf.) Schneider. (*Maclura aurantiaca* Nutt.) (Fam. *Moraceae*.) *Osage Orange*.—The bark of the root of this tree, which is indigenous in the Southern United States, is said to be considerably used in making a yellow dye. Alex. King has found in it *morice* and *moritannic acids*. (*A. J. P.*, xlvii, 257.)

Tradescantia Erecta Jacq. (Now *Tinantia fugax* Scheidw.) (Fam. *Commelinaceae*.)—The natives of South America used an extract of this plant as a haemostatic in cock-fights and it has lately been introduced into medicine, being especially recommended in hemorrhages of the ear and the upper air passages. Nothing definite is known of its actual composition and its styptic virtue has been ascribed, by some, to its tannin content. For description of *Commelina communis*, a perennial herb of the United States, see Preston, *A. J. P.*, 1808, p. 321.

TRAGACANTHA. U. S., Br.

TRAGACANTH Trag. [Gum Tragacanth]

"The spontaneously dried gummy exudation from the stems of *Astragalus gummifer* Labillardiere, or from other Asiatic species of *Astragalus* (Fam. *Leguminosae*)." *U. S.* "Tragacanth is a gummy exudation obtained by incision from *Astragalus gummifer*, Labill., and some other species of *Astragalus*. Known in commerce as Syrian tragacanth." *Br.*

Gummi Tragacantha vel Astragalorum; Gomme Adragante, *Fr. Cod.*; Tragacantha, *P. G.*; Tragant, Traganth, *G.*; Gomma adragante, Dragante, *It.*; Gomo tragacanto, *Sp.*

Numerous species belonging to this genus yield a gummy matter having the properties of *tragacanth*. The drug known in commerce by that name was at first erroneously supposed to be obtained from *A. Tragacantha* of Linnaeus (*A. massiliensis* of Lamarck), which grows in Southern Europe and Northern Africa and is now said to yield no gum. It was afterwards ascribed, on the authority of Tournefort, to a species (*A. creticus* of Lamarck) which grows in Crete and Ionia, and on that of

Olivier, to *A. verus*, which inhabits Asia Minor, Armenia, and Northern Persia. Labillardiere described a species by the name of *A. gummifer* which he found growing on Mount Libanus in Syria, and from which tragacanth exudes, though not that of commerce. Only recently it has been denied that *Astragalus gummifer* is the source of tragacanth. (*Cons. and Tr. Rep.*, 1910, p. 728.)

Sieber denies that any of the above-mentioned species yields the official tragacanth, which he ascribes to *A. aristatus*, growing in Anatolia, especially upon Mount Ida, where the gum is most abundantly collected. This plant, however, is not the *A. aristatus* of Villars, which, according to Sibthorp, furnishes tragacanth in Greece. (Merat and De Lens.) Lindley received two specimens of plants, said to be those which furnish tragacanth in Turkestan, one of which proved to be *A. gummifer* of Labillardiere which was said to yield a white variety, and the other a new species, which he called *A. strobiliferus*, and which was said to yield a red and inferior product. The fact seems to be that the commercial drug is collected from various sources; and it is affirmed that all the species of *Astragalus* with thorny petioles are capable of producing it. These form a natural group, and so closely resemble one another that botanists have found some difficulty in distinguishing them. They are very abundant on the mountains of Asia Minor, and, according to information received by M. J. Leon Soubeiran from Balansa, a scientific traveller who derived his knowledge from personal observation, the gum-producing species are closely analogous to the *A. creticus* of Lamarck. It is in the Anti-Taurus range that the gum is chiefly collected. Transverse incisions are made, near the base of the stem, into the medullary tissues, which alone yield the gum. This exudes very slowly, flowing at night, and ceasing during the day; two weeks usually elapse before the pieces are large enough for collection. The shape of the pieces is influenced by the rapidity of the exudation, and the lines on their surface indicate the daily concretion. The section *Tragacantha* of the genus *Astragalus* includes the principal species which yield gum tragacanth.

According to Haussknecht, tragacanth is yielded by the following species of *Astragalus*: *A. adscendens* Boiss. et Hausskn. (Southern Persia); *A. leioclados* Boiss. (in Middle and Western Persia, by Ispahan and Hamadan); *A. brachycalyx* Fisch. (Kurdistan and Luristan); *A. gummifer* Labill. (widely distributed from Lebanon to Armenia and in the northern regions of the Euphrates and Tigris); *A. microcephalus*

Willd. (the same as *A. gummifer* Labill., and also in Asia Minor); *A. pycnocladus* Boiss. et Hausskn. (particularly in Western Persia); *A. stromatodes* Bge. (in Achyr Dagh, in Northern Syria); *A. kurdicus* Boiss. (Aintab). Other species that yield a tragacanth gum are *A. heratensis* Bge., of the Khorasan Mountains, which yields a gum known as "kutira," and *A. Parnassi* Boiss., var. *cyllenea*, found on the mountains of Peloponnesus.

Harris states that the best Smyrna tragacanth is produced in Asia Minor. It is not, however, collected in the immediate vicinity of Smyrna, but comes from Karahissar, Jalowadsch, and even farther in the interior, where the plant grows wild. This kind of gum consists of white, yellow, and red, hardened pieces, which have become congealed after oozing out of the bush or tree in the hot sun of a Levantine summer. The gum is secured in a similar manner as opium by an incision in the branch. This is done in the spring and summer of each year, and the gum is usually scraped in September, when the first rains begin to fall. During the last twenty years the gum tragacanth trade of Smyrna has decreased. It has been estimated that the trade has fallen from 600,000 pounds to 55,000 pounds in that length of time. (*Oil, Paint and Drug Reporter*, lxxiii, p. 633.)

Properties.—Tragacanth is odorless and nearly tasteless. It occurs either in flaky, leaf-like pieces, irregularly oblong or roundish, or in tortuous vermicular filaments, rounded or flattened, rolled up or extended, of a whitish, yellowish-white, or slightly reddish color, marked by parallel lines or ridges, somewhat translucent, and resembling horn in appearance. In commerce certain varieties of tragacanth are recognized and usually known by the name of the locality from which they have been produced or through which they have entered commerce. The ordinary tragacanth, tragacanth in sorts, sometimes known as traganton, occurs in irregular pieces; Smyrna tragacanth appears usually in broad thick flakes, yellowish or brownish; Syrian tragacanth, in thin, ribbon-like, white flakes, is said really to be obtained in Kurdistan and Persia. Tragacanth is officially described as <(in flattened, lamellated fragments varying from ribbon-shaped bands to long and linear pieces, which may be either straight or spirally twisted, and from 0.5 to 2.5 mm. in thickness; whitish to light brown in color, translucent and horny; fracture short; rendered more easily pulverizable by heating to 50° C. (122° F.); inodorous; taste insipid, mucilaginous. Under the microscope, sections made from Tragacanth,

previously softened in water, and mounted in glycerin, show the lamellae of mucilaginous walls and a few starch grains, the latter being mostly spherical and single, occasionally 2- to 3-compound, the individual grains from 0.003 to 0.025 mm. in diameter and colored blue with iodine. Indian Gum, derived from plants of uncertain origin, upon similar treatment and examination, shows numerous threads of a granular substance, sometimes the hyphae of a fungus and chains of bacteria, and occasional fragments of a yellowish-brown or reddish-brown color, containing lignified wood-fibers, a few rosette aggregates of calcium oxalate, from 0.02 to 0.03 mm. in diameter, and a few spherical starch grains, from 0.003 to 0.007 mm. in diameter. Add 1 Gm. of Tragacanth to 50 mls of distilled water; it swells and forms a smooth, nearly uniform, stiff, opalescent mucilage free from cellular fragments. Indian Gum upon similar treatment forms an uneven mucilage containing a few reddish-brown fragments, and on stirring separates in the form of coarse, uneven strings. Shake 2 Gm. of Tragacanth with 100 mls of water until fully swollen and free from lumps, and then add 2 Gm. of powdered sodium borate and shake the mixture thoroughly until the salt is dissolved; the mucilage does not lose its transparency, nor exhibit any change in consistence, and on pouring is . not slimy or stringy, even after standing twenty-four hours (foreign gums). Boil 1 Gm. of Tragacanth with 20 mls of water until a mucilage is formed, then add 5 mls of hydrochloric acid and again boil the mixture for five minutes; it develops no pink or red color (Indian Gum). The powder is whitish; forming with water a translucent mucilage and under the microscope exhibiting numerous starch grains, from 0.003 to 0.025 mm. in diameter, varying from spherical to elliptical, -with occasional 2-to 4-compound grains, many of the grains being swollen and more or less altered, due to the drying of the Tragacanth before powdering. Powdered Indian Gum shows numerous fragments of lignified vegetable tissue. Tragacanth yields not more than 3.5 per cent. of ash." U. S.

"Thin flattened flakes, irregularly oblong, or more or less curved, marked on the surface by concentric ridges. Frequently two and a half centimetres long, and twelve millimetres wide. White or pale yellowish-white, somewhat translucent. Horny, fracture short. Inodorous; almost tasteless. Sparingly soluble in water, but swelling into a gelatinous mass, which may be tinged violet or blue by N/10 solution of iodine. Ash not more than 4 per cent." Br.

It is hard and more or less fragile, but difficult of pulverization, unless

exposed to a freezing temperature, or thoroughly dried, and powdered in a heated mortar at the temperature of 50° C. (122° F.). Its sp. gr. is 1.384. Introduced into water, it absorbs a certain proportion of that liquid, swells very much, and forms a soft adhesive paste, but does not dissolve. If agitated with an additional quantity of water, this paste forms a uniform mixture; but in the course of one or two days the greater part separates, and is deposited, leaving a portion dissolved in the supernatant fluid. Tragacanth is wholly insoluble in alcohol. It appears to be composed of two different constituents, one soluble in water and resembling gum arable, the other swelling in water, but not dissolving. To separate the soluble from the insoluble part requires agitation with separate portions of water; the solutions are to be decanted and filtered, and the process is to be continued until water ceases to dissolve anything.

Von Sandersleben reported the discovery that when heated with dilute acids tragacanth acquired reducing properties, and formed, along with much syrup, *arabinose*, which crystallized. (*Tollens, Handbuch der Kohlenhydrate*, 1888, 218.) The explanation of this observation, now generally accepted, is that in tragacanth, like some other gums, part of the arable acid is present in soluble form, mostly combined with bases, while another part is present in insoluble form, and is known as *traganthin*. This latter, however, under the influence of certain enzymes, is converted into the soluble form. (Lippmann, *Chemie der Zuckerarten*, 2te Auf., 1895, 925.) C. O'Sullivan states that tragacanth consists of cellulose, the portion insoluble in boiling water, cold dilute acids, and alkalies; also *soluble gum*, yielding a series of gum acids of the nature of *geddic acid*, and which are called *polyarabinon-trigalactan-geddic acids*; starch granules; *bas-sorin*, which yields *atragacanthan-xylan-bassoric acid*, *xylan-bassoric acid* and *bassoric acid*. (*Proc. Chem. Soc.*, 1901.) Examined by Kiitzing by means of the microscope, tragacanth was found to consist of organized cells. (See A. J. P., xxv, 37.) In conformity with this statement is the remarkable fact, discovered by Hugo von Mohl and confirmed by Wigand, that tragacanth is not a secretion of the plant, but the result of the transformation of the cells of the pith and those of the medullary rays which traverse the ligneous part of the stem and older branches. (A. J. P., xxxi, 243.)

It is stated by S. H. Maltass that tragacanth is adulterated, in the Levant, with worthless gums brought from Armenia and Caramania,

which, as they are originally of a dark color and destitute of the flaky form of the genuine gum, are broken into small fragments and whitened by means of lead carbonate before being mixed with the tragacanth. Hanbury states, in confirmation of this, that he has detected lead in the *small tragacanth* imported into London. (*P. J.*, xv, 20.) Gum tragacanth has been recently admixed with and substituted by Indian gum, the product of *Cohlospermum gossypium* (Fam. *Bixaceae*). This occurs in vermiform or rounded tears having a dull, rough surface. It is detected by the official tests. The powdered drug is not only adulterated with the Indian gum, but with powdered acacia, dextrin, wheat and comstarch. Payet gives a test for the detection of acacia in powdered tragacanth which depends on the brown color produced by the oxidase of the former when brought in contact with an aqueous solution of guaiacol in the presence of hydrogen dioxide. (*Ann. de Chim. Analyt.*, x, p. 63.)

Uses.—Tragacanth is demulcent, but, on account of its difficult solubility, is not often given internally. The great viscosity which it imparts to water renders it useful for the suspension of heavy insoluble powders, and it is also employed in pharmacy to impart consistence to troches, for which it answers better than does gum arable, and in making emulsions, although for these purposes it is inferior to acacia. It is also used for its demulcent action in *pharyngitis* by allowing a piece of the gum to dissolve slowly in the mouth. It is officially employed as the basis of many of the troches.

Off. Prep.—Glycerinum Tragacanthas, *Br.*; Mucilago Tragacanthae, *U. S.*, *Br.*; Pulvis Tragacanthae Compositus, *Br.*; Glyceritum Tragacanthas, *N. F.*

Trifolium. *N. F. IV, Red Clover Blossoms.*— " The dried inflorescence of *Trifolium pratense* Linne (Fam. *Leguminosae*). " *N. F.* It is described in the *N. F.* as " Heads are ovoid with rounded summit, mostly from 12' to 25 mm. in length and breadth, shriveled, purplish and more or less brown from drying, consisting of many small papilionaceous flowers, crowded together and clothed at the base with broad, pointed, ciliate stipules of a pale green color with darker veins and which may or may not be accompanied by diminutive trifoliate leaves. The individual flowers are from 12 to 15 mm. in length, longer than the four nearly equal teeth and shorter than the narrower fifth tooth, calyx-teeth subulate, tapering; petals united into a tube below, the standard longer than the wings, but when recurved appearing shorter; stamens diadelphous (nine and one) ; style slender. The odor is faintly aromatic and somewhat tea-like, the taste being sweetish, then slightly bitter. *Trifolium* yields not more than 10 per cent. of ash."

Red clover blossoms were introduced into the N. F. IV and are used to make the fluidextract. For the results of a research of the constituents of *T. pratense* by Power and Solvay, see *C. D.*, 1910, 273. Clover has, by the superstitious, been supposed to possess alterative properties. It also enters into the composition of some antiasthmatic cigarettes. There is, however, no sufficient reason to suspect it of any medicinal virtue.

Trigonella. *Greek Hay Seed. T. Foenumgraecum* L. *Fenugreek. Semen Foenugraeci*, P. G. *Bockshornsamen*, G.—A European annual leguminous plant cultivated in southern Europe, Northern Africa and India for its seeds. These are oblong-cylindrical, somewhat compressed, obliquely truncated at each extremity, 3 to 5 mm. in length, brownish yellow externally, internally yellow and marked with an oblique furrow running half their length. They have a strong peculiar odor resembling that of elm bark, and an oily, bitterish, farinaceous taste, and contain fixed and volatile oils, mucilage, bitter extractive and a yellow coloring substance. E. Jahns (*Ber. d. Chem. Ges.*, xviii, 2518-2523) has obtained *choline*, $C_5H_{15}NO_2$, and trigonelline, $C_7H_7NO_2$. The yield of the former was 0.05 per cent., and of the latter 0.13 per cent. Trigonelline is isomeric and probably identical with pyridine-betaine. By heating trigonelline with concentrated solution of potassium hydroxide, a distillate is obtained which appears to contain pyridine. An ounce of the seeds, boiled in a pint of water, renders it thick and slimy. They yield the whole of their odor and taste to alcohol. On the continent of Europe they are employed in the preparation of emollient cataplasms, enemata, ointments and plasters. They are never used internally for human beings, but the ground seeds are used to an enormous extent in the manufacture of cattle powders or condition powders and to give a maple flavor to confectionery.

Trillium. *N. F. IV. Beth Root. Birth Root. Wake Root. Trillium*, Fr., G.—"The dried rhizomes of *Trillium erectum* Linne and closely allied species of *Trillium* (Fam. *Liliaceae*)."
N. F.

It is described in the N. F. as follows: "Rhizome oblique, globular, oblong or obconical, truncate, below, terminated by a small bud surrounded by a sheath of scarious leaf bases, annulated by leaf scars and fissured by stem scars. It is from 0.6 to 5 cm. in length and from 0.6 to 2.5 cm. in width, more or less compressed laterally, rootlet scars in several concentric rows on the under side in the upper portions. Externally yellowish to reddish-brown; internally of a pale yellow; fracture somewhat uneven with a more or less spongy appearance. Odor distinct; taste bitter and acrid with a sensation of warmth in the throat and when chewed causing an increased flow of saliva. *Trillium* yields not more than 5 per cent. of ash."

The indigenous species, *T. erectum* L. is said to have been employed by the aborigines, and also used by the early settlers; it still has some vogue under the name of *beth root* as an astringent and tonic expectorant; also in *hemorrhages* and to hasten *parturition* and as a local irritant in *skin diseases*. Dose, of powdered root, a drachm (3.9 Gm.) three times a day. E. S. Wayne found in it a substance supposed to be saponin. It is said also to contain volatile oil and tannic acid. D. J. Prendergast believes that the

Trillium erectum contains a glucoside similar to convallamarin. (*Am. Drug.*, Nov., 1887.) For details, see 16th edition, *U. S. D.* Vivian I. Reid (*A. J. P.*, 1892, 67) found a small quantity of fixed oil, saponin to the extent of 4.86 per cent. and an acid crystalline principle which is colored purplish-brown by sulphuric acid and light green with sulphuric acid and potassium dichromate.

This rhizome was introduced into the N. F. IV to use in the preparation of the *fluidextract of trillium* with three volumes of alcohol and one volume of water. The fluidextract is an ingredient in *compound elixir of viburnum opulus*.

Triosteum. *T. perfoliatum* L. *Horse Gentian. Bastard Ipecac. Tinker's Weed. Wild Coffee. Fever Root. Feverzvort. Wild Ipecac. Racine de Trieste*, Fr. *Dreisteinwursel*, G. (Fam. *Caprifoliaceae*.)—This plant is found in rich woods from Massachusetts to Alabama and westward to Nebraska, preferring a limestone soil and shady situations. The rhizome or root, the part used, is horizontal, long, 'about 15 mm. in diameter, thicker and tuberculated near the origin of the stem, of a yellowish or brownish color externally, whitish within, and furnished with fibers which may be considered as branches of the main root. When dry it is brittle and easily pulverized. On microscopic examination, numerous crystals of calcium oxalate are to be seen. It has a sickening odor, and a bitter, nauseous taste. It is said to contain an alkaloid which Andree believed to be identical with emetine, but which Hartwich has shown to be different. It yields its active properties to both water and alcohol. *Triosteum* is cathartic, and in large doses emetic and perhaps diuretic. The bark of the root may be given in doses of twenty to thirty grains (1.3-2.0 Gm.), or the extract in half the quantity. For uses, see *A. J. P.*, 1891, 326.

TRITICUM. U. S. (Br.)

TRITICUM Tritic. [Couch Grass Dog Grass]

"The dried rhizome and roots of *Agropyron repens* (Linne) Beauvois (Fam. *Gramineae*), gathered in the spring." *U. S.* "Couch Grass is the dried rhizome of *Agropyron repens*, Beauv., freed from remains of leaves and rootlets." *Br.*

Agropyrum, *Br.*; *Rhizoma Graminia*; *Radix Graminis*; Quick-grass, Quitch, Scotch-grass, Twitch-grass, Witch-grass, Quickens; *Chiendent officinal ou Petit chiendent*, *Fr. Cod*; *Queckenwurz*el, *Grasswurz*el, *G.*; *Grana* (*Rizoma de*), *Sp.*

This grass, originally a native of Europe, now abounds in meadows and cultivated grounds in the Northern United States, where it is often very troublesome as a weed. It is specifically characterized by its creeping rootstock, the leaves being flat, thin and finely veined, and the flowering glumes being glabrous or scabrous. It is probable that the rhizome of a number of other grasses share the medicinal properties of

Agropyron repens. Of these the Scotch or Bermuda grass, *Capriola Dactylon* (L.) Kuntze, is probably as effective as the official species.

Much spurious triticum has appeared upon the market recently. Most of it can be readily distinguished from the official drug by the presence of starch in the spurious article.

Properties.—Triticum is officially described as follows: "Usually in pieces from 4 to 12 mm. in length and from 1 to 2.5 mm. in diameter; externally light yellow or yellowish-brown, longitudinally furrowed, smooth, lustrous, nodes with circular leaf-scars, a few root-scars and occasional slender roots; fracture tough, fibrous; internally lemon-yellow and with a large, hollow pith; odor slight, aromatic; taste sweetish. Roots filiform, irregularly branching, attaining a length of about 5 cm. and not more than 0.5 mm. in thickness, light brown or yellowish-brown, frequently covered with long root hairs. Under the microscope, transverse sections of Triticum show a single layer of strongly lignified epidermal cells; a hypodermis of from 3 to 6 rows of more or less polygonal cells with strongly lignified walls; a cortex of from 10 to 16 rows of thin-walled parenchyma cells, occasionally with nearly spherical starch grains about 0.005 mm. in diameter, or with irregular masses of a more or less soluble carbohydrate; among the parenchyma cells and near the hypodermis occur small, widely separated fibro-vascular bundles, each with a closed sheath of sclerenchymatous fibers; an endodermis, the lateral and inner walls of the cells moderately thickened, strongly lignified and somewhat porous; several layers of sclerenchymatous fibers immediately inside the endodermal ring, in which are imbedded an interrupted circle of collateral fibro-vascular bundles having large tracheas; adjoining these are usually 8 to 10 rows of parenchyma cells with a few fibro-vascular bundles and a pith in which the parenchyma cells are more or less broken or absent. The powder is light yellowish; consisting of irregular, lignified fragments; numerous fragments showing tracheae with annular or spiral thickenings or marked with simple pores and associated with long, narrow, rather thin-walled, strongly lignified sclerenchymatous fibers; fragments of epidermis made up of cells rectangular in outline, the longer walls considerably thickened, strongly lignified and marked with numerous transverse pores; ends of epidermal cells usually separated from each other by a very narrow cell with thin walls and few pores; numerous fragments of parenchyma rectangular in outline and with thin, porous walls. Triticum yields not more than 3 per cent. of ash." *U.*

S.

"Rhizome pale yellow, rigid, from two to two and a half millimetres in diameter, usually in pieces from three to six millimetres long. Strongly furrowed longitudinally, hollow except at the nodes. Contains no starch. No odor; taste slightly sweet." *Br.*

The morphology of triticum has been described by Holm (*M. R.*, xix, p. 65). Kebler reports (*A. J. P.*, 1909, p. 75) the adulteration of triticum with Bermuda grass, by which he means probably *Capriola Dactylon* (L.) Kze., a grass which is naturalized in the United States from Europe and apparently widely distributed.

The Austrian Pharmacopoeia has a requirement of not less than 30 per cent. of aqueous extractive for this drug.

Uses.—Triticum is never exhibited for the purpose of affecting the general system, but only for its influence upon the genito-urinary organs. It is much used by some surgeons in *irritable bladder*, and also in *cystitis*. It is one of the least stimulant of the remedies of its class, and may be employed very freely. In Europe its decoction is said to be used to a considerable extent as a diluent and slightly nutritious drink. It may be taken *ad libitum*, or the fluidextract may be given in doses of a fluidrachm (3.75 mils) every three hours in five or six ounces of water.

Off. Prep.—Fluidextractum Tritici, *U. S.*; Decoctum Agropyri, *Br.*; Extractum Agropyri Liquidum, *Br.*

TROCHISCI.

TROCHES

Tabellae; Lozenges; Tablettes, *Fr. Cod.*; Pastilli, Rotulae, *P. G.*; Pastillen, Platzchen, Tabletten, *G.*; Pastiglie, *It.*; Tabletetas, *Sp.*

Troches or *lozenges* are small, dry, solid masses, usually of a flattened shape, consisting for the most part of powders incorporated with sugar and mucilage. They are designed to be held in the mouth and dissolved slowly in the saliva, and are, therefore, adapted for the administration of those medicines only which do not require to be given in large quantities and which are destitute of any very disagreeable flavor.

Lozenges were formerly much more used and more skilfully prepared in Europe than in this country, but at present those manufactured here are fully equal to the imported lozenges. Tragacanth, from the greater tenacity of its mucilage, is better suited for their formation than gum arable. The following directions for preparing them are taken from the *Dictionnaire des Drogues*. A mucilage of tragacanth is first prepared with cold water and strained. With this the powders, including sugar, are thoroughly mixed by rubbing upon a marble slab, and are thus formed into a paste, which is spread out by means of a roller upon the surface of the marble, previously powdered over with a mixture of sugar and starch. The thickness of the mass is rendered uniform by a frame upon which the ends of the roller rest. The upper surface is now dusted with sugar and starch, and the mass is divided into small cakes by means of a punch. These cakes are placed upon paper, and, having been exposed to the air for twelve hours, are carried into a drying room moderately heated. When perfectly dry, they are thrown upon a sieve to separate the sugar and starch, and are then enclosed in boxes. Lozenges may be prepared from almost any medicine which it is advisable to administer in this form. The following typical formula may be found useful.

Take citric acid, in powder, a drachm; powdered sugar eight ounces; oil of lemon twelve minims; mucilage of tragacanth a sufficient quantity. Form them in the manner above directed into troches of twelve grains each. Lozenges are sometimes made by saturating blank lozenges with aromatic spirits. Currant paste or jelly has come into use of late years largely as a basis for troches. For formulas for lozenges with currant paste basis, see *U. S. D.*, 19th edition, page 1297.

Lozenges of a cylindrical shape are extensively used, having a basis of licorice, gum, and sugar, and the manufacture of these is now an important industry. Franklin C. Hill devised an improved machine for making Licorice and Wistar's Lozenges. (See *A. J. P.*, 1874, 401.) For Slocum's and Harrison's improved forms of lozenge boards, rollers, etc., see *A. J. P.*, 1879, 589; 1880, 255. A. D. Marcy figured an instrument for shaping troches in *N. R.*, Feb., 1882.

The Br. Pharmacopoeia, 1914, adopted four bases for lozenges, as follows: fruit basis, rose basis, simple basis, and tolu basis. It will be noticed that in the British formulas the quantity of active ingredients

for each lozenge is stated and the kind of basis indicated. This is done merely to avoid repetition.

PREPARATION WITH FRUIT BASIS.

"Take five hundred times the quantity of the drug ordered for one lozenge. Mix it with 6.5 grammes of Tragacanth and 26 grammes of Refined Sugar, both in fine powder. Add sufficient of the black-currant paste of commerce to produce 650 gramme's, beat into a uniform mass, divide into 500 equal lozenges and dry in a hot-air chamber at a moderate temperature." *Br.*

PREPARATION WITH ROSE BASIS.

"Take five hundred times the quantity of the drug ordered for one lozenge. Treat it as described under 'Preparation with Simple Basis,' previously mixing with the Refined Sugar 0.025 millilitre of Oil of Rose." *Br.*

PREPARATION WITH SIMPLE BASIS.

"Take five hundred times the quantity of the drug ordered for one lozenge, mix it with 496 grammes of Refined Sugar and 19.5 grammes of Gum Acacia, both in fine powder. Make the mixture into a paste with 35 millilitres of Mucilage of Gum Acacia and a sufficient quantity of Distilled Water, divide into 500 equal lozenges and dry in a hot-air chamber at a moderate temperature." *Br.*

PREPARATION WITH TOLU BASIS.

"Take five hundred times the quantity of the drug ordered for one lozenge; dissolve such salts of alkaloids as may be ordered in 10 millilitres of Distilled Water; mix the solution with 482 grammes of Refined Sugar and 19.5 grammes of Gum Acacia, both in fine powder. Incorporate 10 millilitres of Tincture of Balsam of Tolu, and any other drugs ordered for the lozenges. Make into a paste with 35.5 millilitres of Mucilage of Gum Acacia and a sufficient quantity of Distilled Water; divide into 500 equal lozenges and dry in a hot-air chamber at a moderate temperature." *Br.*

TROCHISCUS CATECHU. Br.

CATECHU LOZENGE

"Catechu, 0.06 gramme. Mix with the Fruit Basis to form a Lozenge." *Br.*

This lozenge was introduced into the Br. Pharm., 1914. It is mildly astringent.

TROCHISCI CUBEBÆ. U. S.

TROCHES OF CUBEB Troch. Cubeb.

Tablettes de Cubebe, *Fr.*; Kubebenpastillen, *G.*

"Oleoresin of Cubeb, two grammes [or 31 grains]; Oil of Sassafras, one mil [or 16 minims]; Extract of Glycyrrhiza, in fine powder, twenty-five grammes [or 386 grains]; Acacia, in fine powder, twelve grammes [or 185 grains] ; Syrup of Tolu, a sufficient quantity, to make one hundred troches. Rub the powders together until they are thoroughly mixed; then add the oleoresin and the oil, and incorporate them with the mixture. Lastly, form a mass with syrup of tolu, and divide it into one hundred troches." *U. S.*

Each lozenge contains one-third of a grain (0.021 Cm.) of the oleoresin of cubeb, being about one-fourth the strength of the lozenge of 1870, and one-half the strength of the 1890 troches. The preparation is intended chiefly for effect upon the fauces and other parts of the upper alimentary passages, and may be used advantageously in some cases of chronic cough, and in ulceration or chronic inflammation of the fauces.

TROCHISCUS GUAIIACI RESINÆ. Br.

GUAIIACUM RESIN LOZENGE

Tablettes de Resine de Gayac, *Fr.*; Guajakharzpastillen, *G.*

" Guaiacum Resin, 0.2 gramme. Mix with the Fruit Basis to form a Lozenge." *Br.*

TROCHISCUS IPECACUANHAS. Br.

IPECACUANHA LOZENGE

Tablettes d'Ipecacuanha, *Fr. Cod.*; Brechwurzelpastillen, *G.*; Pastiglie d'ipeacuana. *It.*

"Ipecacuanha Root, in powder, 0.015 gramme. Mix with the Simple Basis to form a Lozenge." *Br.*

These are useful expectorant lozenges in catarrhal complaints.

TROCHISCUS KINO EUCALYPTI. Br.

EUCALYPTUS KINO LOZENGE

Eucalyptus Gum Lozenge, Red Gum Lozenge; Tablettes de Kino d'Eucalypte, *Fr.*; Eucalyptuskinopastillen, *G.*

"Eucalyptus Kino, 0.06 gramme. Mix with the Fruit Basis to form a lozenge." *Br.*

TROCHISCUS KRAMERIAE. Br.

KRAMERIA LOZENGE

Krameria Lozenge, Rhatany Lozenge; Tablettes de Ratanhia, *ø.*; Ratanhiapastillen, *G.*

"Extract of Krameria, 0.06 gramme. Mix with the Fruit Basis to form a Lozenge." *Br.*

These are astringent troches, which may be used in chronic angina.

Trompatila.—This is the stem and branches of *Bouvardia triphylla* Salisb. (fam. *Rubiaceae*), a Mexican plant used by the natives for *hydrophobia*. (*A. J. P.*, 1874, 51.)

TURPETHUM. Br.

TURPETH

"Turpeth is the dried root and stem of *Ipomoea Turpethum*, R.Br." Br.

Turpeth Root, Indian Jalap, Trivrit, Nisoth.

Ipomoea Turpethum (*operculina* Turpethum (L.) Peter) (Fam. *Convolvulaceae*) is a convolvulaceous plant which is found throughout India, China, Ceylon, Australia, and is occasionally cultivated in botanical gardens as an ornamental plant. There are two varieties, viz., *Sveta* or white turpeth, and *Kirshna* or black turpeth, the former being preferred as a mild cathartic. The black variety is said to be a powerful drastic. (Watt, "Dictionary of the Economic Products of India.")

According to Merat and De Lens, the root itself formerly came into commerce, but at present turpeth consists of the root and stem of the plant cut into short lengths, usually from 1.5 to 5 cm. in diameter; the central woody portion is often removed by splitting the bark on one side. The pieces are cylindrical, somewhat twisted and externally of a dull gray color. A transverse section shows a porous central wood surrounded by a broad cortical portion, containing yellowish-brown resin cells, lactiferous vessels and crystals of calcium oxalate. The fracture is short in the cortex and fibrous in the central portion. The drug has a faint odor and a nauseous taste, which is perceptible only after it has been some time in the mouth.

"In cylindrical pieces of varying length, from one to five centimetres wide, often split on one side and deprived of the central portion; longitudinally furrowed; dull grey or brown. Fracture of the bark short, of the wood fibrous; internally usually pale grey. In transverse section, a porous wood surrounded by a thick bark in which abnormal wood-bundles are frequently present. Slight odor; taste nauseous, slowly developed." Br.

Boutron-Chalard found in turpeth root, resin, a fatty substance, volatile oil, albumen, starch, a yellow coloring matter, lignin, salts, and ferric oxide. (*J. P. C.*, viii, 121.) The root contains 10 per cent. of resin. (Andouard, *Ann. Ther.*, 1866, 118.) According to Spirgatis this resin is a glucoside, *turpethin*, $C_{76}H_{128}O_{36}$ like that of other *Convolvulaceas*,

insoluble in ether, but soluble in alcohol, to which it imparts a brown color not removable by animal charcoal. To obtain it pure, the alcoholic solution is concentrated; the resin precipitated by, and" afterwards boiled with, water, then dried, reduced to powder, digested with ether, and finally redissolved by absolute alcohol and thrown down by ether. After being treated several times in this way, it is obtained in the state of a brownish resin, yielding on pulverization a gray powder, which strongly irritates the mucous membrane of the nostrils and mouth, and is fusible at 182.2° C. (360° F.). It is inflammable, burning with a smoky flame and emitting irritant vapors. With strong bases it acts like jalapin, takes up water, and is transformed into a soluble acid, *turpethic acid*, C₃₄H₆₀O₁₈, while with dilute acids it is decomposed into *turpetholic acid*, C₁₆H₃₂O₄, and glucose. (J. P. C., 4e ser., i, 236.)

Turpeth root is purgative, somewhat less powerful than jalap, and rather slow in its action.

Dose, five to twenty grains (0.32-1.3 Gm.).

Off. Prep.—Tinctura Jalapæ Composita, *Br.*

Tylophora Leaves. *Tylophorae Folia. Br. Add.* (Fam. *Asclepiadaceae.*) —The dried leaves of *Tylophora asthmatica* (L.) Wight and Arnott, are used in certain parts of India as a poison for vermin, and have been used with fatal results as a poison. *Tylophora asthmatica*, which grows in Bengal, Burmah and Ceylon, has been known in Indian medicine since 1780, and has been largely used in both the civil and the military medical service of Madras. It is officially described as "petiolate, entire, from two to five inches (five to twelve and a half centimeters) long and from three-quarters of an inch to two and one-half inches (eighteen to sixty-five millimeters) broad, lanceolate-ovate or ovate or subrotund in outline, somewhat cordate at the base, abruptly acuminate; rather leathery in texture, glabrous on the upper surface, and finely downy on the lower; of a brownish-green color, which is paler on the lower surface. Odor slightly aromatic; almost devoid of taste." *Br. Add.*

David Hooper has separated from this drug an alkaloid, *tylophorine*, soluble in ether and alcohol, but scarcely so in water; forming crystalline salts, and striking with nitric acid a purplish-red color, with Frohde's reagents a deep sap-green, and with potassium dichromate and sulphuric acid a dirty violet. *Tylophora* resembles in its activity ipecac, and is used as a substitute for that drug in *bronchitis* and in *dysentery*. In doses of from twenty to thirty grains (1.3-2.0 Gm.) it is used as an emetic. The expectorant dose is from one-half to two grains (0.032-0.13 Gm.).

The Dispensatory of the United States of America Twentieth Edition (1918)

Edited by Joseph P. Remington, Horatio C. Woods and others.

[This was the last era in pharmacy when plant drugs were widely prepared, both for Regular School, Eclectic and Irregular physicians, and the Dispensatories were the major reference works used by pharmacists to prepare these products. Official plant drugs and preparations are in larger case, unofficial plant drugs and preparations are in smaller case. I have extracted all plant drugs and preparations, excluded non botanicals and those most reasonably used only by physicians...Opium, Digitalis, etc. *Michael Moore*]

Ulex. *Ulexeuropoeus* L. (Fam. *Leguminosae*), is the common *furse, gorse, or whin* so conspicuous in the waste places and by the roadsides of Great Britain, from its spiny branches and bright yellow flowers situated on the spines, either solitary or in pairs. The young tops are fed to cattle and horses, but the food value has been questioned. The leaf buds have been used as a substitute for tea and the flowers yield a beautiful yellow dye. In the seeds of this plant, A. W. Gerrard has found an alkaloid, *ulexine*. In 1890 Kobert (*D. M. W.*, 1890), as the result of an elaborate physiological study, came to the conclusion that ulexine and cytisine are identical. The suggestion has given rise to a considerable chemico-physiological discussion, a brief abstract of which may be found in P. J., Feb., 1891. Kobert found indications of a second alkaloid in ulex. Partheil (*A. Pharm.*, 1892, 448; 1894, 486) and Plugge (*A. Pharm.*, 1894, 444) are in accord as to the identity of ulexine and cytisine. Ulexine has been used in cardiac *dropsy*. Dose, from one-fifteenth to one-twentieth of a grain (0.004-0.003 Gm.).

ULMUS. U. S.

ELM [Elm Bark Slippery Elm]

"The bark of *Ulmus fulva* Michaux (Pam. *Ulmaceae*), deprived of the outer corky layer and dried." *U. S.*

Red Elm, Moose-elm, and Indian Elm; Cortex Ulmi Interior, Ulmi Cortex; Orme Fauve, *Fr. Cod*; Ecorce d'Orme, *Fr.*; Ulmenrinde, Ruaterrinde, *G.*

The *slippery elm* (*Ulmus fulva*), is a lofty tree, fifty or sixty feet in height, with a trunk fifteen or twenty inches in diameter. The bark of the trunk is brown, that of the branches rough and whitish. The leaves are petiolate, oblong-ovate, acuminate, nearly equal at the base, unequally serrate, pubescent, and very rough on both sides. The buds, a fortnight before their development, are covered with a dense russet down. The flowers, which are apetalous, appear before the leaves, are

sessile, and in clusters at the extremities of the young shoots. The clusters of flowers are surrounded by scales, which are downy like the buds. The calyx is also downy. The stamens are five, short, and of a pale rose color. The fruit is a membranaceous capsule or samara, enclosing in the middle one round seed, destitute of fringe.

Ulmus fulva is indigenous, growing in all parts of the United States north of the Carolinas, but most abundantly west of the Alleghany Mountains. It extends westward to the Dakotas and northward to western Quebec and Lake Huron. It flourishes in open, elevated situations, and requires a firm, dry soil. From the *white elm* (*U. americana* L.) it is distinguished by its rough branches, its larger, thicker, and rougher leaves, its downy buds, and the character of its flowers and seeds. Its period of flowering is in April. The inner bark, separated from the cortex, is the part used. Large quantities are collected in the Lower Peninsula of Michigan.

Fremontia californica Torr., or *California Slippery Elm*, is not botanically allied to *Ulmus fulva*; its bark is said, however, to have the same properties as slippery elm bark, and to be used for a similar purpose.

Properties.—Elm bark is officially described as follows:

"Usually in bundles consisting of flat, oblong pieces, about 30 cm. in length and from 10 to 15 cm. in width; outer surface of a light brown or buff color with occasional dark brown patches of adhering cork, longitudinally striate and with detachable bundles of bast-fibers, and colored blackish upon the addition of a very diluted iodine T.S.; inner surface light yellowish-brown, nearly smooth and finely striate, only slightly darkened upon the addition of a very diluted iodine T.S.; fracture fibrous with projecting bast-fibers, the broken surface porous, due to the large mucilage cells; odor distinct; taste mucilaginous. The powder is very light brown; under the microscope it shows mostly fibrous fragments, and a finely granular portion made up of small starch grains, the latter being immediately colored bluish-black upon the addition of iodine T.S.; starch grains mostly spherical or more or less polygonal, usually about 0.003 mm. in diameter, but also attaining a diameter of 0.025 mm.; bast-fibers very long, about 0.02 mm. in diameter, with rather thin, slightly lignified walls; calcium oxalate in monoclinic prisms, mostly in crystal fibers, the individual crystals from

0.01 to 0.025 mm. in diameter; fragments of large mucilage cells with adhering starch grains. Macerate 1 Gm. of powdered Elm with 40 mls of distilled water for an hour and forcibly strain; the solution is of a mucilaginous consistence." *U. S.*

Ulmus abounds in mucilaginous matter, which it readily imparts to water. The mucilage is precipitated by solutions of lead acetate and subacetate, but not by alcohol. It contains a variety of tannin which colors iron solutions green, in amount about 6.5 per cent. according to Rink, or, according to Davy, a little less than 3 per cent.

Much of the bark brought into the market is of inferior quality, imparting comparatively little mucilage to water. It has the characteristic odor of the genuine bark, but is much less fibrous and more brittle, breaking abruptly when bent, instead of being capable, like the better kinds, of being folded lengthwise without breaking. To what this inferiority is owing, whether to difference in the species or the age, or to circumstances in the growth of the tree producing it, we are unable to state. Ground elm bark is said to be adulterated, usually with substances containing starch. Roberts found commercial specimens which possessed considerable of a brownish outer bark still adhering to them. One specimen was partly mouldy and had considerable adhering wood. (*Proc. Penn. Ph. Assoc.*, 1913, p. 85.) The following test, devised by Geo. M. Beringer, seems to have practical value: Ten grains of ground or pulverized elm bark, thoroughly shaken with one fluidounce of water, will, if pure and of good quality, in fifteen minutes form a thick jelly-like mass of a fawn color.

C. W. Wright, of Cincinnati, in a communication to the *Western Lancet*, states that slippery elm bark has the property of preserving fatty substances from rancidity, and that this fact was known to the Indians, who prepared bear's fat by melting it with the bark, in the proportion of a drachm of the latter to a pound of the former, keeping them heated together for a few minutes, and then straining off the fat. Wright tried the same process with butter and lard, and found them to remain perfectly sweet for a long time. (*A. J. P.*, xxiv.)

Uses.—Elm bark is an excellent demulcent, applicable to all cases in which this class of medicines is employed. It is especially recommended in *dysentery*, *diarrhea*, and *diseases of the urinary passages*. Its mucilage is reputed to be nutritious.

It is commonly used as a drink in the form of infusion. (See *Mucilago Ulmi*.) The powder may be used stirred in hot water, with which it forms a mucilage more or less thick according to the proportion added. The bark also serves as an emollient application in cases of *external inflammation*. For this purpose the powder may be formed into a poultice with hot water, or the bark itself may be applied, previously softened by boiling. McDowell, of Virginia, recommended slippery elm bark for the dilatation of *fistulas* and *strictures* (*Med. Examiner*, i, 244); subsequently H. R. Storer, of Boston, used it advantageously for dilating the os uteri (*B. M. S. J.*, liii, 300), and A. Abbe of the same place, succeeded in curing with it a case of stricture of the rectum, (*B. M. S. J.*, liv, 349).

Off. Prep.—Trochisci Ulmi, *N. F.*

Umbellularia. *Umbellularia californica* (Arn.) Nutt. *California Laurel*. *California Sassafras*. *Spice Tree*. (Fam. *Lauraceae*).—The leaves of this California tree are employed in *neuralgic headaches*, and in *intestinal colic* and *atonic diarrhea*; also externally as a mild counter-irritant. Stillman and O'Neill (*N. R.*, 1883) obtained from the seeds a new acid, *umbellulic acid*. The leaves are said also to contain about 4 per cent. of a volatile oil, having a specific gravity of 0.936, a warm camphoraceous taste, and a strong pungent odor. Burse has separated from the oil by fractional distillation *umbillol*, an oil having the formula $C_8H_{12}O$, which dissolves in concentrated sulphuric acid with red color, and is narcotic. (*Ap. Ztg.*, xi.) According to Schimmel & Co. (*Schim. Rep.*, April, 1897), it also contained *cineol*, $C_{10}H_{18}O$. It is probable that the volatile oil is a strong local anesthetic, as it has been found to act rapidly when brought in contact with exposed pulp or sensitive dentine. The fluidextract has been used in doses of from ten to thirty minima (0.6-1.8 mils).

UNGUENTA.

OINTMENTS

Pommades, Onguents, *Fr.*; Salben, *G.*; Pomatas, Unguentos. *It.*; Pomadas, Unguentos, *Sp.*

These are fatty substances, softer than cerates, of a consistence like that of butter, and such that they may be readily applied to the skin by inunction. When ointments are prepared by merely mixing medicinal substances with simple ointment, hydrous wool-fat, lard, or petrolatum, care should be taken, if the added substance be a powder, that it be brought to the finest possible state of division before being incorporated

with the unctuous matter. If soluble in water or in alcohol, it may often be advantageously rubbed with a little of one of these liquids. Gritty matter should not be allowed to enter these preparations. When an extract is added, if not uniformly soft, it should be made so by trituration with water or alcohol, according to its nature. Many of the ointments become rancid if long kept, and should, therefore, be prepared in small quantities at a time, or only when wanted for use. The tendency to rancidity may be in a considerable degree counteracted by imbuing the unctuous vehicle with benzoin, or with poplar buds, as recommended by Deschamps (*A. J. P.*, xv, 260); but care should be taken that there be no therapeutic objection to the admixture. Elm bark is said to have the same effect. According to Geisler, ten drops of spirit of nitrous ether, incorporated with an ounce of ointment, will overcome the disagreeable fatty odor. (*Ph. Cb.*, 1847, 927.) Hydrous wool-fat or lanolin, petrolatum, and glycerite of starch are now used as vehicles for ointments. In the selection of a vehicle for an ointment it is important to consider the object for which the ointment is to be used. Lanolin is a natural emollient of the skin, composed of cholesterin and other substances.

Glycelceum is an oleaginous compound of finely powdered almond meal 1 part, glycerin 2 parts, and olive oil 6 parts. It was proposed by T. B. Groves, *C. D.*, Sept. 14, 1867, as a substitute for plasma and other fatty bodies, and has no doubt advantages, one of which is the facility with which it can be removed from the skin by a wet sponge. It has been proposed to substitute glycerin for oils and fats in the preparation of ointments, either wholly or in part; but ointments thus prepared are altogether unfit for application by inunction, as a portion of the glycerin remains upon the skin, producing a rough sensation of adhesiveness, very different from the softness caused by oleaginous matter, and in some skin diseases glycerin in an ointment would be positively injurious.

The cerates having been abolished as a class in the British Pharmacopoeia, a few of the individual articles have been transferred to the ointments, making the definition of the latter class of preparations, as given above, not exactly applicable to all the individual substances at present included among them in that Pharmacopoeia. We consider no substance to be strictly entitled to the name of ointment which is not of such a consistence as to adapt it to application to the skin by friction or inunction. Ointments should be dispensed in glass, porcelain, or queensware pots or jars, or, if for temporary use, in tight wooden boxes.

We have used a very convenient method of dispensing soft ointments by introducing them into compressible tubes. These tubes are similar to those used for holding artists' colors, and have the advantage of shielding the ointment from the oxidizing action of the air while allowing the use of the desired quantity. Vanderkleed and Heidelberg (*Proc. P. P. A.*, 1913, p. 312) state that the only satisfactory method of determining whether or not the proper degree of subdivision has been attained is by the use of the microscope, and call attention to some of the precautionary measures which should be taken in order to obtain correct results. Their article is illustrated by numerous photographic representations of ointments of different degrees of fineness. For a classification of ointments in accordance with their therapeutic use, by C. S. N. Hallberg, see *West. Drug.*, 1900, 652.

Uses.—Ointments are used either for their local effects upon the skin or as a means of introducing drugs into the system through endermic absorption. The effects of fat-like substances upon the skin are due in part to their softening or emollient properties, and in part to the protection of the epiderm from the air, bacteria, or friction; they may also serve as carriers of antiseptic or other medicaments which influence pathological conditions of the skin. It is manifest that different qualities for an ointment base are desirable according to the purpose for which it is intended. Thus if it is intended to protect the skin the choice should fall on a substance which is not irritant nor readily absorbed nor liable to become liquid at a body temperature. On the other hand, for endermic administration one should choose a base which easily penetrates the skin. Concerning this last factor there has been a considerable amount of experimental investigation with not altogether harmonious results. The most widely used method has been to rub into the skin ointments made with various bases containing some substance easily demonstrable in the urine, and then determining the proportion of the medicament eliminated. Hirschfeld and Pollio (*Arch. f. Derm. u. Syph.*, 1904, lxxii, p. 163) found that the iodides were absorbed readily in ointments made with petrolatum or lard, but almost not at all from ointments made from wool fat. Bourjet (*Th. M.*, 1893) found that salicylic acid was absorbed readily from ointments made with true fats but poorly in those made with petrolatum or glycerin as the base. Sauerland (*Biochem. Zeit.*, 1912, xl, p. 56) in an elaborate research found that with vaseline, 40 per cent., with lard, 26 per cent., and with wool-fat, 18 per cent. of the iodine of iothion was absorbed through the skin; likewise methyl salicylate was absorbed in the same order,

although in much smaller proportions. On the other hand, spirosal, a glycol salicylate, was absorbed scarcely at all from a lard ointment, but in fair amounts from either wool-fat or vaseline. Gardiner (*B. M. J.*, 1912, i, p. 238) rubbed ointments containing various stains into the shaven skin of guinea pigs and then examined the skin microscopically to observe the depth of penetration. He found that olive oil penetrated more deeply than any substance with which he experimented, but that goose grease and lard also penetrated well. Petrolatum remained limited to the very superficial portions of the skin. Wool-fat, while it penetrated somewhat more deeply than petrolatum, was noticeably behind lard. Wild (*B. M. J.*, 1911, ii, p. 161) employed a very different method to study this subject. He rubbed pure ointment bases into the skin for a measured time and then scraped off what was left on the skin and weighed. The difference between the quantity taken and that recovered he considered to represent the amount absorbed. He found that petrolatum was absorbed practically not at all, that of lard or olive oil about 15 per cent., and of hydrous wool-fat about 20 per cent., but that the absorption of the latter was noticeably less if it was deficient in water. While the evidence quoted is somewhat contradictory and it is probable that some ointment bases are better for one drug and some for another, yet it seems to us that in a general way the conclusion is justified that where absorption is desired lard is probably the best of the official ointment bases.

UNGUENTUM. U. S.

OINTMENT Ung. [Simple Ointment]

Unguentum Adipis, *U. S. 1860*; Unguentum Simplex; Pommade simple, *Fr.*; Unguentum cereum, *P. G. Wachssalbe, G.*

"White Wax, two hundred grammes [or 7 ounces av., 24 grains]; Benzoinated Lard, eight hundred grammes [or 28 ounces av., 96 grains], to make one thousand grammes [or 35 ounces av., 120 grains]. Melt the white wax, add the benzoinated lard, and heat gently until liquefied; then stir the mixture until it congeals. For use in southern latitudes and during the warm season in other localities, 50 Gm. of the benzoinated lard (or more if necessary) may be replaced by an equal quantity of white wax." *U.S.*

Yellow wax was used in this ointment in the U. S. P., 1890, and objection was made to the color of the ointment. It has been very properly replaced by white wax in the U. S. P. VIII and IX, and the lard is now benzoinated.

This is emollient, and is occasionally employed as a mild dressing to blistered or excoriated surfaces, but more frequently as a vehicle, it being the basis of several official ointments.

UNGUENTUM AQUÆ ROSÆ. U. S., Br.

OINTMENT OF ROSE WATER Ung. Aq. Ros.

Rose Water Ointment; Unguentum Emolliens; Cold-cream, Ceratum Galeni, Galen's Cerate, *Fr. Cod.*; Cerat cosmétique, Crème froide, *Fr.*; Unguentum leniens, *P. G.*; Cold Cream, *G.*

*"Spermaceti, one 'hundred and twenty-five grammes [or 4 ounces av., 179 grains]; White Wax, one Hundred and twenty grammes [or 4 ounces av., 102 grains]; Expressed Oil of Almond, five hundred and sixty grammes [or 19 ounces av., 330 grains]; Sodium Borate, in fine powder, five grammes [or 77 grains]; Stronger Rose Water, one hundred and ninety grammes [or 6 ounces av., 307 grains], to make about one thousand grammes [or 35 ounces av., 120 grains]. Reduce the spermaceti and the white wax to fine pieces and melt them on a water bath, add the expressed oil of almond and stir, continuing the heat until the mixture is uniform. Dissolve the sodium borate in the stronger rose water warmed on a water bath to the temperature of the melted wax and fat, and add the warm solution gradually to the melted mixture, stirring it rapidly and continuously until it congeals and becomes of uniform consistence. Ointment of Rose Water must be free from rancidity. If the Ointment has been chilled, warm it slightly before attempting to incorporate other ingredients with it." *U. S.*

"Rose Water, 20.0 millilitres; White Beeswax, 18.0 grammes; Purified Borax, 1.0 gramme; Almond Oil, 61.0 grammes; Oil of Rose, 0.1 millilitre. Melt the White Beeswax in the Almond Oil; add, with constant stirring, the Borax previously dissolved in the Rose Water; add the Oil of Rose, and continue to stir until cold." *Br.*

In the U. S. P., 1890, process the proportion of stronger rose water was

greatly reduced—i.e., from 30 to 20 per cent.; this makes a more stable preparation, but in our opinion the usefulness of the ointment has been curtailed by the reduction, its soft consistence being one of its most valuable characteristics. Sodium borate was added to increase its whiteness; its presence may, however, prove objectionable when the ointment is used as a basis in prescriptions, by reacting with some of the ingredients ordered by the physician. The U. S. P. VIII formula was retained with but slight changes in the U. S. P. IX. The manipulation was somewhat modified to increase uniformity of the product.

This preparation is a white, very soft, and elegant ointment, deriving a grateful odor from the rose water, which remains incorporated with the other constituents if kept enclosed in glazed vessels. We have found it an improvement to add oil of rose in the proportion of one drop to eight ounces, and, when made in the official quantity, to use an instrument known as the "Dover egg-beater" for giving it the desired creamy appearance. In larger amounts an ice cream churn is well adapted for this purpose. It is a pleasant, cooling application to irritated and excoriated surfaces, and may be used with great advantage for *chapped lips* and *hands*, so frequent in cold weather. It is a preparation of very early origin and is sometimes known by the name of Galen's Cerate. "Cold" cream is not recognized in the U. S. Pharmacopoeia IX as an official synonym for ointment of rose water. This course became necessary because of the large number of unofficial ointments of varying composition popularly exploited as cold creams, and these were frequently dispensed, when physicians' prescriptions directed Ointment of Rose Water. The commercial cold creams must be made from substances which are not liable to rancidity, and paraffin oil, liquid petrolatum, white petrolatum, etc., largely form the basis of such, but the official ointment is to be preferred for use in prescriptions. W. C. Alpers furnishes the following formula for a cold cream which is more permanent than the official ointment. One hundred and fifty parts of white wax is melted in 600 parts of paraffin oil with the aid of a gentle beat; 9 parts of borax is dissolved in 240 parts of water; the two fluids are brought to a uniform temperature, not exceeding 60° C. (140° F.), and the aqueous solution is poured into the oily one in a continuous stream, stirring gently for a minute or two; then 1 part of oil of geranium and a little oil of rose are added while stirring, and the product while still warm is poured into jars. The cold cream so obtained is white, soft and smooth, pleasantly odorous, keeps well in the heat of summer and the cold of winter, and becomes only slightly thinner in

summer. As the ointment is liable to become rancid when long kept, and the water to separate upon exposure, Joseph Laidley has proposed the substitution for the rose water of oil of rose and glycerin, the former in the proportion of two drops, the latter in that of four fluidrachms, the quantity of spermaceti being increased by two drachms. (*A. J. P.*, xii, 119.) For some purposes the substitution is useful, but the official preparation is preferable for chapped hands, as the glycerin frequently leaves an unpleasant sensation of stickiness on the skin.

UNGUENTUM CAPSICI. Br.

CAPSICUM OINTMENT

Pommade de Piment des Jardins, *Fr.*; Spanisch-Pfeffersalbe, *G.*

"Capsicum Fruit, bruised, 25 grammes; Hard Paraffin, 10 grammes; Soft Paraffin, 75 grammes; Prepared Lard, 10 grammes. Digest on a water-bath for one hour, stirring occasionally; strain; stir until cold. In India, Prepared Suet (*Sevum Preeparatum*) should be employed instead of Prepared Lard in making this Ointment." *Br.*

This is an active counter-irritant which may be used in the place of liquid liniments in *sprains, bruises, rheumatism,* and other inflammations.

UNGUENTUM EUCALYPTI. Br.

EUCALYPTUS OINTMENT

Pommade d'Eucalypte, *Fr.*; Eukalyptussalbe, *G.*

"Oil of Eucalyptus, 10 grammes; Hard Paraffin, 40 grammes; Soft Paraffin, white, 50 grammes. Melt the Hard and Soft Paraffins together; add the Oil of Eucalyptus; stir until cold." *Br.*

This ointment is used as a stimulant to indolent *ulcers* and in *skin diseases*.

UNGUENTUM HAMAMELIDIS. Br.

HAMAMELIS OINTMENT

Pommade de Hamamelis, *Fr.*; Hamamelissalbe, *G.*

"Liquid Extract of Hamamelis, 10 millilitres; Wool Fat, 60 grammes; Soft Paraffin, 30 grammes. Mix by trituration in a warm mortar." *Br.*

This was one of the " Additions" to the British Pharmacopoeia, 1885, and afterwards introduced into the Br. Pharm., 1898, 1914. It is, in our opinion, of doubtful utility, but may be applied to sprains.

UNGUENTUM STAPHISAGRIÆ. Br.

STAVESACRE OINTMENT

Onguent de Staphisaigre, *Fr.*; Stephanskomersalbe, *G.*

"Stavesacre Seeds, 20 grammes; Yellow Beeswax, 10 grammes; Benzoated Lard, 85 grammes. Crush the Stavesacre Seeds; digest the crushed seeds with the Benzoated Lard on a water-bath for two hours; strain and press through calico; melt the Beeswax in the liquid mixture; stir until cold. In India, Prepared Suet (Sevum Benzoatum) should be employed instead of Benzoated Lard in making' this Ointment." *Br.*

This ointment is but half the strength of that official in the British Pharmacopoeia 1885; it is said to be non-irritant, and is largely used in Great Britain for destroying *body-lice*, also in *scabies* and *prurigo*.

UNGUENTUM STRAMONII. U. S.

STRAMONIUM OINTMENT Ung. Stramon.

Pommade de Stramoine, *Fr.*; Stechapfelsalbe, *G.*

"Pilular Extract of Stramonium, ten grammes [or 154 grains]; Diluted Alcohol, five mils [or 81 minims]; Hydrous Wool Fat, twenty grammes [or 308.6 grains]; Benzoinated Lard, sixty-five grammes [or 2 ounces av., 128 grains], to make about one hundred grammes [or 3 ounces av., 231 grains]. Triturate the extract with the diluted alcohol until a smooth

mixture is obtained; with this incorporate the hydrous wool fat, then add the benzoinated lard, and mix thoroughly." *U. S.*

This is a more certain preparation than that of the former editions of the U. S. Pharmacopoeia, which was made by boiling the fresh leaves in lard. The color of the ointment of the U. S. P. IX is different from that of the earlier Pharmacopoeias, the greenish tint being due to the use of official extract of stramonium which is now made from the leaves instead of the seeds. For remarks by A. P. Sharp of Baltimore, on the preparation of this ointment, see *A. J. P.* (xxvii, 391). A useful anodyne application in *irritable ulcers, painful hemorrhoids, and bruises.*

Urechites. *Urechites suberecta* Jacq. *Savannah Flower. Yellow-flowered Nightshade.*—This is an apocynaceous plant, which grows abundantly in the West Indian Islands and to some extent in Florida, is said to be used in Jamaica by the negroes as a poison. The symptoms which it produces are violent vomiting and purging, with convulsions. J. J. Bowrey (*J. Chem. S.*, June, 1878) has isolated from it two glucosides, *urechitin* and *urechitoxin*, having respectively the formula $C_{28}H_{42}O_8$ and $C_{13}H_{20}O_5$. Isaac Ott (*T. G.*, 1880) finds the plant to be a powerful cardiac poison, first increasing and then depressing the arterial pressure, and finally, if the dose be large enough, killing by producing cardiac arrest. The results reached by Ott are in accord with those of Ralph Stockman (*Laborat. Rep., Royal College of Physicians*, Edinburgh, vol. iv, 1892), who finds that both of the glucosides are very active poisons belonging to the digitalis group. On the other hand, Vowinkie came to the conclusion that even small doses of the plant depress the heart, and experiments made upon man by Bowrey show that in large doses the drug produces nausea, vomiting, general depression, great perspiration, and slight swelling of the pulse. Stockman (*Rev. de Clin. et de Ther.*, June 29, 1892) found that the leaves contain a toxic alkaloid, which he calls *urechitine*, $C_{28}H_{42}O_8 + H_2O$, and a glucoside, *urechitonin*, which is less toxic. In Jamaica the drug is said to have been used in the treatment of intermittent and other sthenic fevers. The dose of the fluidextract is from two to ten minims (0.12-0.6 mils).

URGINEA. Br.

URGINEA [Indian Squill]

"Urginea consists of the younger bulbs of *Urginea indica*, Kuntzi, collected soon after the plants have flowered, divested of their dry, outer, membranous coats, cut into slices, and dried. When powdered should be kept quite dry over quicklime." *Br.*

Urginea indica is a plant resembling *Urginea maritima*. It is easily

distinguished from the latter in that the bulb when entire is scaly and not tunicated as the European Squill. *Urginea indica* grows in sandy soil near the sea coast throughout India and also extends to the lower Himalayas. The medicinal properties of the drug are apparently identical with the Squill of the Greeks. The outer coats are quite inert and should be removed as indicated in the definition of the Br. Pharm.

" Curved or sickle-shaped strips, separated or connected, several together, to a portion of the shortened axis; usually one to five centimetres long and five to ten millimetres wide; yellowish-white, fleshy, often longitudinally ribbed; tough when slightly moist, but brittle and pulverisable when dry. No odor; taste bitter and acrid." *Br.*

The bulbs of *Urginea indica* are rounded, conical or pear-shaped and about the size of an onion; tunicated, consisting of fleshy coats which enclose each other completely; color whitish; taste bitter and acrid. The bulbs of *Scilla indica* Baker, which were recognized by the Br. Add. 1900, differ in that they are not tunicated but made up of thick fleshy rubricated scales; otherwise, except that they are somewhat smaller, they resemble those of *Urginea indica*.

Uses.—The bulbs of Indian squill have long been used in India for purposes similar to that for which the official squill is employed in Europe and America, but no sufficient chemical examinations have been made to prove the identity of the Indian and European drugs.

Dose, one to three grains (0.065-0.2 Gm.).

Off. Prep.—Acetum *Urgineae*, *Br.*; Oxymel *Urgineae* (from Vinegar), *Br.*; Pilula *Ipecacuanhae cum Urginea*, *Br.*; Pilula *Urgineae Composita*, *Br.*; Sympus *Urgineae*, *Br.*; Tinctura *Urgineae*, *Br.*

Urtica. *Ortie brulante*, Fr. *Brennessel*, G.— Various species of this genus (Fam. *Urticaceae*) are furnished with poisonous stinging hairs. *Urtica gigas* A.Cunn. (now *Laportea gigas* Wedd.), of Eastern Australia is said frequently to kill horses, and to produce in man a sting whose impression lasts for months. (*N. R.*, 1875.) It has generally been thought that the virulence of the hairs is due to the presence of free formic acid (*A. J. P.*, xxii), and David Hooper (*P. J.*, April, 1887) has demonstrated the presence of formic acid, or a substance very closely allied to it, in the hairs of the *Nilgri nettle* (*Girardinia palmata* Gaudich.). Nevertheless, it does not seem probable that formic acid is the poison. G. Haberlandt believes it to be a non-volatile albuminoid, and L. Renter has obtained from several nettles a glucoside. (*A. J. P.*, Jan., 1890.) Oddi and Lomonaco (*Rif. Med.*, April, 1892) isolated from the common

nettle a crystalline alkaloid, and found that in mammals the extract acts powerfully upon the vasomotor system, and in frogs causes centric paralysis with diastolic cardiac arrest.

U. dioica L., or *common nettle*, and *U. urens* L., or *dwarf nettle*, European plants naturalized in waste places to some extent in the United States, have been used in medicine as local irritants, as diuretics (*A. J. P.*, 1866), and especially for the purpose of arresting *uterine hemorrhage*. The fluidextract may be given in doses of half a fluidrachm (1.8 mils) or a decoction of the strength of an ounce to a pint in teacupful doses. Under the name of *brandol* is marketed a preparation used in the treatment of *burns* and *wounds*; it is a liquid consisting of 93 per cent. infusion of *urtica*, 2 per cent. picric acid and 5 per cent. glycerin.

Ustilago. *U. S.* 1880. *Corn Smut*—The genus *Ustilago* belongs to the *Ustilaginaceae*, all the members of which generally develop their spores in the ovary or anthers of the host plant, forming a slimy mass, which in maturing becomes a black dust made up of spores. They produce the *smut* in cereals. *Ustilago Maydis* (DC.) Tul. is produced on the stems, the pistils (corn grains), and the male inflorescence (tassel) of the Indian corn. It is specifically characterized by its minute spherical spores, about 0.007 mm. in diameter. It is abundant in the United States. Upon the corn the smut appears in masses, varying in size from a cherry to a child's head; These masses are smooth, irregularly globose, or sometimes lobulated, having at first a livid, bluish tint, and then becoming blackish, and finally bursting and emitting the black contents, consisting of innumerable globose very minute spores, each of which is covered with beautiful little pointed processes. In a dried state the masses are blackish and covered with a black powder.

C. H. Cressler found in *ustilago* an alleged alkaloid, *secaline* (*trimethylamine*), besides a thick, viscid, fixed oil and a resin soluble in ether, but not in alcohol. (*A. J. P.*, 1861, 306.) Rademaker and Fischer (*Nat. Drug.*, 1887, 296) believed that they had discovered a white, bitter alkaloid, *ustilagine*, soluble in ether, while H. B. Parsons decided that the fixed oil contained an acid which he provisionally named *sclerotic acid*; also an amine-like volatile substance extracted by ether. (*N. R.*, March, 1882; also *West. Drug.*, 1894.) A. W. Balch [*Journ. Boston Soc. Med. Sci.*, March, 1901) was not able to find any active substance in the smut.

The belief that corn smut is an abortifacient to the lower animals (*A. J. P.*, Sept., 1861) appears to be without foundation, as in the experiments made by the United States Department of Agriculture in 1898 (*Farmers' Bulletin*, No. 69) no effect was produced by corn smut given to pregnant cows. The experiments of James Mitchell (*T. G.* ii, 223) that *ustilago* abolishes sensation, reflex action, and later general motor power in the frog, is contradicted by the results of Balch, who also found that enormous doses of the substance have no effect upon the color of the cock's comb. In doses of one to two drachms (3.9-7.7 Gm.) it has been claimed by W. A. N. Borland that the fluidextract markedly increases the severity and frequency of the uterine pains in human labor. The whole drift of our present evidence is to show that *ustilago* is probably inert.

UVA URSI. U. S. (Br.)

UVA URSI [Bearberry]

"The dried leaves of *Arctostaphylos Uva-ursi* (Linne) Sprengel (Fam. *Ericaceae*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter." U. S. "Bearberry Leaves are the dried leaves of *Arctostaphylos Uva-ursi*, Spreng." *Br.*

Uvæ Ursi Folia, *Br.*; Barren Myrtle, Mountain Box, Rock-berry; Kinnikinnic; Uva-ursi, Busserole, Raisin d'Ours, *Fr. Cod.*; Folia Uvae Ursi, *P. G.*; Barentraube, Barentrauben-blatter, *G.*; Uva Ursina, *It.*; Gayuba, *Sp.*

The *uva ursi*, or *bearberry*, is a low evergreen shrub, with trailing stems, the young branches of which rise obliquely upward for a few inches. The leaves are scattered, upon short petioles, from half an inch to an inch long, obovate, or oblong-spatulate, acute at the base, obtuse at the apex, entire, with a rounded margin, thick coriaceous, smooth, shining, deep green on their upper surface, paler and covered with a net-work of veins beneath; furnished especially near the margin or near the midrib with minute hairs, which are usually abundant in young leaves, but may be few or absent in old leaves, especially those which have been much handled. The flowers, which stand on short reflexed peduncles, are in small clusters at the ends of the branches. The calyx is small, five-parted, reddish, and persistent. The corolla is ovate or urceolate, reddish-white, or white with a red lip, transparent at the base, contracted at the mouth, and divided at the margin into five short reflexed segments. The stamens are ten, with short filaments and bifid anthers; the ovary round, with a style longer than the stamens, and a simple stigma. The fruit is a small, round, depressed, smooth, glossy red berry, with an insipid mealy pulp and five cohering seeds.

This humble but hardy shrub inhabits the northern latitudes and high mountains of Europe, Asia, and America. On the American continent it extends from Hudson's Bay as far southward as New Jersey and Pennsylvania, in some parts of which it grows in abundance. It prefers a barren soil, flourishing on gravelly hills and elevated sandy plains. The leaves are the only part used in medicine. They are imported from Europe, but are also collected within our own limits, and the market of Philadelphia is supplied to a considerable extent from New Jersey. They should be gathered in autumn, and only the green leaves selected. In Europe the *uva ursi* is adulterated with the inert leaves of the

Vaccinium Vitis-Idaea L. (Cowberry, Mountain Cranberry); these may be distinguished by being obovate, having revolute margins which are sometimes slightly toothed, and the presence of fine blackish dots or bristly points upon their lower surface. Leaves of the *Chimaphila umbellata* (L.) Nutt., sometimes found among the uva ursi, may be readily detected by their greater length, their cuneiform-lanceolate shape, and their serrate edges.

Arctostaphylos glauca Lindl., *manzanita*, is a small tree or shrub indigenous in California, where it generally grows in dry and rocky places on the west of the mountain ranges. The leaves appear to possess properties similar to those of the official species. (See Flint, *A. J. P.*, 1873, p. 187.) The fruit of *A. arguta* Zucco, a Mexican species, is said to be a narcotic poison.

Properties.—Uva ursi is officially described as: " Usually more or less entire, laminae obovate or oblong-spatulate, from 12 to 30 mm. in length and from 5 to 13 mm. in breadth; summits obtuse or rounded; margins entire, slightly revolute; bases cuneate, tapering into short, stout petioles; upper surfaces dark green, glabrous and shiny, finely reticulate; under surfaces yellowish-green and slightly pubescent, especially on the midribs; coriaceous, fracture short; odor aromatic, tea-like; taste astringent and somewhat bitter. The powder is olive green; under the microscope it shows irregular fragments; epidermal cells polygonal, those of the lower surface showing broadly elliptical stomata about 0.035 mm. in length, surrounded by from 5 to 8 neighboring cells; cells of mesophyll with chloroplastids and frequently irregular masses of a carbohydrate; fragments of fibro-vascular bundles with spiral tracheae associated with narrow, strongly lignified sclerenchymatous fibers and frequently also with crystal fibers with mono-clinic prisms, from 0.006 to 0.015 mm. in diameter ; numerous fragments made up of cells having a yellowish-brown content which are colored a bluish-black upon the addition of ferric chloride T.S. Place 0.1 Gm. of powdered Uva Ursi on a watch crystal and cover with another watch crystal and gently heat the powder; a crystalline sublimate forms, consisting of long rods and feather-like aggregates which polarize light with a brilliant play of colors. Macerate 1 Gm. of powdered Uva Ursi with 10 mls of boiling water, shake the mixture occasionally until cold and then filter it; the filtrate yields a grayish-purple precipitate upon the addition of a few drops of ferrous sulphate T.S." *U. S.*

"Obovate or spatulate, about two centimetres long, yellowish-green, coriaceous, entire, shortly petiolate. Upper surface glabrous, shining, reticulate; veinlets depressed. Slight odor; taste very astringent." *Br.*

The commercial drug frequently consists of the entire plants and therefore contains a large quantity of stems. The latter should not be present, according to the official definition, in greater amount than five per cent. Farwell states that the leaves are sometimes very dark or blackish-green, which is probably due to carelessness in drying. (*M. R.*, xvii, p. 35.) Holm has contributed an interesting article on the morphology of the plant. (*M. R.*, xx, p. 95.)

Uva ursi leaves contain—besides tannic and gallic acids, bitter extractive resin, gum, fatty matter, and salts of potassium and calcium—two glucosides, *arbutin*, $C_{12}H_{15}O_7$, and *ericolin*, and a resinous principle, *urson*. The tannin is so abundant (6 or 7 per cent.) that the leaves are used for tanning in Russia.

Arbutin is somewhat widely diffused in the species of *Ericaceae*, such as *Chimaphila umbellata* (L.) Nutt., *Chimaphila maculata* (L.) Pursh, *Epigaea repens* L., and *Gaultheria procumbens* L. Kawalier (*Chem. Gaz.*, 1853, p. 61) obtained it from *uva ursi* by precipitating the decoction with lead acetate, filtering, treating the liquid with hydrogen sulphide, again filtering, evaporating to the consistence of syrup, and allowing the product to stand for several days. This gradually assumed the form of a crystalline jelly, which, being placed upon linen so as to allow the mother liquor to drain off, and then pressed, yielded nearly colorless crystals, which were purified by solution in boiling water and treatment with animal charcoal. Arbutin thus obtained is in long, acicular, colorless crystals, united in tufts, and of a bitter taste. It is soluble in water, alcohol, and ether, unchanged apparently by a heat of 100° C. (212° F.), but fusible at 167° to 168° C. (332.6° - 334.4° F.), without action on vegetable colors, and not precipitated by ferric salts or by lead acetate or subacetate. It is a glucoside, being resolvable by emulsin, or more rapidly by boiling with sulphuric acid, into glucose and *hydroquinone*, $C_6H_6O_2$ (*arctuvine* of Kawalier). The occurrence of methylhydroquinone among the products of decomposition led Hiasiwetz and Haber-mann to give the formula $C_{25}H_{34}O_{14}$ to arbutin, but Schiff showed that this was because arbutin was almost always accompanied by *methylarbutin*, $C_{12}H_{15}(CH_3)O_7+H_2O$. This compound

has been made synthetically by Schiff (*Ber. d. Chem. Ges.*, 1882, p. 1841) by acting upon arbutin with methyl iodide and potassium hydroxide in methyl alcohol solution, and purely synthetically by Michael (*Ber. d. Chem. Ges.*, 1885, p. 118) by the action of methylhydroquinone and acetochlorhydrone. It is decomposed by dilute acids into glucose and methylhydroquinone. Upon heating 1 part of arbutin with 8 parts of manganese oxide, 2 parts of sulphuric acid, and 1 part of water, it gives off the penetrating odor of quinone. The aqueous solution is rendered blue by a small quantity of solution of ferric chloride, and green by a larger quantity. No precipitate is produced by either acids or alkalis. It blackens ammoniacal solution of silver nitrate after boiling with diluted sulphuric acid, and throws down cuprous oxide from alkaline copper solutions upon heating. It dissolves in sulphuric acid, forming a colorless solution, turning red after a short time; a trace of nitric acid turns this solution yellow-brown. An aqueous solution (1 in 20) is not changed by hydrogen sulphide. A good test for arbutin is that of Julius Jungmann, as follows: When phosphomolybdic acid is added to a solution of arbutin previously rendered alkaline by ammonia or other alkali, a blue color is produced, which is deep when the solutions are strong, but observable even when they are very dilute. (*A. J. P.*, May, 1871, p. 204.)

After the extraction of arbutin there is obtained from the mother liquor *ericolin*, $C_{34}H_{56}O_{21}$. This is also found in many other ericaceous plants. It is glucosidal in nature and yields on decomposition, besides glucose, a volatile oil, *ericonol*. Another crystallizable principle has been discovered by Trommsdorf, who calls it *urson*, $C_{30}H_{48}O_3$. It appears to be of a resinous character, although it can be obtained in silky needles, being tasteless and inodorous, insoluble in water, difficultly soluble in alcohol and ether, fusible, at a higher temperature volatilizable, and inflammable in the air. It is obtained by treating uva ursi with a very small quantity of ether by percolation, allowing the ether to evaporate, washing the crystalline extract with ether, and recrystallizing from alcohol. (*A. J. P.*, xxvii, 334.)

A. G. Perkin has obtained from the leaves of uva ursi a yellow coloring principle of the composition $C_{15}H_{10}O_7$, crystallizing in glistening yellow needles. On fusion with alkali, phloroglucinol and protocatechuic acid were formed. Though resembling quercetin in these points, it forms deep green solutions with diluted potassium hydroxide. (*A. J. P.*, 1898, 584.)

Uses.—Uva ursi is used to-day almost exclusively in the treatment of catarrhs of the urinary tract, especially acute cystitis. Although by some it is believed to exercise an astringent and alterative influence on these membranes, it is probable that its action is simply that of a mild antiseptic. Lewin (*V. A. P. A.*, 1883, xcii, p. 517) attributes its virtues to the arbutin which is decomposed in the system liberating hydroquinone. Bass, however (*Z. E. P. T.*, 1912, x, p. 120), is doubtful whether enough hydroquinone can appear in the urine to exercise any antiseptic effect. But whether or not its virtue is due to arbutin or some other principle, the clinical evidence is strong that uva ursi is a useful drug in these conditions. Formerly it was also employed in *gravel*, *nephritis*, *urethritis*, and *menorrhagia*, but has been largely abandoned. Because of the formation of hydroquinone in the body the urine often acquires a greenish color from the use of uva ursi.

Arbutin has been employed in medicine not only for its antiseptic effect but also as a diuretic in doses of from one to three grains (0.065-0.2 Gm.).

Dose, powdered uva ursi, from twenty grains to a drachm (1.3-3.9 Gm.), to be repeated three or four times a day; but the fluidextract is always preferred.

Off. Prep.—Fluidextractum Uvae Ursi, *U. S.*;

Infusum Uvae Ursi, *Br.*; Elixir Buchu Compositum (from Compound Fluidextract of Buchu), *N. F.*; Fluidextractum Buchu Compositum, *N. F.*

Uzara. *Uzaron.*—Under this name the root of an undetermined African plant, probably belonging to the *Asclepiadaceae*, has been used both by the natives and European physicians in the treatment of *dysentery*, especially of the amoebic variety. Guerber and Frey (*A. E. P. P.*, 1913, lxxv, p. 75) have determined that it contains neither alkaloid nor tannin, but does contain non-nitrogenous glucosides which have a digitalis-like action upon the heart and diminish peristalsis of the intestines. It appears to owe its virtues in part to its amoebicidal action, but in part also to its effect upon the intestinal muscles.

Vaccinium. *Vaccinium crassifolium* Andr. (Fam. *Vacciniaceae*.) —The leaves of this American shrub are said to be astringent and diuretic, and capable of replacing uva ursi. Dose, of the fluidextract, from a half to one fluidrachm (1.8-3.75 mls).

VALERIANA. U. S. (Br.)

VALERIAN Valer.

"The dried rhizome and roots of *Valeriana officinalis* Linne (Fam. *Valerianaceae*)." *U. S.* "Valerian Rhizome is the dried rhizome and roots of *Valeriana officinalis*, Linn. Collected in the autumn." *Br.*

Valerianae Rhizoma, *Br.*; Valerian Root; Radix Valerianae Minoris, *R. Valerianae Sylvestris*, *R. Valerianae Montanae*; Common, Garden, Cat's or Great Wild Valerian, All-heal, Summer Heliotrope, Herb Bennet, Vandal Root; Valeriane officinale, *Fr. Cod.*; Racine de Valeriane, Valeriane, *Fr.*; Radix Valerianae, *P. G.*; Baldrian, Wilde Baldrianwurzel, Baldrian-wurzel, *G.*; Valeriana, *It.*; Valeriana (Rizoma de), *Sp.*

Official or great wild valerian (*Valeriana officinalis*) is a large, handsome, herbaceous plant, with a perennial rhizome, and an erect, round, channelled stem, from two to four feet high, furnished with opposite pinnate leaves, and terminating in flowering branches. The leaves of the stems are attached by abort, broad sheaths; the radical leaves are larger and long petiolate. In the former the leaflets are lanceolate and partially dentate, in the latter elliptical and deeply serrate. The flowers are small, white or rose-colored, agreeably odorous, and disposed in terminal corymbs interspersed with pear-shaped bracts. The number of the stamens is three. The fruit is a capsule containing one oblong-ovate, compressed seed. The plant is a native of Europe, where it grows either in damp woods and meadows or on dry elevated grounds. As found in these different situations, it presents characters so distinct as to have induced some botanists to make two varieties. Dufresne makes four, of which three prefer marshy situations. The variety which affects a dry soil (*sylvestris* L. Ph.) is not more than two feet high, and is distinguished by its narrow leaves.

The valerian plant is cultivated to some extent in New England and New York, and in Europe, in England and Holland. In this country it will grow in light, well-prepared, and well-drained soil, and is propagated by dividing the roots in the fall and setting these portions acids mentioned, forming corresponding esters with them: (4) at from 285° to 290° C. (545°-554° F.), a greenish, syrupy oil, which when rectified is colorless, and seems to have the composition of a *borneol oxide*, (C₁₀H₁₇)₂O. Schim-mel & Co. (*Schim. Rep.*, April, 1897) summarize the most recent researches upon valerian oil from different sources. In the oil from Dutch and Thuringian roots, the amount

varying from 0.5 to 1 per cent., they find pinene, camphene, borneol, bornyl formate, bornyl acetate, and *bornyl isovalerate*, together with a sesquiterpene and an alcohol, C₁₀H₂₀O₂. In the oil from Japanese roots (amounting to from 6 to 6.5 per cent.) (*Kesso oil*), they find pinene, camphene, dipentene, terpineol, borneol, bornyl acetate, bornyl isovalerate, and *kessyl acetate*. Trommsdorff ascertained the existence in the oil of *valeric acid*.

This acid is a colorless volatile liquid, of an oleaginous consistence, having an odor analogous to that of valerian, and a very strong, sour, disagreeable taste. It is soluble in thirty parts of water, and in all proportions in ether and alcohol. It combines with salifiable bases, forming soluble salts, which retain, in a diminished degree, the odor of the acid. (*J. P. C.*, xx, 316.) The acid does not pre-exist in the oil, but is produced by the decomposition of its borneol ester. Valeric acid is obtained by distilling the impure oil with magnesium carbonate, decomposing by sulphuric acid the magnesium valerate which remains, and again distilling. The following process by T. and H. Smith, of Edinburgh, avoids the inconvenience of distilling so bulky a root as valerian, while it answers the same purpose as that of Rabourdin. Boil the root for three or four hours with rather more than its bulk of water in which an ounce of sodium carbonate is dissolved for every pound of the root, replacing the water as it evaporates. Express strongly, and boil the residuum twice with the same quantity of water, expressing each time as before. Mix the liquids, add two fluidrachms of strong sulphuric acid for every pound of the root, and distil until three-fourths of the liquid have passed over. Neutralize this with sodium carbonate, concentrate the liquid, decompose the sodium valerate contained in it by sulphuric acid, and collect the valeric acid set free, by a separator, funnel, or by distillation. (*A. J. P.*, xvii, 253.) Lefort obtains the acid by the rapid oxidation of the volatile oil. He distilled 100 parts of the root with 500 of water, 10 of sulphuric acid, and 6 of potassium dichromate, and in this way procured a larger proportion of acid than by any other process. (*J. P. C.*, 3e ser., x, 194.)

Uses.—Valerian is used as a sedative to the higher nerve centers in conditions of *nervous unrest*, *hysteria*, *hypochondriasis*, *neuralgic pains*, and the like. The virtues of the plant seem to depend chiefly on the esters of valeryl which are contained in the volatile oil. According to Chevalier (*Nouv. Rem.*, 1912, xxix, p. 169), the volatile oil of valerian is a depressant to the whole central nervous system, including both the

motor and psychical centers of the brain and the motor cells of the spinal cord. The esters contained in this drug are unstable bodies and in the process of drying largely oxidized with the formation of valeric acid. As the latter is practically without physiological action much of the virtue of the plant is lost during the drying process. Probably for this reason preparations of this drug are very uncertain in their activity and valerian has largely fallen into disrepute. Chevalier has introduced the juice of the fresh root which he asserts is a valuable remedy not only for the conditions mentioned above, but even as a narcotic in *insomnia* and an anticonvulsant in *epilepsy*. The dose of this juice, which has been introduced under the name of *energetene of valerian*, is one to three coffeespoonsful. It appears also to have some slight influence upon the circulation, slowing the heart and increasing its force, and causing a rise in blood pressure, and has been used in the treatment of cardiac palpitations.

Dose, twenty to forty grains (1.3-2.6 Gm.). The dose of the oil of valerian, which is occasionally employed, is four to five minims (0.25-0.3 mil).

Off. Prep.—Tinctura Valerianae, *U. S.*; Tinctura Valerianae Ammoniata, *U. S., Br.*; Fluidextractum Valerianae, *N. F.*

VALERIANÆ INDICÆ RHIZOMA. Br.

INDIAN VALERIAN RHIZOME

"Indian Valerian Rhizome is the dried rhizome and roots of *Valeriana Wallichii*, DC." *Br.*

Valeriana Wallichii is a perennial herb growing in the temperate Himalayas and in the Khasia Mountains. The rhizome is more largely used as a perfume than in medicine. It is used in preparations for the hair and the dried rhizome is used as an incense. It is officially described as follows: "Rhizome curved, about five centimetres long, from five to ten millimetres thick, dull brown, with raised transverse leaf-scars, numerous prominent root-sears and a few thick roots; the crown bearing the remains of petioles. Fracture short. In transverse section, dark with a large pith and diffuse ring of small wood-bundles. Strong, characteristic, disagreeable odor; taste unpleasant, camphoraceous." *Br.*

According to Lindenberg (*Ph. Z. R.*, 1886), Indian valerian is practically identical in its composition with the European drug, but contains a slightly larger amount of volatile oil. It may be employed in the same class of cases as valerian.

Off. Prep.—*Tinctura Valerianae Indicae Ammoniata, Br.*

Valonia. *Acorn Cups. Vallone, Velanede, Gallon, Fr. Knoppenn, Walonen, G.*—The great cups of the acorns of the *Quercus Aegilops* L. (Fam. *Cupuliferae*), a native of Bosnia, contain a very large percentage of tannin. They are extensively exported for dyeing and tanning, and have been employed as an astringent in diarrhea.

Vandellia. *Vandellia diffusa* L. (Fam. *Scrophulariaceae*).—This is an herb of Paraguay, said to be used by the natives as an emetic. (*P. J.*, 1872, 849.)

Vanilla. *N. F. IV (U. S. P. VIII). Vwiilla Bean. Vanille, Fr. Cod. Fructus Vaniliae, P. G. Vanille, G.*—"The cured, full-grown, unripe fruit of *Vanilla planifolia* Andrews (Fam. *Orchidaceae*)." *N. F.*

Vanilla planifolia is a fleshy, dark green, perennial climbing plant, with a very long, smooth, dark green stem, much branched, and furnished at the nodes with aerial roots, which cling to the tree or the wooden framework supporting the plant. The dark green, tough leaves are alternate, oval, sessile, attenuate at the apex, fleshy and veinless. The pale greenish-yellow, sessile flowers are about two inches in diameter, and occur in loose, axillary racemes of eight or ten. The fruit is a slender pod, seven or eight inches long, filled with an oily mass containing numerous small, black, shining seeds.

This plant is a native of the West Indies, Mexico and South America, but is now extensively cultivated. The plant does well from the sea-level up to two thousand feet of altitude, requiring for its perfection, however, a moist, hot climate, with an habitual dry summer spell which seems to be necessary to bring good flowering. It is propagated by means of cuttings, sometimes two or three feet in length, but preferably from ten to twelve feet long, taken from growing shoots; these are planted after the dry season is over and should produce flowers in two years. Preferably placed upon trees, but sometimes on long stakes, trellises, wire supports, etc., the slip is placed with one end on the ground, covered with leaves or some light top dressing. In many cases the vines are planted so closely as scarcely to leave room for cultivators to pass, but it has been found that under these circumstances the vanilleries are especially liable to destructive fungous diseases. As the flower does not fertilize itself, fertilization (pollination) by hand is necessary; it is usually performed by women and children. It is said that a fairly trained workman can fecundate over one hundred flowers per hour. In most localities not more than thirty fertilized flowers should be left to a plant. The pods reach their full size in from five weeks to eight months, according to the altitude of the locality and to the amount of shade. The first indication of ripening is a slight yellowing of the whole pod; as soon as this occurs the

Pods should be picked, and sorted, and the curing process commenced. If left to ripen further the pods are prone to split and otherwise deteriorate. For the purpose of curing them the pods are kept in a heated room for some days (about 110° F.), then transferred to a cooler one (90° F.), and finished at ordinary temperature. During the process, which lasts some months, there is a loss of 70 to 80 per cent. of weight. For details as to culture, see Bulletin 21, 1898, U. S. Department of Agriculture, Division of Botany. The practice of curing the beans by placing them under blankets in the sun is still in vogue, but that of using a regulated artificial heat is more certain, and it is the modern method.

When thoroughly cured the beans are sorted and tied into bundles, which are wrapped in sheet lead or placed in small metallic boxes. In doing this it is essential that the bundle be wrapped in a thin vegetable parchment paper, as chemical action occurs when the beans come in contact with the metal.

Fruits which have not been picked early enough are inferior and are frequently cut into short pieces and sold as "cuts." If by chance the fruit should be picked too early the quality of the resulting product is distinctly inferior. The fruit as first picked has no aroma, the vanillin during the process of curing being produced from the glucoside *coniferin* in the interior of the fruit. This was shown to be converted into *coniferyl* alcohol and glucose, and the former of these subsequently changed into vanillin.

The cultivation of vanilla has extended from South America throughout the tropics, so that at present, although the wild plant is abundant in the Mexican States of Vera Cruz and Oaxaca the vanilla of the markets comes almost exclusively from vanilleries. Holland is supplied from Java plantations; France from Tahiti, Madagascar, Reunion, Guadeloupe, and other of her colonies. From Mauritius and the Seychelles the product goes to London. In the markets most of the varieties are known by the name of the country in which they are produced. The finest of the varieties is the Mexican, although of recent years the Bourbon beans have so improved that they almost rival it in strength and flavor. At present the Mexican bean is sold at somewhat less than double the price of the Bourbon; the Bourbon at almost double the price of the Tahiti, the latter bean being commonly much injured by carelessness in the process of curing.

Of *Mexican vanilla*, the first quality occurs in pods from 15 to 20 cm., long, flattened, 6 to 8 mm. in diameter, with the lower end slightly attenuated, the upper end gradually tapering for about a quarter of the length of the pod, usually curved and slightly twisted near the point. The color is dark brown, the pods fairly plump, the surface ridged longitudinally, and with an incrustation of fine crystals beginning at the ends, gradually extending; when fresh somewhat viscid, but always roughish to the touch. For an interesting account of the Mexican vanilla plant by Charles E. Hires, see *A. J. P.*, 1893, 576.

Of the Mexican vanillas the most valuable variety, called *ley*, or *vainilla mansa*, by the Spaniards, consists of cylindrical, somewhat flattened pods, six or eight inches long, three or four lines, thick, nearly straight, narrowing towards the extremities, bent at the base, shining and dark brown externally, wrinkled longitudinally, soft and

flexible, and containing within their tough shell a soft black pulp, in which numerous minute, black, glossy seeds are embedded. It has a peculiar, strong, agreeable odor, and a warm, aromatic, sweetish taste. The interior pulp portion is most aromatic. In it are more or less numerous, minute crystals. Another variety, called *vainilla simarona* by the Spaniards, is smaller, of a lighter color, and less aromatic. The pods are said to be very dry and to contain no vanillin. (*Nueva Farmacopea Mexicana*.) According to Schiede, it is yielded by a distinct species, the *Vanillasylvestris* Schiede. A third variety is the *vainilla pompona* of the Spaniards (*boba vainilla*, or *platano vainilla*). In this, the pods are from 12 to 18 cm. long, from 12 to 18 mm. broad, shaped somewhat like a plantain, almost always open, very dark brown or nearly black, soft, viscid, and of a strong odor. Schiede states that it is the product of the *Vanilla Pompona* Schiede. The variety *vainilla vezacate* is said to be derived from pods gathered long before maturity. (*Nueva Farmacopea Mexicana*.) The *vainilla pompona* of the Spaniard is evidently the *vanillons* of European commerce, which are usually from 10 to 13 cm. long and from 15 to 25 mm. in diameter, frequently sharply angled, brown to red-brown in color, usually split open and free from efflorescence. Owing to the transverse markings by twine with which they have been wrapped during the process of curing, the beans have a peculiar twisted appearance. Their odor, which resembles that of heliotrope, is due to the presence in them of *heliotropin*, in lieu of *vanillin*.

Bourbon vanilla, produced in the Isle of Reunion to the amount of 200,000 pounds a year, resembles Mexican vanilla, but is scarcely so long in the tapering portions, is of a dark-brown almost black color, is not so firm as the Mexican, has the surface smooth and waxy, and soon becomes covered with a coating of acicular crystals known as "frost." The odor of this vanilla is said to resemble that of Tonka bean rather than that of Mexican vanilla.

The *Seychelles* and *Mauritius vanilla* (*inferior Bourbon* of the trade) has the pods about six inches in length, not over a quarter of an inch in width, and characterized by the pale color, the faint odor, and a smooth but not waxy surface.

South American or *Guadeloupe vanilla* resembles the Mexican bean, but is usually recognizable, when the bean is entire, by the latter being broad and flattened, usually half an inch or more wide, slightly tapering at the lower end, and at the upper sharply attenuated an inch or so at the point. It has a reddish brown color, and is of a rank odor. It is very pulpy, with a surface intermediate in feel between the Bourbon and the Mexican, and having but few crystals. One variety of this vanilla, sold under the name of *vanillons*, has the odor of heliotrope and is much used by perfumers and tobacco manufacturers.

Tahiti vanilla, "*transplanted Mexican vanilla*," has its pods from six to seven inches long, flat, from three-eighths to half an inch wide, with a reddish-brown color. They are almost destitute of vanilla flavor, and have an odor suggesting heliotrope. It is said they contain piperonal and also vanillin. (*Ph. Cb.*, 45.)

Java vanilla, which is almost exclusively consumed in Holland, has a pod from four to six inches long, with a flavor as fine as that of the Mexican bean, and a much stronger

odor.

Vanilla pods are described by the N. F. as:

"Pods linear, flattened, from 15 to 35 cm. in length and from 5 to 9 mm. in breadth: summits terminating in flat circular scars; gradually tapering, more or less bent and curved or hooked at the bases, or in the Tahiti variety, broad in the middle and tapering towards either end, the base closely resembling the summit; externally blackish-brown, longitudinally wrinkled, moist-glossy; occasionally with an efflorescence of vanillin in the form of acicular crystals or mono-clinic prisms; frequently with narrow, elliptical or irregular, more or less wrinkled, dark-brown patches of cork; occasionally split into three parts near the tip, flexible and tough, one-celled, containing a blackish-brown pulp and numerous blackish-brown seeds; the latter being flattened, irregularly triangulate or nearly circular in outline, reticulate and varying from 0.25 to 0.3 mm. in diameter. Odor and taste characteristic and

very agreeable. Under the microscope, transverse sections of the pods of *Vanilla* show an epidermis with a somewhat thickened outer cuticularized layer having occasionally rounded or conical masses of an excretion of a gum-like substance; a layer of collenchyma of one or two rows of cells; a thick sarcocarp composed of parenchyma cells in which are imbedded an interrupted circle of fibrovascular bundles; the parenchyma cells are deeply undulate in outline and usually contain a thin protoplasmic layer enclosing numerous oily globules or may contain bundles of raphides of calcium oxalate; the individual crystals varying from 0.2 to 0.4 mm. in length; some of the parenchyma cells are specially modified and distinguished by their somewhat thickened walls with long, oblique, slit-like pores or the thickening may extend in the form of broad, spiral bands; in the fibrovascular bundles the phloem is central, being more or less surrounded by a few tracheae, the walls possessing; slit-like pores or spiral thickenings, and at the outside of the bundle is a closed circle of sclerenchymatous fibers, the walls being thin, strongly lignified, provided with numerous, transverse, simple pores, the outer wall of the outer row of fibers being irregular or sinuate; from the inner walls of the endocarp arise the placentae bearing numerous brownish-red or blackish seeds, and from the cells of the endocarp also arise numerous long, nearly straight hairs, the ends being rounded, the hairs being more or less matted together by a gummy or resinous mass in which some of the seeds are held; in mounts made in hydrated chloral T.S. or potassium hydroxide T.S., the immature, brownish-red seeds show a deeply reticulate seed-coat, with cells of an oblong-polygonal form in surface view. Place a few of the crystals, occurring as an emorescence on the fruit, on a microscope slide or watch crystal and add a drop of phloroglucinol T.S. and hydrochloric acid; the solution immediately acquires a carmine-red color (distinction from *benzoic acid*). The amount of extractive yielded to dilute alcohol should not be less than 12 per cent. *Vanilla* yields not more than 6 per cent. of ash." *N. F.*

Transverse sections of the pods of vanilla show an epidermis with a somewhat thickened outer cuticularized layer having occasionally rounded or conical masses of an excretion of a gum-like substance; a layer of collenchyma of one or two rows of cells; a thick sarcocarp composed of parenchyma cells in which are imbedded an

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A characteristic test for the vanillin crystals which occur as an efflorescence on the fruit is as follows: On a microscope slide or watch crystal, place a few crystals and add a drop of phloro-glueinol T.S. and hydrochloric acid; the solution immediately acquires a carmine-red color (distinction from *benzoic acid*). The amount of extractive which vanilla of good quality yields to dilute alcohol should not be less than 12 per cent. Nor should it yield more than 6 per cent. of ash.

Vanilla beans from which the vanillin has been removed by means of a solvent are sometimes offered for sale. The fraud is to be detected by the absence of flavor and odor. Such beans, and also beans of an inferior quality, are sometimes "improved" in appearance and in odor by the use of benzoic acid. For the detection of this fraud the pharmacist should avail himself of the fact that while the crystals of benzoic acid are flattened and rhomboidal and generally lie upon the bean, those of vanillin are usually acicular and stand out at right angles from the surface of the fruit. The absence of the crystalline coating on the vanilla beans seems to be no proof of inferiority, for Henri Lecomte affirms that it is not rarely absent in the best Mexican bean. (*B. Sc. Pharm.*, 1901.)

According to Bucholz, vanilla does not yield volatile oil when distilled with water, and the aroma appears to depend on chemical changes which may take place during and after the curing of the fruit. Many years since, vanilla was analyzed by Bucholz and Vogel, the former of whom found in it a disagreeable-smelling fixed oil, a soft resin having a feeble odor of vanilla when heated, a bitterish extractive resembling tannin, sugar, starch and benzoic acid. But the characteristic odorous principle was not isolated until Goble obtained *vanillin*, by acting on vanilla with solvents. Although the latter substance has been largely manufactured, it does not take the place of the preparations of vanilla, the flavor and odor of the latter being greatly preferred. It passes with water in distillation. If vanilla, finely divided, be distilled with water, a turbid liquid passes, which becomes clear by agitation with ether, and the ether on evaporation yields crystals of vanillin. Vanilla, in the fresh state in which it is

gathered, does not in the least possess the characteristic fragrant odor. H. Lecomte (*J. P. C.*, 1903, 343) studied the conditions which bring about the formation of vanillin. According to his researches, there exist in the vanilla plant two ferments, which differ in a marked degree from each other in their functions. The one, an oxydase, is present in the individual organs of the plant, such as the leaves, shoots and their aqueous extracts, in the green and ripe fruit, and in the prepared commercial fruit. Lecomte detected it in the organs of plants of different origin, by means of G. Bertrand's reactions. At the same time, the presence of manganese salts was observed in all products, which renders it not impossible that they stand in some relation to the above-named ferment. The second ferment is contained in the sap of the vanilla, and acts as a hydrolyzing ferment. With regard to the mechanical treatment of vanilla, it would appear in the first instance as if it counteracted the function of the ferment. It consists, as is well known, of the immersion of the fruit during twenty seconds in water at 85° C. (185° F.), a manipulation which might bring about the destruction of the ferment. But the author has convinced himself that a temperature of about 50° C. (122° F.), such as the interior of the fruit probably only reaches during the short duration of the process, really promotes the function of the oxydase. Both ferments, the oxydase as well as the one possessing the hydrolytic action, appear to be necessary for the formation of vanillin in the plant, and their action may possibly be explained thus: During the preparation, the coniferin produced by the plant is split up into glucose and coniferyl alcohol. This process would explain also the occurrence of grape-sugar in vanilla. The oxydase then converts the coniferyl alcohol into vanillin. Tiemann and Haarmann obtained from Mexican vanilla 1.69 per cent. of vanillin, from Reunion vanilla 2.48 per cent., from Java vanilla 2.75 per cent. Stokeby found in vanilla, resin, wax, a fixed oil, a brown resinous matter, tannic acid changing the salts of iron to green, gum, sugar, phosphates and sulphates: hydrochloric acid separated from it oxalic acid, and potassium hydroxide, humic acid. (*J. P. C.*, 4e ser., iii, 76, 1866; see also paper by Clay W. Holmes, *Proc. A. Ph. A.*, 1887, 526.)

Vanilla is used in the N. F. IV in making the tincture of vanilla (10 per cent. with a menstruum of alcohol and water), which is used as a flavoring agent in *elixir of ammonium valerate*, *elixir of hops*, *elixir of strychnine valerate* and *syrup of the bromides*.

Vanilla Poisoning.—Many years ago Orfila reported cases of violent gastro-intestinal irritation from eating vanilla ices, and since then others have reported similar instances of poisoning. In 1886 Vaughan in the investigation of an ice cream which had caused serious poisoning in eighteen persons found that the vanilla used to flavor it, in doses of 30 drops failed to produce any symptoms in either himself or his assistants, and he was able to separate the ptomaine tyrotoxon, which he had previously found in other milk food (see *A. J. P.*, xvi, p. 452). It is highly probable that many of these cases are due to ptomaine poisoning rather than vanilla poisoning; but if the one reported by Rosenthal (*P. J.* xv, p. 24) be accurately stated it must be allowed that in some instances the vanilla itself is at fault. In this connection the reports of Claverie (*J. P. C. Supp.* 1908, xxv) of violent dermatitis in workmen handling vanilla beans is of interest. He attributes the symptoms to the oily exudate of the vanilla pods.

VERATRINA. U. S.

VERATRINE Veratrin. [Veratria]

" A mixture of alkaloids obtained from the seed of *Asagraea officinalis* (Chamisso and Schlechtendal) Lindley (Fam. Liliaceae). Preserve it in well-closed containers, protected from light." *U. S.*

Veratrine, *Fr. Cod*; Veratrinum, *P. G.*; Veratrin, *G.*; Veratrina. *It., Sp.*

No process is given in the *U. S. P. IX* for preparing veratrine and the *Br. Pharm.*, 1914, deleted it. A process will be found in the *U. S. D.*, 19th edition, pages 1327 and 1328.

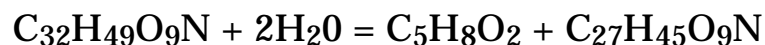
In the *U. S.* process of 1870 the first step is to obtain a tincture of cevadilla, which is evaporated to the consistence of an extract. This contains the veratrine combined with a vegetable acid, probably gallic, as it exists in the seeds. From the extract the alkaloid is dissolved by the acidulated water, which at the same time converts it in great measure into a sulphate, a small portion possibly remaining in the solution combined with an excess of the natural acid. The magnesia combines with the acids and throws down the veratrine, which is then taken up by alcohol and again yielded in a purer state by evaporation. To purify it still further, it is redissolved in water by the agency of sulphuric acid, is submitted to the action of animal charcoal, and is finally precipitated by ammonia. In the British process, the tincture was concentrated until it began to let fall a precipitate, and was then poured into water, which throws down the resin and oil with a portion of the coloring matter and retains the salt of veratrine. This is then decomposed by ammonia, and the precipitated veratrine is slightly washed with cold water to free it from adhering impurities. If much water be employed in the washing, a considerable portion of the veratrine will be lost, in consequence of impure veratrine being in some degree soluble in water. The remaining steps of the British process consist in the purification of the veratrine by forming a hydrochloride in solution, decolorizing this by animal charcoal and again precipitating by ammonia.

The *U. S.* process of 1870 is essentially that of Couerbe. The veratrine obtained by it, though not pure, is sufficiently so for medicinal use. A drachm of it, in this state, may be procured from a pound of cevadilla. Meissner, in 1819, applied the term *sabadilline* to an alkaloid extracted

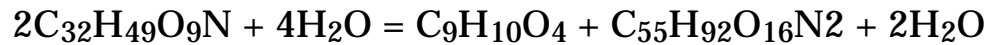
by him. Pelletier and Caventou had probably produced the same preparation when they announced the discovery of veratrine in the same year. This substance is the veratrine described as prepared by Couerbe's process. Couerbe, in 1834, announced the discovery of an additional alkaloid, to which he gave Meissner's old name of sabadilline, and Weigelin, in 1871, announced the discovery of a third alkaloid, which he called *sabatrine*. G. Merck, in 1855, obtained veratrine in a crystallized state by solution and separation from strong alcohol.

Wright and Luff (*J. Chem. S.*, 33, p. 338) have brought order from this confusion by a careful study of the whole subject. They found three alkaloids in *sabadilla* seeds: *cevadine*, $C_{32}H_{49}O_9N$ (the alkaloid hitherto known as the veratrine of Merck); *veratrine*, $C_{37}H_{53}O_{11}N$; and *cevadilline*, $C_{34}H_{53}O_8N$. Of these, the *cevadine* (formerly veratrine) forms, when crystallized from alcohol, needles or compact crystals which fuse at $205^{\circ} C.$ ($401^{\circ} F.$), effloresce rapidly in the air, and become opaque, are insoluble in water, easily soluble in alcohol and ether, and dissolve in warm concentrated hydrochloric acid with a dark violet color, which on boiling becomes intensely red. When heated with alcoholic potassium hydroxide they are decomposed into *methyl-crotonic (tiglinic) acid* and *cevine*, $C_{27}H_{43}O_8N$. The veratrine of Wright and Luff is obtained from the mother liquor of the *cevadine* by extraction with ether. It forms an uncrystallizable resinous mass, fusing at $180^{\circ} C.$ ($356^{\circ} F.$), but yields crystallized salts. Boiled with sodium hydroxide it is decomposed into *dimethyl-protocatechuic (veratric) acid* and *verine*, $C_{28}H_{45}O_8N$. *Cevadilline* remains after the extraction of the veratrine, insoluble in ether. It is also uncrystallizable, nearly insoluble in ether and in boiling benzene, but easily soluble in fusel oil.

Fluckiger recognized only two of these alkaloids, and made them both of the composition $C_{32}H_{49}O_9N$. The first, which he called *cevadine*, he stated is decomposed by boiling with barium hydroxide when in alcoholic solution, and yielded products as follows:



The first of these products is *methyl-crotonic acid*, and the second is *cevine*. The other alkaloid he called *veratridine*, and gave its decomposition as follows:



The first of these products is *dimethyl-protocatechuic acid*, and the second he called *veratroin*. (Fluckiger, *Pharm. Chem.*, 1888, ii, p. 532.) Merck still terms the cevadine of Wright and Luff veratrine, and prepares it in white crystals of the formula $C_{32}H_{49}O_9N$, fusing at 202° C. (395.6° F.). Frankforter (*A. J. P.*, 1897, 372) confirmed this formula, $C_{32}H_{49}O_9N.H_2O$, but gave to the purified veratrine the melting point from 146° to 148° C. (294.8° - 298.4° P.).

Two acids have also been found in *sabadilla*— the *sabadillic* or *cevadic acid* of Pelletier and Caventou, forming needle-like crystals fusing at 20° C. (68° P.), and the *veratric acid* of Merck, which Koerner showed to be dimethylproto-catechuic acid.

Uses.—Probably because of its unfortunate name it has been assumed by some that veratrine represents the therapeutic virtues of *veratrum*. Its physiological action, however, differs greatly from that of *veratrum*, and if it possess any therapeutic usefulness it is certainly not for the conditions for which *veratrum* is employed.

Veratrine is an intense local irritant and somewhat locally anesthetic. Rubbed upon the skin it excites a sensation of warmth and a peculiar tingling. Sometimes an evanescent blush is produced and still more rarely an eruption upon the skin, but generally no decided signs of inflammation are evinced. When taken into the mouth it produces an almost insupportable sense of acrimony, and snuffed up the nostril it produces violent sneezing, and when taken into the stomach in large doses it causes violent vomiting, serous purging with intense burning in the mouth and throat and general muscular weakness. It is a powerful muscle poisoning and if given in sufficient dose in the lower animals it causes an extraordinary prolongation of the contraction of the striated muscles; the time required for relaxation of voluntary muscles may be 20 or 30 times as long as normal. A similar influence is exerted upon the ventricular muscles, at least in the frog, but the slowing of the heart rate seen in warm blooded animals seems to be due chiefly to stimulation of the cardio-inhibitory center. Death in mammals is generally due to depression of the respiration.

The only justifiable therapeutic use of veratrine is as an anodyne counter-irritant in *neuralgias* and various forms of *arthritis*. Even for this purpose it has no advantages sufficient to offset the dangers of systemic poison which might follow from its absorption.

Dose, one-thirtieth of a grain (0.002 Gm.).

Off. Prep.—Oleatum Veratrinae, *N. F.*; Uguentum Veratrinae, *N. F.*

VERATRUM VIRIDE. U. S.

VERATRUM VIRIDE Verat. Vir. [Green Hellebore, American Hellebore]

" The dried rhizome and roots of *Veratrum viride* Alton (Fam. *Liliaceae*), without the presence or admixture of more than 5 per cent. of stems or other foreign matter." *U. S.*

Big or False Hellebore, Swamp Hellebore, Indian Poke, Itch-weed, Tickle-weed, Bugbane; Veratre vert, Fr.; Gninger Germer, (?; Vedegambre verde, Sp.

In the several revisions of the U. S. Pharmacopoeia, *veratrum* has been handled in a vacillating manner. In 1880 and 1890 the drug was restricted to that obtained from *V. viride*. In 1900 both *V. viride* and *V. album* were recognized, this being done for reason of the large importations of *Veratrum* (*V. album*) and there being no practical method of distinguishing between these two drugs. The U. S. Pharmacopoeia IX has wisely restricted the definition, in the interest of uniform medicine, to *V. viride*. This, however, may offer some practical commercial difficulties as it is not always easy to differentiate its substitution by *V. album*, and certainly it is almost impossible to detect an admixture with the European drug.

That the two species are very closely allied, and the two rhizomes histologically, chemically, and toxicologically very similar is indisputable, but similarity is not identity. The European plant seems to be more actively poisonous than is the American, and has been said by some chemists to contain a larger proportion of the alkaloids. It usually also has a distinctly greater action upon the intestinal tract and it is probable that the proportionate amounts of the alkaloids differ in the

two species. The conclusions reached in an elaborate physiological research made by H. C. Wood and H. C. Wood, Jr., for the Committee of Revision of the U. S. VIII was that the drugs can scarcely be distinguished physiologically, but that the European plant is more likely to disturb the intestines and that in the absence of any cogent reason for recognizing *V. album*, *veratrum viride* should alone be retained.

The American hellebore, *Veratrum viride*, known also by the names of *Indian poke*, *poke root*, and *swamp hellebore*, has a perennial, thick, fleshy rhizome, the upper portion of which is tunicated, the lower solid, and beset with numerous whitish roots. The stem is annual, cylindrical, striated, pubescent, and solid, from three to six feet in height, furnished with bright green leaves, and terminating in a panicle of greenish-yellow flowers. The leaves gradually decrease in size as they ascend. The lower are from six inches to a foot long, oval, acuminate, plaited, nerved, and pubescent, and embrace the stem at their base, thus affording it a sheath for a considerable portion of their length. Those on the upper part of the stem, at the origin of the flowering branches, are oblong-lanceolate. The panicle consists of numerous flowers, distributed in racemes with downy peduncles. Each flower is accompanied by a downy, pointed bract, much longer than its pedicel. The perianth consists of six oval acute segments, thickened on the inside at their base, with the three alternate segments longer than the others. The six stamens have recurved filaments and roundish two-lobed anthers. The ovary is ovoid, tri-carpellary; styles three and persistent. Some of the flowers have only the rudiments of pistils. Those on the upper end of the branchlets are barren, those below fruitful. The fruit is a three-lobed capsule, three-celled, and containing flat imbricated seeds. This indigenous species of *veratrum* inhabits swamps, wet meadows, and the banks of mountain streamlets. It is more abundant northward, but reaches as far south as Georgia. From May to July is the season for flowering. It is doubtful whether the rhizome should be collected in autumn or just before flowering. It should be thoroughly dried and carefully preserved, as otherwise it deteriorates.

Veratrum album L. (*V. viride* Roehl., but not *V. viride* Alton.).—The specific difference between this plant, which is a native of Europe and Northern Asia, and *V. viride* of North America has been questioned by various botanists, but it is now generally acknowledged that the two species are distinct. (See *Index Kewensis*; also Engler and Prantl.) *V. album* resembles closely the American species, but is distinguished by its

yellowish-white flowers. The rhizome of *V. nigrum* of Central Europe is said to be sometimes substituted for that of *V. album*, but is much smaller. According to the Pharmacographia, that of the Mexican species, *V. frigidum* Schl., exactly resembles that of *V. album*.

Properties.—As found in commerce, veratrum is usually in small pieces or fragments, but sometimes it comes whole or sliced, so that its characteristic form may be observed. In this condition it is seen to consist of a rhizome one to three inches in length by somewhat less than an inch in thickness where broadest, tapering to a very obtuse or truncated extremity, simple or divided, compact but light, of a dark-brown color externally, and either closely invested with numerous yellow rootlets often several inches long, or exhibiting marks on the surface whence they have been removed. When sliced, the cut surface is of a dingy-white color. The rootlets are from three to six inches long, about as thick as a large knitting needle, or somewhat thicker, obviously much shrunk in drying, and marked by numerous closely set indentations, which give them a characteristic appearance. Not unfrequently portions of the dried stem or leafstalks remain attached to the rhizome, which should always be rejected, as they were ascertained by Procter to be inert. (*A. J. P.*, 1864, p. 99.)

Veratrum Viride is officially described as follows : " Rhizome upright, obconical, usually cut longitudinally into 2 to 4 pieces, from 2 to 7 cm. in length and from 1.5 to 3 cm. in diameter, externally light brown to dark brown or brownish-black, frequently bearing at the summit numerous, closely arranged, thin leaf-bases, otherwise rough and wrinkled, somewhat annulate from scars of bud-scales and bearing in the outer portion numerous roots, the lower part more or less decayed; fracture hard and horny; internally yellowish or grayish-white, marked with numerous, irregular fibre-vascular bundles; inodorous but sternutatory; taste bitter and acrid. Roots nearly cylindrical, from 3 to 8 cm. in length and from 1 to 3 mm. in diameter; externally light brown to yellowish-brown, deeply transversely wrinkled; fracture short, bark whitish, very thick, enclosing a porous central cylinder. The powder is grayish-brown to dark brown, strongly sternutatory; under the microscope it exhibits numerous starch grains from 0.003 to 0.02 mm. in diameter, spherical or ellipsoidal, single or 2- to 3-compound, the individual grains being often swollen or otherwise more or less altered; calcium oxalate in raphides, from 0.035 to 0.15 mm. in length; fragments with tracheae, the walls being more or less strongly lignified and marked with scalariform or

reticulate thickenings, frequently containing a lemon-yellow substance and associated with narrow, slightly lignified, porous, sclerenchymatous fibers; reddish-brown or brownish-black cork fragments occasional." *U. S.*

It has been asserted that the color of *V. album* is much lighter than that of *V. viride*, but this certainly is practically incorrect, however it may apply to carefully preserved specimens. Very commonly the roots have been removed from commercial *V. album*, while in America they are generally allowed to remain on the rhizomes. According to R. H. Denniston, no microscopic differences can be detected in the rhizomes, but in the roots distinction is possible owing to the fact that directly beneath the epidermis in the *V. viride* the collenchyma region consists of but two or three rows of large, irregular and distorted cells, while in *V. album* this region is generally made up of seven to eight rows of rounded, thicker-walled and smaller cells, which are not in the least distorted. Any such test is, of course, inapplicable to the drug in powder. In the color test proposed by R. H. Denniston, sulphuric acid is added to the powder; with *V. album* a brick-red color, with *V. viride* an orange-red color, will be produced. Of course the test is of little value in determining the character of a powder, as it does not possess sufficient differentiation.

The pharmacognosy of *V. viride* has been well illustrated by Bastin (*A. J. P.*, 1895, p. 196). The structure of *V. album* has been presented by Meyer (*Arch. d. Pharm.*, 1882, p. 81; and in "*Wissenschaftliche Drogenkunde*," vol. 2, p. 46). Rosenthaler has submitted veratrum to pyroanalysis and has obtained a sublimate which is in part crystalline and gives a yellowish-red color with sulphuric acid. (*Apoth. Zeit.*, xxviii, p. 991.)

(much chemistry deleted)

Uses.—The various alkaloids present in veratrum act upon the system in very different manners, and none of them appears to exercise exactly the same action as the whole drug. According to H. C. Wood (*Phila. Medical Times*, 1874, iv, p. 737), jervine is a depressant to the respiratory center, to the vasomotor center, and to the heart muscle, and also lowers reflex activity by an effect upon the spinal cord, and rubijervine is chiefly a stimulant to the cardio-inhibitory mechanism, but has a more depressant action upon the respiratory center. According to Eden (*A. E. P. P.*, 1892, xxix, p. 440), small doses of protoveratrine

stimulate cardiac inhibition thereby causing a lowering of the blood pressure. In large doses there is a secondary paralysis of inhibition accompanied by rise in the pressure. In large quantities it also exercises a poisonous effect upon the voluntary muscles similar to that of veratrine. Rubijervine is present in such small proportions (according to Breideman, *J. P.*, 1906, lxxxiv, 0.053 per cent.) and is so feeble a substance that it is improbable that it plays any part in the physiological action of the drug. Jervine, although present in larger quantities (0.34 per cent.), according to H. C. Wood, Jr., is less poisonous than the drug itself. Protoveratrine, although present in small amounts (0.06 per cent., according to Breideman), is an extremely toxic substance and is the most important of the ingredients at present known. It appears to differ, however, in some of its properties from the whole drug.

When a moderate dose of veratrum is introduced into the system, the most marked change produced is reduction in the rate of the pulse accompanied with a fall in the arterial pressure. At the same time there may be some slowing in the respiration. With proper doses the slowing of the pulse is extreme and we have seen, in the lower animals, even complete arrest of the heart at this stage of the poisoning. The slowing of the pulse does not occur if the pneumogastric nerves have been divided previous to the injection of the drug, and is at once abolished either by section of these nerve's or by the administration of atropine. It must be regarded, therefore, as due to stimulation of the cardio-inhibitory center. The reduction in the arterial tension in the normal animal may, therefore, be attributed to the slowing of the pulse. The conclusions of H. C. Wood, Jr. (*U. P. M. B.*, March, 1908), that contrary to the older views, veratrum does not lower arterial tone, have been confirmed by the experiments of Pilcher and Sollmann (*J. P. Ex. T.*, 1915, vii, p. 295) on animals and the observations of Collins (*A. I. M.*, 1915, xvi, pp. 54-58) on man. After toxic doses of veratrum there is a late paralysis of the intracardiac terminals of the pneumogastric nerve and consequent increase in the pulse rate with at first a rise of the blood pressure followed by a fall. This toxic fall in the blood pressure appears to be due to a direct depressant action upon the heart muscle. There is, following the toxic dose, also marked reduction in the respiratory activity, death being due eventually to failure of this function.

Veratrum was introduced into medicine about a century ago by the group of physicians who called themselves "eclectics." By them it was attributed with mysterious "adenagic" virtues and used in all sorts of

inflammatory diseases. Later under the belief that it dilated the blood vessels and hence would relieve various local congestions, regular practitioners employed it largely in the treatment of *pneumonia*, *peritonitis*, and other sthenic fevers. While it is still employed to some extent in this type of disorder, our knowledge of its physiological action indicates that its true field of usefulness is rather in chronic, than in acute, diseases. Thus it is a very valuable agent for the reduction of excessively *high blood pressure in arteriosclerosis, interstitial nephritis*, and other conditions of *hypertension*; in cases with feeble myocardia it should be used cautiously because the stimulation of the cardio-inhibitory mechanism predisposes to cardiac dilatation. For the same purpose it is often employed in threatened *apoplexy*, in *chronic endocarditis*, especially in those in which there is considerable degree of cardiac hypertrophy, and in the so-called *irritable heart* seen in soldiers and athletes. In *exophthalmic goitre* and various other forms of *tachycardia* it is frequently of great service to reduce the pulse rate and prevent the heart exhausting itself in excessive activity. In certain of these conditions its line of usefulness more or less parallels that of digitalis. It differs, however, sharply from that drug, in that while digitalis tends to increase the tone of the heart muscle, veratrum rather diminishes cardiac tone. Veratrum has also been used widely by obstetricians in the treatment of *puerperal eclampsia*. Whether its benefit in this condition is to be attributed to a depressant action upon the motor cord, as some believe, or whether it be due to a lowering of the blood pressure, is as yet uncertain. The dose of veratrum must be gauged by the effect it produces; in general it may be said that if it does not slow the pulse no benefit will be received by the patient. The drug should therefore be pushed until evidence of its action is seen in the reduction of the pulse rate. Ordinarily from one to three minims (0.06-0.2 mil) of the fluidextract may be given every two or three hours until it manifests its action. It should be remembered, however, that in some cases the cardio-inhibitory mechanism is refractory to the action of the drug and no dose will slow the pulse, and if given incautiously it may do great harm. Fortunately in most instances if given in too large dose it will manifest its toxic action by nausea before any more serious symptoms are produced.

Toxicology.—The symptoms of veratrum poisoning are vomiting accompanied with great nausea and much retching. There is profound prostration with muscular weakness, the skin bedewed with perspiration and pale in color, the pulse, in the milder cases, or in the

early stage of the severe cases, is extremely slow and easily compressible, later, in the severe types of poisoning, it may become rapid and irregular. The respirations are often shallow and sometimes stertorous. Frequently there is much complaint of dizziness and in a few cases there has been dilatation of the pupil with disturbance of vision. Because of the promptness with which vomiting comes on even very large single doses of veratrum may be recovered from, thus Buckingham (*A. J. M. S.*, 1865) reports a case in which recovery followed a teaspoonful of the fluidextract. But when repeated large doses have been taken, the poisoning is much more dangerous.

In the treatment of veratrum poisoning if the patient be vomiting it is well to give a couple of glasses of water in order to thoroughly cleanse the stomach, at the same time twenty grains (1.3 Gm.) of tannic acid may be exhibited as an imperfect chemical antidote. If for any reason vomiting has not occurred it should be at once provoked or the stomach washed out by means of a stomach pump. The patient must be kept in a horizontal position and should not be allowed to sit up to vomit. After washing out the stomach in the manner described above, efforts should be made to stop the vomiting by the use of counter-irritation over the epigastrium and the cautious employment of morphine. But since when the drug proves fatal death is due to the respiratory arrest the latter should not be given in too large doses. If seen in the early stages when the pulse is slow, atropine is a remedy of great value antagonizing the effect of the veratrum upon the pneumogastric nerve and at the same time checking the excessive sweating and stimulating the respiratory center. Other active respiratory stimulants, such as hypodermic injections of ammonia and strychnine, may be employed, and if the bodily temperature is low it should be maintained by the external application of heat.

Dose, one to two grains (0.065-0.13 Gm.).

Off. Prep.—Fluidextractum Veratri Viridis, *U. S.*; Tinctura Veratri Viridis, *U. S.*

Verbascum. *Verbascum Thapsus* L. *Mullein*. *Flores Verbasci*, *P. G. Bouillon blanc*, *Molene*, *Fr. Wolkraut*, *Konigskerze*, *G.* (Fam. *Scrophulariaceae*).—The ordinary mullein weed is too well known to need description. As remedial agents both leaves and flowers have been employed. *Mullein Flowers* (*Verbasci Flores*) are official in the *N. F. IV* and are described as "the dried corollas, with adhering stamens, of *Verbascum phlomoides* Linne or of *Verbascum thapsiforme* Schraeder (Fam. *Scrophulariaceae*).

Preserve the flowers in tightly-closed containers. Corolla light-yellow, the outer surface grayish with a fine, soft, woolly indumentum, the inner surface sparsely hairy and finely veined; tube of the corolla only 1 or 2 mm. in length and almost equally broad, the limb from 14 to 30 mm. in breadth, between wheel-shaped and saucer-shaped, obscurely two-lipped, the unequal lobes rounded-obovate. Stamens five, borne on the base of the corolla, shorter than the corolla, two of them longer than the other three, the filaments thick and fleshy, more or less pilose, especially the three shorter ones, usually orange colored. Stamen-hairs cylindrical, unicellular, non-branching, surface minutely reticulate, apex rounded, frequently enlarged. Pollen grains smooth, triangular and more or less rounded, from 0.025 to 0.03 mm. in diameter. The flowers impart a yellow color to boiling water, and a rather permanent green color with dilute sulphuric acid, the latter color becoming brown upon the addition of alkalis. Odor peculiar, agreeable; taste mucilaginous, not agreeable. Mullein Flowers yield not more than 6 per cent. of ash." *N. F. Mullein Leaves (Verbasci Folio.)* are official in the *N. F. IV* and are described as "the dried leaves of *Verbascum Thapsus* Linne (Fam. *Scrophulariaceae*), and of other species of *Verbascum*. Obovate with narrowed base, or varying to oblong or oblong-lanceolate, without a true petiole, obtuse or tending toward acuteness at the summit, from 1 to 6 dm. in length and from 3 to 15 cm. in breadth; very thick, rather tough, light yellowish-gray or greenish-gray, densely long-tomentose, with numerous, multicellular, branching, non-glandular hairs. Nearly odorless; taste mucilaginous and slightly bitter. *Verbascum* yields not more than 14 per cent. of ash." *N. F.*

Mullein leaves are demulcent and emollient, and are thought to possess anodyne properties, which render them useful in pectoral complaints. On the continent of Europe, an infusion of the flowers, strained in order to separate the rough, hairs, is considerably used in mild *catarrhs*. An oil, produced by saturating olive oil with mullein flowers, during prolonged exposure to the sun, is used as a local application in Germany for *piles* and other *mucous membrane inflammations*. The mullein oils sold in pharmacies are of this nature, or some of them alcoholic tinctures. The dried leaves are sometimes smoked, to relieve irritation of the respiratory mucous membranes; fomentations with mullein leaves also have some repute as anodynes. Internally, the decoction (an ounce to the pint, flowering tips) may be taken in the quantity of from four to six fluidounces.

According to L. Rosenthal (*P. J.*, July, 1902), the seeds of *Verbascum sinuatum* L., which are used in Greece as a fish poison, contain 6.13 per cent. of saponin. Traces of the same substance were found in the fruits of *V. phlomoides* L. and *V. thapsiforme* Schrad.

Verbascum flowers were introduced in the *N. F. IV* as one of the ingredients in *Pectoral species*, and the leaves in *Fluidextract of mullein leaves* made with diluted alcohol.

Dose, one to two drachms (3.9-7.8 Gm.).

Verbena. *N. F. IV. Blue Vervain.*—"The dried overground portion of *Verbena hastata*

Linne (Fam. *Verbenaceae*), collected when flowering." The plant is a tall shrub growing in damp situations throughout the United States. "In broken or cut pieces; stem stout, obtusely quadrangular, rough, pubescent; leaves opposite, petioles from 12 to 25 mm. in length, blades from 6 to 12 cm. in length, lanceolate, acuminate, acute, coarsely and sharply serrate or the lower hastate lobed, deep green above, paler beneath, conspicuously veined; flowers in terminal interrupted panicles of spikes, spikes erect cylindraceous, densely flowered, each flower subtended by a lanceolate acute bract; calyx adherent, little more than half the length of the corolla, tubular, five-lobed, the mouth slightly oblique; corolla small, bright blue, salver-form tube externally pubescent, sub-equally five-lobed; stamens adnate to the corolla tube, included, di-dynamous; fruit dividing at maturity into four one-seeded parts. Odor heavy, especially if dampened; taste bitter and disagreeable. Verbena yields not more than 10 per cent. of ash." *N. F.* The *fluidextract of verbena* is official in the *N. F.* There is no reason to suspect it of medicinal virtue. The dose stated in the *N. F.* is fifteen grains (1 Gm.).

Vernonia. *Vernoniaanthelmintica* Willd. (Fam. *Compositae*.)—This is an East Indian plant, whose black, bitter, and nauseous seeds have a high reputation in Ceylon as an anthelmintic in doses of sixty grain's (3.9 Gm.). (*P. J.*, April, 1883; also *Ph. Rev.*, 1896, 274.)

Veronica. *Veronicaofficinalis* L. *Speedwell. Veronique male*, Fr. *Ehrenpreis*, G. (Fam. *Scrophulariaceae*.)—Several species of *veronica*, common to Europe and this country, have been medicinally employed. Of these, *V. officinalis* L., and *V. Beccabunga* L., or *European brooklime*, are the most conspicuous. *V. officinalis* has a bitterish, warm, and somewhat astringent taste. Enz found in it a bitter principle soluble in water and alcohol, but scarcely so in ether, and precipitated by the salts of lead, but not by tannic acid; an acrid principle; red coloring matter; a variety of tannic acid producing a green color with ferric salts, a crystallizable fatty acid, with malic, tartaric, citric, acetic, and lactic acids; mannite; a soft, dark green, bitter resin. Mayer, of New York, found evidences of an alkaloid and of a saponaceous principle. (*A. J. P.*, 1863, 209.) Vintlesco found a glucoside in *V. officinalis* and *V. chamaedris*. (*J. P. C.*, 1910, No. 4.) The plant has been considered diaphoretic, diuretic, expectorant, tonic, etc., and was formerly employed in *pectoral* and *nephritic complaints, hemorrhages, diseases of the skin*, and in the treatment of *wounds*. *V. Beccabunga* was used in the fresh state in *scurvy*.

Viburnum Opulus. *N. F. IV (U. S. P. VIII). High Bush Cranberry Bark. Cramp-bark. Wild Guelderrose. Cherry-wood. Red or Rose Elder. Pincushion Tree. Squaw Bush*; in cultivation *Snowball Bush. Obier*, Fr. *Wasserholderrmde. Wasserschweike*, G.—"The dried bark of *Viburnum, Opulus* Linne var *americanum* (Miller) Aiton (Fam. *Caprifoliaceae*), without the presence of more than 5 per cent. of wood and other foreign matter." *N. F.*

Viburnum Opulus, cranberrytree or *high bush cranberry*, belongs to the section of the genus which has peduncled cmyes, light red, acid, roundish drupes, with very flat orbicular not sulcate stones, palmately veined leaves, and scaly winter buda. It is a

large bush, reaching the height of ten feet, growing in low grounds from New Brunswick far westward, and southward to Pennsylvania. The leaves are from three- to five-ribbed, strongly three-lobed, broadly wedge-shaped or truncate at the base, with the spreading pointed lobes mostly toothed in the sides and entire in the sinuses. The petioles bear two glands at the apex. The *snow-ball tree*, or *Guelder rose*, is a variety in which the whole inflorescence has been turned into a mass of showy sterile flowers.

"In strips, or occasionally in quills or chip-like fragments, the bark attaining a thickness of 3 mm.; outer surface of the thinner pieces of a light gray color with crooked, longitudinal, purplish-brown stripes and very small brown lenticels, the thicker pieces purplish-red or occasionally blackish, except when very young, and more or less finely fissured or thinly scaly; inner surface varying in color from yellowish to rusty-brown, with very short oblique striae, except where the outer wood layer adheres; fracture short and weak, the fractured surface mostly whitish, varying to pale brown in the inner layer, rusty brown in the outer layer, covering the green tangential layers of phelloderm. Odor strong and characteristic; taste mildly astringent and decidedly bitter. Under the microscope, sections of *Viburnum Opulus* show as outer corky layer, of five to twenty-five rows of cells, the walls being nearly colorless, frequently thickened on the inner surface, individual cork cells from 0.015 to 0.045 mm. in radial diameter and from 0.030 to 0.075 mm. in tangential diameter; outer bark of about ten rows of cells containing a brownish-yellow, amorphous substance, small starch grains or chloroplastids; medullary rays one to two cells in width, usually not more than one cell wide; inner bark with occasional groups of bast fibers composed of one to ten cells, the walls being very thick, non-lignified, lamellated and finely porous; adhering wood with large tracheae having scalariform or reticulate thickenings, and being surrounded by wood fibers with thick lignified walls; starch grains, mostly in cells of parenchyma and medullary rays, either single or compound, the individual grains not exceeding 0.006 mm. in diameter; calcium oxalate in rosette aggregates, 0.015 to 0.04 mm. in diameter, numerous fragments of parenchyma cells, the lumina filled with a reddish-brown amorphous substance. The powder of *Viburnum Opulus* is light grayish-brown, consisting of irregular fragments; polygonal cork cells, with thin, colorless walls; parenchyma with rosette aggregates of calcium oxalate, from 0.015 to 0.04 mm. in diameter; starch grains very small and mostly in parenchyma cells; fragments of parenchyma containing a brownish-yellow amorphous substance; occasional tracheal fragments associated with lignified wood fibers, bast fibers. and stone-cells." *N. F.*

For studies of *Viburnum* barks, see *A. J. P.*, 1895, 378, 394; also *Ph. Post.* 35, 773, Gibson (*Proc. Indiana Pharm. Assoc.* 1900, 112) believes that there is a glucoside present in the bark of *V. Opulus*; he describes it as resinous, greenish in color, soluble in alcohol, slightly soluble in water.

The berries of this plant are used to a considerable extent as a substitute for the ordinary cranberry, and are antiscorbutic, but there is no sufficient reason to believe the bark has any medicinal properties of any kind. *V. obovatum*. Walt., a tree shrub growing from Virginia southward, is said to be an antiperiodic. (*A. J. P.*, 1878.) *Viburnum opulus* was dismissed from the U. S. P. IX, but introduced in the N. F. IV. It

is used in making *Fluidextract of Viburnum Opulus* with a menstruum of 2 volumes of alcohol and 1 volume of water. *Compound Tincture of Viburnum*, and *Compound Elixir of Viburnum Opulus*. Dose, thirty to sixty grains (2.0-3.9 Gm.).

VIBURNUM PRUNIFOLIUM. U. S. (Br.)

VIBURNUM PRUNIFOLIUM Viburn. Prun. [Black Haw]

"The dried bark of *Viburnum prunifolium* Linne or of *Viburnum Lentago* Linne (Fam. *Caprifoliaceae*), without the presence or admixture of more than 5 per cent. of wood or other foreign matter" U. S. "Black Haw is the dried bark of *Viburnum prunifolium*, Linn." Br.

Virburnum, Br.; Stagbush, Sheep-berry.

Viburnum prunifolium is a tall, very handsome shrub, which is quite common in the Middle and Southern United States, east of the Mississippi, flowering in May and ripening in the early autumn its ovoid or oblong blackish fruit. It is specifically characterized by its acuminate, glabrous winter buds, by its acuminate, sharply serrulate, ovate leaves on long, slender, sometimes broadened and wavy margined petioles. Its sessile cymes are 2 to 5 inches broad and bear oval bluish-black drupes.

Viburnum Lentago L., *Sheep Berry*. *Sweet Viburnum*, resembles the previous species, but has the winter buds smaller, less acute and often reddish pubescent, and its leaves stouter petioled and not acuminate at the apex. Its geographical limit overlaps that of *V. prunifolium*, but extends much further westward and northward, even to Manitoba. The bark of *V. dentatum* L., or *Arrow wood*, is said to be sometimes substituted for the official drug.

Properties.—The bark is officially described as "in irregular, transversely curved or quilled pieces, from 1.5 to 6 cm. in length, and from 0.5 to 1.5 mm. in thickness; outer surface grayish-brown, or, where the outer cork has scaled off, brownish-red, longitudinally wrinkled; inner surface reddish-brown, longitudinally striated; fracture short but uneven, showing in bark which is young or of medium thickness, a dark brown cork, a brownish-red outer cortex, and a whitish inner cortex in which are numerous light yellow groups of sclerenchymatous tissues; odor slight; taste distinctly bitter and somewhat astringent. The powder is dark brown; under the microscope it exhibits numerous large stone cells, which are often elongated, thick-walled and strongly lignified;

bast-fibers few, crystals of calcium oxalate from 0.015 to 0.035 mm. in diameter, occurring mostly in rosette aggregates, occasionally in crystal fibers; monoclinic prisms of calcium oxalate few." *U. S.*

"In quills or curved pieces, one to four millimetres thick; dull brown or reddish-brown. Outer surface longitudinally wrinkled or, in older bark, with shallow fissures and scaly; inner surface longitudinally striated, reddish-brown. Fracture granular. In transverse section, a dark brown outer portion and a whitish or reddish bast with numerous groups of sclerenchymatous cells. Slight odor; taste astringent and bitter." *Br.*

The morphology of *viburnum prunifolium* is well illustrated by Holm in *M. R.*, xxii, p. 35. Illustrations of the bark of the several species of *viburnum* are given in Kraemer's "*Scientific and Applied Pharmacognosy*"; also see *P. J.*, 1903, lxx, p. 197. Lloyd states that the bark of all native species of *viburnum* are collected by root diggers and sold under the name of black haw. (*Ph. Rev.*, xxiii, p. 333.) The bark of the root is preferred to that of the stem and the official definition formerly limited the drug to the root bark. Farwell reported the substitution of the genuine drug by the bark of some other species of *viburnum* than those specified by the Pharmacopoeia. The bark is much darker than the official bark and consisted largely of stem bark. (*M. R.*, xvii, p. 35.)

Herman van Alien found the following constituents in *viburnum*: (1) a, brown resinous body, of a very bitter taste, from which it was found impossible to separate the sugar; (2) a greenish-yellow resin or neutral principle of a bitter taste, slightly soluble in water, freely so in alcohol, called by Kramer *viburnin*; (3) valeric acid; (4) a tannic acid giving a greenish-black color with ferric salts; (5) oxalic acid; (6) citric acid; (7) malic acid; (8) sulphates; (9) calcium, magnesium, potassium, and iron chlorides. (*A. J. P.*, 1880, 443.) As the result of elaborate investigation, T. Shennan (*Royal Coll. Phys. Lab. Rep.*, Edinburgh, vi, 1897) concludes that the *Viburnum, prunifolium* contains *viburnic*—i.e., valeric—acid, and a nonvolatile alkaloid which, however, he failed to obtain in a pure condition.

Viburnum has been used quite largely in the treatment of *dysmenorrhea, after-pains*, and other *uterine disorders*. Pilcher (*A. I. M.*, Jan., 1917), however, has shown that in the doses ordinarily employed it has no effect of any kind on the uterine muscle.

R. L. Payne, Jr., has found that when given in toxic amount to the lower animals viburnum produces muscular weakness, ending in complete paralysis. with loss of reflex action, which he believes to be due to an influence upon the motor side of the spinal cord. In warm blooded animals there is also marked lowering of the arterial pressure, believed by Payne to be the result of a direct action of the drug upon the heart. Experiments of Payne have in a measure been confirmed by those of T. Shennan, but as the latter took six drachms of the fluidextract within thirty minutes, with no demonstrable effect except a doubtful decrease of the rate and force of the pulse, it is plain that the drug is very feeble.

The solid extract (dose, from three to ten grains (0.2-0.65 Gm.)) does not represent the drug completely, owing to loss of volatile acid; so that the fluidextract should be preferred, in doses of from one-half to one fluidrachm (1.8-3.75 mils).

Dose thirty to sixty grains (2.0-3.9 Gm.).

Off. Prep.—Extractum Viburni Prunifolii, *U. S.*; Fluidextractum Viburni Prunifolii, *U. S. (Br.)*; Elixir Viburni Prunifolii (from Fluidextract), *N. F.*

Vieirine.—This substance is obtained from the lark of the *Remijia Vellozii*, DC. (Fam. *Rubiaceae*), of Brazil. It is used in Brazil in doses of from one to four grains (0.065-0.26 Gm.) repeated pro re nata, as a tonic and as an anti-periodic in place of quinine.

Vinca.—Under this name are included *V. major* L., *Greater Periwinkle*, and *V. minor* L., *Lesser Periwinkle* (Fam. *Apocynaceae*). It is said to be very useful in arresting *menorrhagic* and other *hemorrhages*. (*P. J.*, 1871, 961; *Ibid.*, 1873, 963; also *A. J.P.*, 1872.)

Vincetoxicum. *V. officinale* Moench. (now more properly *Cynanchum Vincetoxicum* (L.) Pers. *White Swallow-wort*. *Vincetoxicum. Asclepiade, Dompte-venin, Hirundinaire*, Fr. *Schwalbenwurz, Giftwende*, G.—A perennial, herbaceous European plant, the root of which was formerly esteemed a counterpoison, and hence the botanical name. It has a bitterish, acrid, taste, and, when fresh, a disagreeable odor, which is diminished by drying. Kubler found a glucoside, *vincetoxin*, C₅₀H₈₂O₂₀; which he states differs from *condurangin* which other investigators asserted to be identical. (*A. Pharm.*, 1908, 659.) Taken internally, especially in the recent state, it excites vomiting, and is capable, in larger quantities, of producing dangerous, if not fatal, inflammation of the stomach. Feneulle found in the root a principle analogous to emetin. It has been used in *skin diseases* and *scrofula*.

Vinegar of Ipecacuanha. *Br.* 1898. *Acetum Ipecacuanhae.*—"Liquid Extract of Ipecacuanha, 1 fluidounce (Imperial measure) or 50 mils; alcohol (90 per cent.), 2 fluidounces (Imperial measure) or 100 mils; Diluted Acetic Acid, 17 fluid-ounces (Imperial measure) or 850 mils. Mix; filter, and, if necessary, add sufficient diluted acetic acid to produce one pint (Imperial measure) or one thousand mils of the Vinegar of Ipecacuanha." *Br.*, 1898. Diluted Acetic Acid is a good menstruum for ipecacuanha, and this vinegar will doubtless prove effective as an expectorant. (For uses see *Ipecacuanha*.) Dose, five to forty minims (0.3 to 2.5. mils).

Viola. Violet—The genus *Viola* (Fam. Violaceae) includes numerous species, many, perhaps all of which are possessed of analogous medicinal properties. *Viola tricolor* L., the *Heart's-ease*, *Pansy*, or *Johnny-jump-up* of the gardens, was formerly recognized by the U. S. Pharmacopoeia; while *V. odorata* L., and *V. pedata* L., have held places in both the British and the United States Pharmacopoeias.

V. odorata L. (*Violette*, *Violette odorante*, Fr.; *Wohlriechendes Veilchen*, *Veilchen*, G.; *Violetta*, It.; *Violeta*, Sp.), the common violet of Europe, resembles very closely the American blue violet, *V. cucullata* Ait., from which, however, it is at once distinguished by its delicious fragrance. It is the *sweet violet* of our gardens. *V. pedata* L., is an indigenous, stemless violet, characterized by its large blue or variegated beardless flowers, and its deeply three- to five-divided, pointed pedate leaves.

The flowers of *V. odorata* yield their odor and their slightly bitter taste to boiling water. Their infusion affords a delicate test for acids and alkalies, being reddened by the former and rendered green by the latter. Their odor is destroyed by desiccation, and the degree to which they retain their fine color depends upon the care used in collecting and drying them. They should be gathered before being fully blown, deprived of their calyx, and rapidly dried, either in a heated room or by exposing them to a current of very dry air. The flowers of other species are often mingled with them, and, if of the same color, are equally useful as a chemical test.

In the root, leaves, flowers, and seeds of *Viola odorata*, Boullay discovered an alkaloid, *violine*, allied to emetine, but possessing distinct properties. It exists in the plant combined with malic acid. Orfila asserts that it is exceedingly active and even poisonous. It is probably found in other species of *viola*. Mandolin (*Jahresb.*, 1883) obtained a glucoside analogous to quercitrin, which he names *viola-quercitrin*. It crystallizes out of hot water in fine yellow needles. When boiled with diluted acids, it is decomposed into *quercetin*, *isodulcite* and a fermentable glucose,

$$C_{27}H_{30}O_{16} + 3H_2O =$$

$C_6H_{14}O_6 + C_6H_{12}O_6 + C_{15}H_{10}O_7$ he also obtained salicylic acid from several species of *viola*. (*A. J. P.*, 1882, 10.) Kraemer (., *Marking*, 1896) detected methyl salicylate and this was later confirmed by Schimmel & Co. See also Gadd's article, *Y. B. P.*, 1905, 466.

The herbaceous parts of various species of violets are mucilaginous, emollient, and slightly laxative, and have been used in *pectoral*, *nephritic*, and *cutaneous diseases*. In Europe a syrup prepared from the fresh flowers of *Viola odorata* is employed as an

addition to demulcent drinks, and as a laxative for infants. The root, which has a bitter, nauseous, slightly acrid taste, acts in the dose of from thirty grains to a drachm (2.0-3.9 Gm.) as an emetic and cathartic. It is probable that the same property is possessed by the roots of all the violets, as it is known to be by several species of *Ionidium*, which belongs to the same family. The existence in small proportion of the emetic principle in the leaves and flowers accounts for their expectorant properties.

Virginia Creeper. *Psedera quinquefolia* (L.) Greene (*Parthenocissus quinquefolia* (L.) Planch. *Ampelopsis quinquefolia* Michx.) *American Ivy*. *Vigne merge*, Fr. *Wilder Wein*, *Amerikanischer Epheu*, G.—The bark twigs of this indigenous, woody creeper of the fam. *Vitaceae* have been used by the eclectics as an alterative, tonic, and expectorant. They contain tartaric acid and potassium and calcium tartrates, albumen, sugar, pyro-catechin, and some other principles. McCall employed the bark collected late in the fall in *dropsy*, with asserted very good results. (*Penins. and Independ. Med. Journ.*, June, 1858.) In two cases of poisoning reported by Bernays, the symptoms were violent vomiting and purging, collapse, and deep sleep, with dilated pupils. (*P. J.*, vii.)

Viscum. *Viscum album* L. *Mistletoe*. *Gui de Chene*, *Gillon*, Fr. *Mistel*, G. [Fam. *Loranthaceae*.] —A European evergreen, parasitic shrub growing on various trees, particularly the apple and other fruit trees, and forming a pendent bush from two to five feet in diameter. The plant is famous in the history of Druidical superstition. In the religious rites of the Druids, the mistletoe of the oak was employed, and hence was afterwards preferred when the plant came to be used as a remedy; but it is in fact identical in all respects with those which grow upon other trees. (*P. J.*, 1897, 289.) The fresh bark and leaves have a peculiar, disagreeable odor, and a nauseous, sweetish, slightly acrid and bitterish taste. *Viscin*, which forms the glutinous constituent in the berries, leaves, and stalks of the mistletoe, is the principal constituent of birdlime. Crude viscin may be obtained by kneading the finely bruised mistletoe bark with water, as long as anything is dissolved, and removing the ligneous impurities mechanically. A purer product may be obtained by boiling the crude product in strong alcohol, macerating the residue with ether, evaporating the ethereal extracts, purifying these extracts by kneading first with alcohol and then with water. The formula $C_{20}H_{48}O_8$ ($C_{20}H_{32} + 8H_2O$) has been given to it by Reinsch. Pawlevsky [*Bull. Soc. Chim.* (2), 34, 348) obtained from mistletoe a crystallizable acid, slightly soluble in water, insoluble in alcohol and ether, fusing at from 101° to 103° G. (213.8°-217.4° F.), to which he gave the formula $CH_3O_3.OH$. The berries, which are white, and about the size of a pea, abound in the peculiar viscid principle, and are sometimes used in the preparation of birdlime, of which this principle is the basis. Mistletoe is said to be productive of vomiting and purging when largely taken. The berries caused in a child three years old vomiting and prostration, coma, a fixed and somewhat contracted pupil, and convulsive movements. [*Ann. Ther.*, 1859, 36.) A fatal case is recorded. (*M. T. G.*, 1867, 26.) The plant was formerly looked upon as a powerful nervine, but it is now out of use. The leaves and wood were given in the dose of a drachm (3.9 G-m.) in substance. *Viscum* has been recommended by Gaultier (*S. M.*, 1907) for the reduction of high blood pressure in *arterio-sclerosis* and other conditions of excessive arterial

tension. But Dossin (*A. I. P. T.*; 1911, xxi, p. 432) finds that the lowering of blood pressure is of but short duration and is preceded by a rise and concludes, therefore, that the drug is not clinically useful for this purpose. Gaultier employed a watery extract in doses of 3 grains (0.2 Gm.) daily. According to P. Riehl (*D. M. W.*, xxvi, 1900), viscin affords an excellent basis for the making of applications to the skin, a benzene viscin solution mixed with starch affording an excellent plaster mass.

The *American Mistletoe* is the *Phoradendron flavescens* (Pursh) Nutt. It is a woody parasite, growing upon the branches of deciduous trees from New Jersey to Florida and westward. It is probably the plant reported as growing upon the elm, by which several children were poisoned. (Henry Dye, *Memphis Med. Recorder*, iv, 344.) The prominent symptoms were vomiting and great thirst followed by frequent discharge of bloody mucus from the bowels, with tenesmus. One of the children was found in a collapsed state, in which death took place. Dye states also that, in other instances, as he had been informed, children had eaten the *berries* without any ill effect. In the western part of the United States *Arcanthobium Americanum* Nutt., and *Phoradendron juniperinum* Englm., are also known under the name of mistletoe. Crawford (*J. A. M. A.*, 1911, lvii) has found that the extract of *P. flavescens* or the *P. juniperinum*, when injected into the blood stream, produces a sharp rise in the blood pressure similar to that produced by epinephrine. He also succeeded in isolating an active base, the composition of which, however, he did not satisfactorily determine, but suggests that it may be phenylethylamine. W. H. Long, confirmed by Lee Payne (*North Carolina Med. Journ.*, vol. vii, 253) asserts (*New Prep.*; ii, 31) that the American mistletoe is a very certain oxytocic, and very efficacious in arresting post-partum and other varieties of uterine hemorrhage. He gives a fluidrachm (3.75 mils) of the fluidextract every twenty minutes in labor until the effect is produced; every four to six hours in menorrhagia. Dalassus proposes a formula for an aqueous extract of mistletoe. Five hundred parts of the ground, dry, young twigs and leaves are infused for 12 hours in 3000 parts of boiling water, expressed and the residue treated with 1500 parts of boiling water. The united liquids are then evaporated to the consistence of an extract. *Syrup of mistletoe* is made by dissolving 1 part by weight of the above extract in 10 parts by weight of boiling water and adding 990 parts of simple syrup.

Vitex.—The various species of this genus have been attributed by the ancients with wonderful powers, and the *V. trifolia* is still used occasionally for medicating baths.

White Ash Bark. *N. F. IV. Fraxinus.*—It is described as "the dried bark of *Fraxinus americana* Linne (Fam. *Oleaceae*) and probably of other species of *Fraxinus*, deprived of the corky layer. In flat pieces of varying length and width, from 3 to 6 mm. in thickness, externally yellowish or pale brown, sometimes with ridges of a warty nature and fissures of a grayish-brown color with markings of lichens; inner surface, pale brown to yellowish, longitudinally striate; fracture very uneven, fibrous. Odor faintly aromatic; taste bitter, weakly acid. Fraxinus yields not more than 10 per cent. of ash." *N. F.* A large forest tree of the northern United States and Canada. It contains a volatile oil, an alkaloid and several resins. The bark has been used in *dysmenorrhea* by Charles P. Turner and others. A wine is official in the *N. F.*

Fraxinus excelsior L. *Frene*, Fr. *Esche*, G. *Fresco*, Sp. (Fam. *Oleaceae*).—The bark of the *Common European Ash* occurs in quills and is of a grayish or grayish-green color. It is bitter and astringent, and at one time was employed in the treatment of *intermittent fever*. It contains a crystalline glucoside and a bitter principle, and a fixed oil obtained from the seeds. (*Chem. Ztg.*, 1911, 478.) The leaves have long been used in *rheumatic affections* and *gout*. Garot has shown that they contain 16 per cent. of calcium malate. (See *J. P. C.*, 3e ser., xxiv, 311; also 4e ser., xii, 60.) Dose, an ounce (31 Gm.), infused in half a pint (236 mls) of boiling water, three times a day. (See *Am. J. M. S.*, N. S., xxv, 492.)

White Pine Bark. *N. P. IV. Pinus Alba*— "The dried inner bark of *Pinus Strobus* Linne (Fam. *Pinaceae*)." *N. F.* "In flat pieces of variable size and from 1 to 3 mm. in thickness; outer surface varying from a pale pinkish-white when fresh, to a light or rather deep yellowish-brown on keeping, occasionally with small patches of the gray-brown periderm adhering; more or less cottony, and often showing small scattered pits; inner surface either lighter or darker than the outer, finely striate; fracture tough, fibrous; transverse section showing an outer yellowish and an inner whitish band. Odor slight, terebinthinate; taste slightly mucilaginous, bitter, sweet and astringent.

The powdered drug, when examined under the microscope, exhibits numerous rounded or oval, simple starch grains, up to 0.03 mm. in diameter, some having a cleft or fissure through the center; few monoclinic prisms of calcium oxalate about 0.02 mm. in diameter; resin in reddish-brown, angular masses; thin-walled parenchyma cells, iso-diametric to elongated, many containing starch grains; tracheids very few or absent. White Pine Bark yields not more than 3 per cent. of ash." *N. F. IV.*

This bark was introduced into the *N. F. IV* for the purpose of making *Compound Syrup of White Pine* and *Compound Syrup of White Pine with Morphine*. The differentiation of these two syrups was a wise step in the last revision; but in our opinion it would have been wiser to have dropped *white pine* and all of the preparations; the syrup containing morphine has long been used and has no doubt contributed its share towards cultivating the morphine habit.

Winter's Bark. *Wintera*.—The bark of *Drimys Winteri* Forst. *Cortex Winteranus*. *Ecorce de Winter*, *Cannelle de Magellan*, Fr. *Winter's Zimmt*, G. (Fam. *Magnoliaceae*).—For descriptions of tree, see *U. S. D.*, 16th edition. The tree is a native of the southern parts of South America, growing along the Strait of Magellan, and extending as far north as Chile. According to Martius, it is found also in Brazil. The bark of the tree was brought to England, in the latter part of the sixteenth century, by Captain Winter, who attended Drake on his voyage round the world, and while in the Strait had learned its aromatic and medicinal properties. Since this period, from time to time various barks have appeared in European commerce as *Winter's bark*, although not any that was the genuine bark. Among those in the London market was at one time the bark of *Cinnamodendron corticosum* Miers. (Fam. *Canellaceae*), of Jamaica, which is pungent like true Winter's bark, but is of a much paler brown color, and resembles canella bark except in the absence of the

chalky-white inner surface. More recently this bark has been replaced by the bark of *Croton Malambo* Karst. (Fam. *Euphorbiaceae*), which resembles in color and thickness the bark of the *Cinnamodendron*, but has a bitter taste and a calamus-like flavor. For the description of a specimen which was in possession of George B. Wood many years since, see *U. S. D.*, 19th ed., p. 1696. P. N. Arata and F. Canzoneri (*P. J.*, June 14, 1890) describe a bark which they assert to be a genuine Winter's bark from the Strait of Magellan. From this they separated a volatile oil by distilling the bark with water, exhausting the distillate with petroleum, and distilling off the solvent. The crude oil, amounting to 0.64 per cent. of the weight of the bark employed, was a mixture of several substances. *Winterene*, $C_{15}H_{24}$, is the essential oil separated from this by fractional distillation. It is readily oxidized on exposure to the air, becoming yellow. The formula $C_{25}H_{40}$ was calculated from the ultimate analysis and vapor density, but the authors consider that the ready oxidizability of winterene and its analogy to similar essences point rather to the formula $C_{15}H_{24}$, which would place it in the group of sesquiterpenes, such as cedrene, cubebene, etc. The presence of tannic acid and ferric oxide, according to Henry, serves to distinguish Winter's bark from *Canella alba*, with which it has often been confounded. The bark above described as commercial Winter's bark is destitute of both tannic acid and ferric oxide, and cannot therefore be the bark examined by Henry.

The bark of the *Drimys granatensis* L. f. (now regarded as identical with *D. Winteri* Forst.), has been imported into London under the name of *Meridacoto*, and it has been stated that it contains *cotoin*. It occurs in short pieces of a yellowish-gray color, traversed longitudinally by hard cellular layers, which distinguish it at once from coto and paracoto bark. Its odor resembles that of true coto, but is more feeble. A careful chemical study of it by O. Hesse (*P. J.*, vol. iv) shows that it contains no cotoin, but a crystalline substance, $C_{13}H_{14}O_4$, to which the name of *drimin* was given. From the leaves Hesse obtained a wax alcohol, *drimol*, $C_{28}H_{58}O_2$. As *Drimys granatensis* L. f., is recognized as *D. Winteri* Forst., it is plain that Merida coto must be looked upon as a form of Winter's bark coming from Venezuela.

Winter's bark is a stimulant aromatic tonic, and was employed by Winter as a remedy for *scurvy*. It may be used in half-drachm (2.0 Gm.) doses for similar purposes with cinnamon or canella alba, but is scarcely known in the medical practice of this country. *Drimys chilensis* of De Candolle, growing in Chile, yields a bark having similar properties (Carson, *A. J. P.*, xix, 81) ; also *D. aromatica* F. Muell., of Australia. (*P. J.*, xxi.)

Wistaria. *Wistaria chinensis* DC. (*Kraunhiachinensis*.) (Fam. *Leguminosae*.)—Ottow (*P. J.*, Oct., 1886) has obtained from this ornamental leguminous woody climber a crystalline poisonous glucoside, *wistarin*.

Withania. *Withania coagulans* Dun. (Stocks.) *Vegetable Rennet*. (Fam. *Solanaceae*.)—This shrub, common in Afghanistan and East India, has the property of coagulating milk, and has been used for preparing a vegetable rennet ferment for making cheese. Sheridan Lea found upon examination that the substance which possesses the coagulating power is a ferment closely resembling animal rennet. The

active principle is soluble in glycerin, and can be extracted from the seeds by this solvent; the extract possesses strong coagulating powers even in small amounts. Alcohol precipitates the ferment body from its solutions, and the precipitate, after washing with alcohol, may be dissolved again without having lost its coagulating powers. The active principle of the seeds will cause the coagulation of milk when present in very small quantities, the addition of more of the ferment simply increasing the rapidity of the change. The coagulation is not due to the formation of acid by the ferment. If some of the active extract be made neutral or alkaline, and added to neutral milk, a normal clot is formed, and the reaction of the clot remains neutral or faintly alkaline. The clot formed by the action of the ferment is a true clot, resembling in appearance and properties that formed by animal rennet, and is not a mere precipitate. Lea prepared an active extract, applicable for cheese making purposes, by grinding the dry seeds very finely in a mill, and extracting them for twenty-four hours with such a volume of 5 per cent. sodium chloride solution that the mass is still fluid after the absorption of water by the fragments of the seeds as they swell up. From this mass the fluid part may be readily separated by using a centrifugal machine (such as is used in sugar refining), and it can then be easily filtered through filter paper; without the centrifugal machine the separation of the fluid from the residue of the seeds is tedious and imperfect; forty grammes of the seeds treated as above, with 150 mils of 5 per cent. sodium chloride solution, gave an extract of which 0.25 mil clotted 20 mils of milk in twenty-five minutes, and 0.1 mil clotted a similar portion of milk in one hour. When added in these proportions the curd formed is quite white. The presence of the coloring matter is, however, perhaps on the whole unimportant, since even if a larger quantity of the ferment extract is added in order to obtain a very rapid coagulation, the coloring matter is obtained chiefly in the whey, the curd being white; by adding sufficient common salt to make the percentage up to 15 per cent., and alcohol up to 4 per cent., the preparation would retain its activity very well. (P. J., 1884, 606.)

Wrightia, *Wrightia zeylanica* R. Br. (*W. antidysenterica* R. Br.) (Fam. *Apocynaceae*).— Under the names of *Conessi bark*, *Tellicherri bark*, and *Codaya pala*, a spongy, rusty-colored, bitter bark of this apocynaceous tree was formerly used in Europe as a remedy in *dysentery* and *diarrhea*, and is said still to be largely employed by the native practitioners of India. Stenhouse obtained from the seeds, besides a fixed oil which they contain in large quantity, a non crystalline alkaloid, called by him *wrightine*, which seems to be the same substance previously described by Hains under the name of *conessine*. (*P. J.* (2), vi, 432.) The alkaloid conessine is now a commercial product prepared by Merck, and the formula $C_{24}H_{40}N_2$ is given it. It occurs in delicate, white, interlaced masses of crystals, melting at $121^{\circ} C.$ ($249.8^{\circ} F.$), sparingly soluble in water, readily so in alcohol. A small quantity rubbed with a few drops of concentrated sulphuric acid affords on the addition of nitric acid a golden and finally orange-yellow color. We are not aware that the medicinal properties of this have been investigated.

A species of the allied genus *Holarrhena* (*H. africana* A. DC.), is stated by German missionaries to be used in parts of tropical Africa in *dysentery*. Polstorx and Schirmer (*Ber. d. Chem. Ges.*, 1886. 78) prepared the alkaloid both from *Holarrhena africana*

and from *Wrightia zeylanica*, finding it to be identical in the two cases. When oxidized by iodic acid in sulphuric acid solution, conessine is changed to oxyconessine, (C₁₂H₂₀NO.)₂.

Wurrus.—Under the name of *Vars*, *Wars*, or *Wurrus*, a powder somewhat similar to kamala has been used as an anthelmintic in Southern Arabia, and exported into commerce from Aden. It is believed to be the product of *Flemmingia Grahamiana* W. et Arn. (Fam. *Leguminosae*.) (*P. J.*, Sept., 1887.) It is composed of cylindrical or subconical grains, 170 to 200 mm. long by 70 to 100 broad, with oblong resin cells arranged perpendicularly in three or four tiers.

Xanthium.—Guichard believes that he has found an alkaloid in the *X. spinosum* L. (*P. J.*, vii, 249.) In the *Xanthium Strumarium* L., *Cocklebur* or *Clotbur*, which is common both in Europe and in America, A. Zander believes that he has found a glucoside, *xanthostrumarin*. M. V. Cheatham thinks that there is a second active principle. (See *A. J. P.*, vol. xi, 271; vol. xiv, 134.) Clotbur is stated to be an active styptic, both local and general. Dose, of the fluidextract, from one to two fluidrachms (3.75-7.5 mils).

Xanthorrhiza. *Yellow-root. Shrub Yellow-root. Xanthorrhiza apiifolia* L'Her. (Fam. *Ranunculaceae*.)—This is a low shrub, with a horizontal rhizome, which sends off numerous suckers. The stem is simple, about 6 mm. thick, with a smooth bark and bright yellow wood. The leaves, are compound, consisting of several ovate-lanceolate, acute, doubly serrate leaflets, sessile upon a long petiole, which embraces the stem at its base. The flowers are small, purple, and disposed in long, drooping, divided racemes, placed immediately below the first leaves. Yellow-root grows from Southern New York to Georgia and west to Kentucky. It flowers in April. The root was formerly in the Secondary List of the U. S. Pharmacopoeia, but the bark of the stem possesses the same virtues. The root is from 7 cm. to 1 dm. in length, and about 12 mm. thick near the stem. It shrinks somewhat in drying, and, as found in commerce, is in slender pieces of various lengths, wrinkled longitudinally, with a light yellowish-brown, easily separable epidermis, a thick, hard, bright yellow woody portion, and a very slender central pith. It is inodorous, and of a simple but extremely bitter taste. It imparts its color and taste to water. The infusion is not affected by ferric salts. J. Dyson Perrins found *berberine* in it. (*P. J.*; May, 1862.) Samuel S. Jones believed that he had proved the existence in the drug of a second alkaloid. (*A. J. P.*, vol. xvi, 1861.) *Xanthorrhiza* possesses properties closely analogous to those of calumba, quassia, and other simple tonic bitters, and may be used for the same purposes and in the same manner. Woodhouse employed it in the dose of forty grains (2.6 Gm.).

Xanthorrhoea Resins. *Gum Acaroides. Gum Acroides. Grass-tree Gum. Botany Bay Gum.*—Yellow and reddish resinous substances, the products of *Xanthorrhoea hastilis* R. Br. and *X. australis* R. Br. (fam. *Liliaceae*), have been introduced into England from Australia. They are obtained by spontaneous exudation from the stems of the plants, which are usually shrubs. The *yellow variety* (from *X. hastilis*) is in tears, in flattish pieces having on one side the mark of the stem, or in masses of various size and irregular shape. It has a reddish-yellow color, resembling gamboge when broken, and

when heated emits a fragrant odor like that of Tolu balsam. It contains resin, cinnamic and benzoic acids, and a trace of volatile oil, and may therefore be ranked among the balsams. When heated with nitric acid, it yields a large proportion of picric acid. In medicinal properties it is said to bear a close resemblance to storax and the balsam of Tolu. A tincture, made in the proportion of two ounces to a pint of alcohol, may be given in the dose of one or two fluidrachms. The *red variety* (from *X. australis* R. Br.) resembles dragon's blood in color, and appears to be analogous to the other variety in properties. (See *A. J. P.*, 1881; also *A. J. P.*, vol. xv, and *D. C.*, 1895, 83.) These resins have been introduced as a shellac substitute in varnish making.

XANTHOXYLUM. U. S.

XANTHOXYLUM Xanthox. [Prickly Ash Bark]

" The dried bark of *Xanthoxylum americanum* Miller, known in commerce as *Northern Prickly Ash Bark*, or *Xanthoxylum Clava-Herculis* Linne, known in commerce as *Southern Prickly Ash Bark* (Fam. *Rutaceae*)." *U. S.*

X. americanum: Toothache Tree, Angelica Tree, Suterberry, Pellitory Bark, Yellow-wood; Clavalier, Frene epineux. *Fr.* Zahnwehholz, Zahnwehrinde, *G.*

X. Clava-Herculis: Sea Ash, Hercules' Club, Pepper-wood.

Northern Prickly Ash (*Xanthoxylum americanum*) is a shrub from five to twenty-five feet in height, with alternate branches, which are covered with strong, sharp, scattered prickles. The leaves are alternate and pinnate, consisting of four or five pairs of leaflets, and an odd terminal one, with a common footstalk, which is sometimes prickly on the back, and sometimes unarmed. The leaflets are nearly sessile, ovate, acute, slightly serrate, and somewhat downy on their under surface.

The flowers, which are small and greenish, are disposed in sessile umbels near the origin of the young shoots. The plant is polygamous, some shrubs bearing both male and perfect flowers, others only female. The number of stamens is five, of the pistils three or four in the perfect flowers, about five in the pistillate. The capsules are stipitate, oval, punctate, of a greenish-red color, with two valves, and one oval blackish seed. This species of xanthoxylum is indigenous, growing in woods and in moist shady places throughout the Northern, Middle, and Western States. The flowers appear in April and May, before the foliage. The leaves and capsules have an aromatic odor, recalling that of oil of lemon.

Botanists are not agreed concerning the distinction of the genus *Fagara*

from *Xanthoxylum*. Thus, the authors of the *Index Kewensis* consider the two genera identical, while Engler and Pranti separate them. The most important character separating them seems to be the absence of sepals in *Xanthoxylum*. Most of the species of the genus *Fagara* are tropical trees.

Z. Clava-Herculis L. [*Fagara Clava-Herculis* (L.) Small], or Southern Prickly Ash, varies in size from a large bush to a small tree. Its bark is armed with warty prickles, and large conical cork wings occur on the branches and the petioles. The alternate leaves have from seven to nine ovate-lanceolate, crenate-serrulate, unequal-sided leaflets, smooth and shining on the upper surface. It grows on dry soil, westward as far as Western Texas, and perhaps into Mexico, eastward to the Atlantic coast, and northward to Southern Virginia, especially affecting the coast region.

The fruits (*Prickly ash berries*) of both of the official species probably contain the same principles found in the barks. The dried berries are recognized by the N. F. under the name of *Xanthoxyli Fructus*, and are described below.

There has been much confusion in regard to the nomenclature of the prickly ashes. *Aralia spinosa* L., or angelica tree, which grows in the Southern States, is occasionally confounded with *X. Clava-Herculis*, in consequence partly of being sometimes called, like the latter, prickly ash. Its bark is nearly smooth externally, is beset with slender prickles in transverse rows and has a taste different from that of *F. Clava-Herculis*. Besides the official trees, the bark of *F. flava* (Vahl), Frug. and Urban (*X. caribaeum* S. Wats.), the satin-wood of semi-tropical Florida and the West Indies, has appeared in commerce under the name of *yellow Hercules club* or *yellow thorn*. This bark is thin, with an odor like that of *Angustura* bark, a bitter, disagreeable, acrid taste, and a canary-yellow color, which it imparts to the saliva when chewed. It would seem, also, that under the name of *prickly yellow wood*, *yellow wood*, or *fustic*, the products of other West Indian *xanthoxylums* and allied plants find their way into commerce.

Xanthoxylum veneficum Bailey, of Australia is, according to J. H. Maiden, a violent convulsive poison, 5 grains of the extract being a fatal dose for a cat. *Xanthoxylum scandens* is said to be used by the natives of Java as a fish poison, and according to Van der Haar, contains an

alkaloid. (P. J., 71, 134; 73, 814.)

Properties.—Although the bark of the Southern prickly ash was not recognized by the U. S. Pharmacopoeia until the revision of 1880, as long ago as 1864 Bridges pointed out that it had entered commerce, and gave the physical characteristics separating it. (*Proc. A. Ph. A.*, xii, p. 270.) The characteristics of the two barks are very well given in the following official description.

"Northern Prickly Ash Bark.—In transversely curved fragments or quills, from 2 to 15 cm. in length; bark from 0.5 to 2 mm. in thickness; outer surface light gray to brownish-gray with grayish patches of foliaceous lichens bearing numerous small black apothecia; longitudinally wrinkled and with numerous whitish lenticels; the cork occasionally abraded, showing the yellowish or orange inner bark; inner surface yellowish-white, finely longitudinally striate and usually with numerous, bright, shining crystals; fracture short, uneven; odor slight; taste bitter, acrid, becoming pungent. Under the microscope, transverse sections of Northern Prickly Ash Bark show an outer corky layer consisting of from 4 to 20 rows of cells, the tangential walls being more or less thickened and lignified; a wide strata of collenchyma inside of the cork cambium composed of from 8 to 10 rows of tangentially elongated cells, with very thick walls and containing plastids; a more or less indistinct row of endodermal cells beneath which occur small groups of primary bast-fibers; the inner bark consists of numerous parenchyma cells among which are included large oil-secretion reservoirs, separated by medullary rays which are mostly one cell in width; the parenchyma cells as well as the oil-secretion reservoirs contain numerous colorless oily globules. Scrapings from either the inner or outer surface show numerous rod-shape crystals and flat prisms, from 0.015 to 0.25 mm. in length, which polarize light with a display of bright colors.

"Southern Prickly Ash Bark.—In transversely curved or irregular, oblong, flattened pieces, or in quills from 2 to 40 cm. in length, bark from 1 to 4 mm. in thickness; outer surface light gray to brownish-gray, marked by numerous large, barnacle-shaped projections of cork, from 0.5 to 3.5 cm. in thickness, otherwise with numerous grayish patches of foliaceous lichens, bearing' blackish apothecia, and numerous, elliptical lenticels; inner surface light yellowish-brown to' olive brown, obscurely longitudinally striate and free from crystals; odor and taste as in Northern Prickly Ash Bark. Under the microscope, transverse sections of

Southern Prickly Ash Bark show a strong development of lignified cork occurring in the form of rings, the successive layers being separated by several rows of narrow tabular cells strongly thickened on the tangential walls; beneath the cork cambium occurs a thin layer of collenchyma followed by the outer tissues of the primary cortex and consisting of small groups of rather large stone cells and occasional, scattered groups of bast-fibers and parenchyma; the inner bark consists of parenchyma, a more or less indistinct leptome or sieve tissue among which are numerous, large, light yellowish oil-secretion reservoirs, medullary rays from 1 to 2 cells in width and occasional groups of stone cells and bast-fibers; starch grains numerous, nearly spherical, from 0.002 to 0.01 mm. in diameter, and occurring in the parenchyma cells and medullary rays; calcium oxalate chiefly in mono-clinic prisms from 0.01 to 0.025 mm. in diameter, occurring in crystal fibers and in parenchyma cells of the primary cortex. Powdered Xanthoxylum is light grayish-brown, under the microscope it shows mostly irregular fragments of cork cells, nearly colorless and strongly lignified, fragments of parenchyma containing either small starch grains, oily globules or monoclinic prisms of calcium oxalate; stone cells in small groups with thick, colorless walls and containing frequently a reddish-brown substance; bast-fibers few and non-lignified. In the Northern Prickly Ash, the stone cells are usually absent, and the calcium oxalate crystals and the fragments of cork are relatively few." U. S.

Xanthoxylum is practically never adulterated, and hence the drug has never been studied very exhaustively. Kraemer illustrates the inner structure of the Southern prickly ash bark in his work on "*Scientific and Applied Pharmacognosy*." Recently the bark of a tropical American species, *X. Ochroxylum* D. C., has been the subject of a pharmacognostical study by Le-prince. (*Report. Pharm.*, 1912, xxiv, p. 215.)

W. L. Cliffe after careful examination demonstrated that the bark of Southern prickly ash exceeded that of the Northern prickly ash in active properties. (*A. J. P.*, 1901, 562.) In 1829, Edward Staples isolated from *X. americanum* a crystalline *xanthoxyline* which was again found by J. U. Lloyd in 1876. Subsequently, from the same plant Edward T. Moffet (*A. J. P.*, 1886, 417) obtained a supposed alkaloid in yellow crystals, soluble in alcohol and chloroform, insoluble in petroleum benzin, ether, and benzene. G. H. Colton (*A. J. P.*, 1880, p. 191) separated from the Southern prickly ash, tasteless, colorless, silky acicular crystals, soluble

in alcohol, ether, and chloroform, less soluble in benzene, and insoluble in water. The identity of all these principles was assumed until E. G. Eberhardt (*A. J. P.*, 1890, 231) obtained from the Southern prickly ash a colorless crystalline principle agreeing in solubilities with that of Colton. On analysis it gave figures indicating the formula $C_{20}H_{19}O_6$ or $C_{30}H_{28}O_9$. At the same time he analyzed a sample of Lloyd's crystalline principle from *X. fraxineum* (*X. americanum* Mill.), which had been preserved in the cabinet of the Philadelphia College of Pharmacy, and found for it the formula $C_{29}H_{27}O_8$. Numerous reactions also indicated that the two principles were different. Thus, Lloyd's crystals dissolve in concentrated sulphuric acid with light red color, and on the addition of an excess of water produce a whitish precipitate which is taken up by chloroform; the crystals from the *X. Clava-Herculis*, dissolve in concentrated sulphuric acid with dark red color, and on dilution separate a purplish precipitate, which is not taken up by chloroform. Lloyd's principle melts, moreover, at $129.5^{\circ} C.$ ($265.1^{\circ} F.$), while Eberhardt's melts at $119^{\circ} C.$ ($246.2^{\circ} F.$). In 1863, J. D. Perrin separated from the Caribbean *Xanthoxylum Clava-Herculis* an alkaloid which he considered to be *berberine*. This had also been described as early as 1826 by Chevallier and Pelletan under the name of *xanthopicrite*. *X. senegalense* (*artar root*) was analyzed by Giacosa and Soave (*A. J. P.*, 1890, 500), who found a fixed oil, a neutral crystalline substance, melting at $120^{\circ} C.$ ($248^{\circ} F.$), and two alkaloids. The first of these they call *artarine*, and give to it the formula $C_{20}H_{17}O_4N$ (which makes it agree with *berberine*), or $C_{21}H_{17}O_4N$, in which case they consider that it may be *methylhydroberberine*. The second alkaloid, crystallizing in blood-red needles, they did not analyze.

Uses.—Xanthoxylum is stimulant, producing, when swallowed, a sense of heat in the stomach, with more or less general arterial excitement, and a tendency to diaphoresis. It is thought to resemble mezereum and guaiac in its remedial action, and is given in the same diseases. As a remedy in *chronic rheumatism*, it enjoys some reputation in this country. The bark, used as a masticatory, is a popular remedy for *toothache*. Xanthoxylum is capable of being used as a counter-irritant, and great relief is sometimes afforded in various forms of chronic pelvic disease in women by means of a hot pack, applied to the lower part of the trunk, of two to four ounces of fluidextract of xanthoxylum and an ounce of tincture of cayenne pepper to two quarts of water. A decoction prepared by boiling an ounce in three pints of water down to a quarter

may be given in the quantity of a pint (473 mls), in divided doses, during the twenty-four hours.

Dose, fifteen to thirty grains (1-2 Gm.).

Off. Prep.—Fluidextractum Xanthoxyli, U. S.; Elixir Corydalis Compositum, N. F.

Xanthoxylum Berries. *Xanthoxyli Fructus*. N. F. IV. *Prickly Ash Berries*.—"The fruit of *Zanthoxylum americanum* Miller (*Northern Prickly Ash*), or *Zanthoxylum Clava-Herculis* Linne (*Southern Prickly Ash*) (Fam. Rutaceae)." N. F. IV.

Prickly ash berries were introduced in the N. F. IV to be used as an ingredient in *compound fluid-extract of stillingia* N. F. IV, made with a menstruum of 25 volumes of glycerin, 50 volumes of alcohol and 25 volumes of water, finishing with diluted alcohol. The berries are described as "Capsules with short stalks (*X. americanum*) or without stalk (*Z. Clava-Herculis*); when fresh, ellipsoidal, fleshy, gray-brown, when dry, dehiscent; carpels two, convex, summit short pointed; seeds one or two oblong, black, shining, and wrinkled from drying. The carpels have a pungent, warm, aromatic taste and on chewing leave a tingling sensation on the tongue; when breathed upon they emit a faintly aromatic odor resembling that of citral. Prickly Ash Berries yield not more than 7 per cent. of ash." N. F. IV.

Yohimbine.—This is an alkaloid which is obtained from the bark of *Corynanthe Yohimbi* Schum., a rubiaceous tree growing in the Southern Cameroons district in Africa. The bark comes into commerce in flattened or slightly quilled pieces 75 cm. long to 4 to 8 mm. thick, with an external corky layer of a gray-brown color covered with isolated lichens. It shows numerous longitudinal and transverse fissures like some old specimens of cinchona bark. The transverse fracture is of a uniform yellowish-brown color, and presents short, soft fibers like rough velvet. The taste is bitter.

The alkaloid has been obtained in white needles melting at 234° C. (453.2° F.) and having the composition C₂₃H₃₂N₂O₆.

The salt of this base that is ordinarily used is the hydrochloride, being preferable on account of its solubility and high percentage of the alkaloid.

It was originally investigated by Oberwarth and Loewy (*V. A. P. A.*, cliii, and *B. K. W.*, No. 42, 1900), who found it to be in animals and also in man a very active excitant to the sexual organs and functions. On the other hand, Kravkoff, as the result of experiments upon the lower animals and upon man, concluded that it has no aphrodisiac effects and frequently produces nausea, salivation, irritability, and other disagreeable results.

Muller (*A. I. P. T.*, 1907, p. 65) found that *yohimbine*, in small doses stimulated, and in

large doses depressed, the respiratory center. If lethal doses are given the heart continues beating after the respiration has ceased. Small doses have little effect upon the blood pressure, but moderate-sized doses caused a slight rise in the blood pressure with local dilatation of the vessels of the pelvic organs. He believes that its aphrodisiac action is due to an increase in the excitability of the lower centers in the spinal cord. On the other hand, many authors believe that its effect is due to the hyperemia produced. Toff (*D. M. W.*, 1904) has found it useful because of this effect in scanty or *irregular menstruation*.

It has been used by numerous clinicians in *neurasthenic impotence*, with reports which are generally favorable to its influence. (For literature, see *M. R.*, 1901, 1902.) It is said to be of no value when the impotence depends upon organic nerve trouble, and to be harmful when it is caused by chronic inflammatory disease of the sexual organs or of the prostate gland. Dose, of the hydrochloride, 0.005 Gm. (one-twelfth grain), either in tablet or solution, three or four times a day. Yohimbine has also been employed in a 1 per cent. solution hypodermically.

Zea. *N. F. IV (U. S. P. VIII). Corn Silk. Stigmata Maydis. Filament de Mais, Fr. Maispistille, G.*—"The fresh styles and stigmas of *Zea Mays* Linne (Fam. *Gramineae*)." *N. F.*

This drug is the so-called "silk" of the ear of ordinary Indian corn or maize, cultivated in the warmer temperate and subtropical countries of the world. It consists of "slender filaments from 10 to 20 cm. in length, and about 0.4 mm. in diameter; of a light green, purplish-red, yellow or light brown color; stigmas bind, the segments very slender, frequently unequal and from 0.4 to 3 mm. in length. Under the microscope, the styles are seen to consist for the most part of parenchyma and two parallel, vascular bundles with narrow, spiral or annular tracheae; the epidermal cells are rectangular, many of these being extended into multicellular hairs, the latter being from 0.2 to 0.8 mm. in length, the basal portion consisting of two to five united cells, the upper portion being usually unicellular; the cells of the hairs are rich in cytoplasm and usually contain a small, spherical nucleus; the purplish-red styles contain a purplish-red cell sap. Digest a small portion of the fresh styles and stigmas in diluted alcohol and filter; a pale purplish-red solution is produced, separate portions of which, on the addition of acids, become distinctly purplish or yellowish-red; on the addition of alkalies, green; on the addition of ferric chloride T.S., olive-green changing to greenish-brown; and on the addition of an aqueous solution of alum, bluish or purplish, the color being quite permanent." *N. F.* Rademaker and Fischer (*A. J. P.*, 1886, p. 369) determined the presence of 2.25 per cent. of *maizenic acid* in dried corn silk. It was first described, however, by Vautier. It is freely soluble in water, alcohol and ether, but insoluble, in benzin. Rademaker and Fischer found, in addition to the acid, fixed oil, resin, chlorophyll, sugar, gum, extractive, albuminoids, phlobaphene salt, cellulose and water.

Used as a mild stimulant diuretic, useful in *acute* and *chronic cystitis* and in the bladder irritation of *uric acid* and *phosphatic gravel*. It has also been employed in *gonorrhoea*, and has been affirmed by Landreux to be a useful diuretic and even cardiac

stimulant in the dropsy of heart disease. It probably is, however, of little value.

Concerning the activity of *maizenic acid* we have little definite knowledge, but it probably represents whatever physiological power the drug possesses; it has been given in the dose of one-eighth of a grain (0.008 Gm.).

Corn silk was official in the U. S. VIII but dismissed from the U. S. IX. It was introduced in the N. F. IV. The fluidextract of *zea* N. F. is made with a menstruum of diluted alcohol.

Dose, one to three drachms (3.9-11.6 Gm.).

Zedoary. *N. F. IV. Zedoaria. Radix Zedoariae. Rhizoma Zedoariae, P. G. Zedoarie, Fr. Zitterwurz, G.*—"The dried rhizome of *Curcuma Zedoaria* (Bergius) Roscoe (Fam. *Zingiberaceae*)."
N. F. There are two kinds of zedoary, the long and the round, distinguished by the old official titles of *radix zedoariae longae* and *radix zedoariae rotundas*. Both kinds come from the East Indies. The *long zedoary* is in slices, from 2.5 to 7.5. cm. in length, and from 1 to 2.5 cm. thick, obtuse at the extremities and exhibiting the remains of the radical fibers. The *round* is commonly seen in communities, and is "usually cut into transverse rounded sections, twisted and wrinkled, from 1 to 4 cm. in diameter, and from 5 to 10 mm. in thickness; externally grayish-brown, hairy, rough, with few root scars; transverse surface pale reddish to gray-brown; a distinct, dark circular endodermis, which is from 2 to 5 mm. in width, separates the cortex; the stele contains numerous, orange-colored resin cells and irregularly distributed, lighter colored wood bundles which are fewer in the cortex; fracture short, somewhat mealy and waxy. Odor aromatic, camphor-like; taste aromatic, warm, slightly bitter. Under the microscope, sections show a thick cork, a thin epidermis with numerous characteristic hairs, thick-walled, one- to six-celled, up to 1 mm. in length and often thicker in the middle than at the base; the parenchyma of the cortex and of the central cylinder rich in starch; secretion cells isodiametric with suberized walls, contents colorless or yellowish; the endodermis of small, thin-walled quadratic cells, the fibro-vascular bundles collateral, more numerous in the central cylinder and nearer the endodermis; few bast fibers in the cortex and no crystal cells. The powder contains numerous starch-grains which are ovoid, from 0.02 to 0.07 mm. in length and from 0.007 to 0.03 mm» in thickness, having the point of origin of growth in the smaller end of the grain; numerous characteristic, thick-walled hairs; rich in parenchyma; very few bast fibers; no calcium oxalate crystals or stone cells. Zedoary yields not more than 7 per cent. of ash." *N. F.*

Zedoary yields a volatile oil, when distilled with water, and contains a pungent soft resin and bitter extractive.

Zedoary was introduced into the N. F. IV and is used as an ingredient in *bitter tincture of zedoary, antiperiodic pills, antiperiodic pills without aloes, bitter tincture, antiperiodic tincture* and *antiperiodic tincture without aloes*.

Zedoary is a warm, stimulating aromatic, useful in flatulent colic and debility of the

digestive organs. It is rarely employed, as it produces no effects which cannot be as well or better obtained from ginger. The dose is from ten grains to half a drachm (0.65-2.0 Gm.).

Zerechtit. *Tschuking. Landtia Schimperii* Benth. and Hook. (*Ubioea Schimperii* J. Gay *Arctotis Schimperii* O. Kze.)—The leaves, flowers and fruit of an Abyssinian composite. (See *Proc. A. Ph. A.*, xxvi, 228.)

Zerumbet. *Cassumuniar.*—Under these names an East Indian root was formerly used, having some analogy in sensible and medicinal properties to ginger, and ascribed to the *Zingiber Zerumbet* of Roscoe. By some authors the zerumbet has been erroneously confounded with the round zedoary. Greiger describes it as in pieces of the size of a fig or larger, externally grayish-brown and wrinkled, internally yellowish, hard and tough, of a biting, aromatic taste and a spicy odor.

ZINGIBER. U. S., Br.

GINGER *Zingib.*

"The dried rhizomes of *Zingiber officinale* Roscoe (Fam. *Zingiberaceae*), the outer cortical layers of which are often either partially or completely removed. Preserve it in tightly-closed containers, adding a few drops of chloroform or carbon tetrachloride, from time to time, to prevent attack by insects." *U. S.* "Ginger is the scraped and dried rhizome of *Zingiber officinale*, Roscoe." *Br.*

Gingembre (gria et blanc), *Fr. Cod.*; Rhizoma *Zingiberis*, *P. G.*; Ingwer, *G.*; Zenzero, *It.*; Jengibre (Rizoma de), *Sp.*

There are about twenty species of the genus *Zingiber*, the commercial ginger being obtained from *Zingiber officinale*. According to Watt, this species is probably a native of tropical Asia, but is not known except in the cultivated state. It is now extensively cultivated in the tropical countries of both the Eastern and Western Hemispheres.

The ginger plant, *Zingiber officinale*, has a biennial or perennial, creeping rhizome, and an annual stem, which rises two or three feet in height, is solid, cylindrical, erect, and enclosed in an imbricated membranous sheathing. The leaves are lanceolate, acute, smooth, five or six inches long by about an inch in breadth, and stand alternately on the sheaths of the stem. The flower-stalk rises by the side of the stem from six inches to a foot, and, like it, is clothed with oval acuminate sheaths; but it is without leaves, and terminates in an oval, obtuse,

bracteal, imbricated spike. The flowers are of a dingy yellow color, and appear two or three at a time between the bracteal scales. The flowers have an aromatic odor, and the stems when bruised are slightly fragrant; but it is in the rhizome that the virtues of the plant reside. This is fit to be dug up when a year old. The rhizome of the ginger is lifted from the soil by a single thrust of the fork at the time when the stems of the plant turn white, before the rhizome has begun to get tough and fibrous. The root is scalded in boiling water and rapidly dried, when it constitutes the *black* or ordinary ginger of commerce.

In Jamaica the so-called *white* or *Jamaica ginger* is produced by carefully peeling the fresh rhizomes so that only the epidermis is removed, the cells immediately beneath the epidermis being the richest in volatile oil and resin. The peeled pieces are macerated sometimes in water and sometimes in lime juice, and not rarely the color of the ginger is improved by finally coating it with chalk. (See Kilmer, *A. J. P.*, 1898, p. 65; Harris, *P. J.*, 1909, xxix, p. 379.) An inferior white ginger is also produced in the East Indies. The thoroughness of desiccation is a matter of commercial importance. The moisture in ginger should not exceed 10 per cent., but in the poorer specimens may constitute one-fourth of the whole weight. In China the fresh ginger is rasped into a powder and as such dried. Formerly *East Indian ginger* was imported into the United States from Calcutta, while the *Jamaica* or *West Indian ginger* came usually through London. At present the cultivation of ginger is spread almost over the whole sub-tropical world, and the drug is produced in St. Lucia, Dominica and Africa, Cochin-China, Japan, etc. The world's production of ginger is estimated to be annually over 20,000,000 pounds. Of this nearly 4,000,000 pounds is annually exported from Jamaica, the United States using about 1,500,000 pounds. (*C. D.*, lxxvii, p. 489; *Cons. and Tr. Rep.*, 1910, p. 1085.)

In Martinique a ginger is said to be obtained by the cultivation of *Zingiber Zerumbet* Rose. The ginger of Siam is said to be produced by *Alpinia Galanga*, and is the same drug, therefore, as the *Greater* or *Java Galanga Root*. The large, ordinary, preserved ginger of China is, according to C. Ford (*Kew Bulletin*, 1891) also the product of *A. Galanga*. It is made by boiling young, tender, carefully selected and decorticated rhizomes in syrup. Preserved ginger from the West Indies is made from the official plant. According to Hartwich and Swanlund, the rhizome of the *Zingiber Mioga*, which is cultivated in China and Japan, has a taste less pungent than that of the official ginger, and distinctly

recalling bergamot. In commerce the varieties of ginger are known by the place of their production. African and Cochin ginger on an average yield more resin and volatile oil than do the older varieties.

The recent root is from one to four inches long, somewhat flattened on its upper and under surface, knotty, obtusely and irregularly branched or lobed, externally of a light ash color with circular rugae, internally yellowish-white and fleshy. It sometimes begins to grow when kept in a damp atmosphere. The *common* or *black ginger* is of the same general shape, but has a dark ash-colored wrinkled epidermis, which, being removed in some places, exhibits patches of an almost black color, apparently the result of exposure. Beneath the epidermis is a brownish, resinous, almost homy cortical portion. The interior parenchyma is whitish, the cells being filled with starch. The powder is of a light yellowish-brown color. This variety is most extensively used. The Jamaica or white ginger is white or yellowish-white on the outside. The pieces are rounder and thinner, and afford when pulverized a beautiful yellowish-white powder.

The uncoated ginger of the East Indies resembles the Jamaica, but is darker, being gray rather than white. As the Jamaica commands a much higher price than even the uncoated East India production, the latter is occasionally altered to simulate the former. This is sometimes done by coating the exterior with calcium sulphate or carbonate, sometimes by bleaching with the fumes of burning sulphur or in other ways, by which not only the exterior but also the internal parts are rendered whiter than in the unprepared root. Powdered ginger which has been exhausted in the preparation of essence, technically known as "*spent ginger*," is used to a large extent in the adulteration of powdered ginger. Its detection without assay of some sort is almost impossible, unless so much is present as to sensibly alter the taste of the powder. Alien and Moor rely upon the proportion of cold water extract yielded and the soluble ash. Dyer and Gilbard state that the fixed ethereal extract is of little value, on account of its variability in genuine ginger, but that the extract obtained by alcohol after ether affords a valuable criterion. In genuine ginger the average yield is 2.9 per cent. while in spent ginger it is 1.2 per cent. They also affirm that in genuine ginger the ash produced is 2.7 per cent., in the exhausted ginger it is 0.3 per cent. A. Russell Bennett concludes that spent ginger can be detected by noting the alcoholic and cold water extracts and the soluble ash, affirming that ginger should yield not less than 5 per cent. of extract

with 90 per cent. alcohol, 8.5 per cent. of cold water extract and 1.5 per cent. of soluble ash.

Commercial gingers are known as "scraped," "decorticated," and "coated." The "scraped" gingers are those from which the cortex has been removed in whole or in part by peeling, as seen in the Jamaica, Cochin and Japan varieties. In the "coated" gingers a portion of the outer natural layers are retained as in the African, Calcutta and Calicut varieties. "Bleached" and "unbleached" gingers are also distinguished, the former being lighter in color due to careful washing or special treatment. All of the above varieties mentioned are recognized in the U. S. Pharmacopoeia IX, and are described as follows:

"Jamaica Ginger.—Rhizomes free from the outer corky layers, in horizontal, laterally compressed, irregularly branched pieces, from 4 to 16 cm. in length; and from 4 to 20 mm. in thickness; externally light brown, longitudinally striate, ends of the branches with depressed stem-sears; fracture short-fibrous, mealy and resinous; internally yellowish to light brown, cortex thin, endodermis a thin yellow layer enclosing a large central cylinder with numerous groups of fibro-vascular bundles and yellowish oil cells; odor agreeably aromatic; taste aromatic and pungent.

"African Ginger.—Rhizomes with cork partly removed on the flattened sides, the patches without cork smooth and of a light brown color, the portions with cork longitudinally or reticulately wrinkled and grayish-brown; fracture short or short-fibrous, internally lemon-yellow or dark bluish with yellowish oil-secretion cells and light yellow to reddish-brown resin cells; odor strongly aromatic; taste intensely pungent.

"Calcutta Ginger.—Rhizomes resembling the African Ginger, the branches or 'fingers' being somewhat larger, and with a considerable proportion of shriveled pieces, externally grayish-brown or grayish-blue; fracture short and mealy, or homy; internally light yellow or light brownish-yellow with numerous yellowish oil cells and yellowish-brown resin cells; odor aromatic; taste starchy and strongly pungent.

"Calicut Ginger.—Rhizomes resembling African Ginger, more of the periderm being usually removed; externally more or less uniformly light brown; fracture short or short-fibrous, and mealy; internally light-yellow or brownish-yellow with numerous yellowish oil and resin cells;

odor. aromatic; taste very pungent.

"Cochin Ginger.—Rhizomes with most of the corky layer removed on the flattened sides; externally light brown to grayish-yellow, fracture short and mealy; internally yellowish-white with numerous yellowish oil cells and brownish-red or blackish resin cells; odor aromatic; taste pungent but not so persistent as in the African variety.

"Japanese Ginger.—Rhizome somewhat resembling Cochin Ginger but usually with a thin coating of lime; externally nearly smooth or slightly wrinkled and of a whitish color; fracture short and very mealy; internally varying from a yellowish-white to light brown and with numerous brownish-red resin cells; odor aromatic; taste pungent.

" Powdered Ginger is light yellow, or light brown to dark brown; under the microscope it exhibits numerous starch grains varying greatly in form and size in the different varieties, being nearly spherical, ovoid, ellipsoidal or pear-shaped and frequently with a characteristic beak, usually -from 0.005 to 0.04 mm., occasionally from 0.045 to 0.06 mm. in the long diameter; sclerenchymatous fibers long, thin-walled, non-lignified, with oblique pores and distinctly undulate on one side; oil-secretion cells with suberized walls and containing a light yellowish or yellowish-brown, oily substance; cork cells absent in the Jamaica variety. Introduce 4 Gm. of ground Ginger into a 200 mil flask, fill to the mark with distilled water, and agitate at half-hour intervals during eight hours. Then allow the mixture to stand for sixteen hours, and filter. Evaporate 50 mls of the filtrate, representing 1 Gm. of the drug, on a water bath, dry to constant weight at 100° C. (212° F.) and weigh; it yields not less than 8 per cent. of residue. Ginger yields not less than 2 per cent. of a nonvolatile extract soluble in ether and not less than 4 per cent. of an extract soluble in alcohol. Ginger yields not more than 8 per cent. of ash." *U.S.*

"In flattish, irregularly branched pieces, usually from, seven to ten centimetres long; each branch marked at its summit by a depressed scar. Fracture short with projecting fibres. Agreeable, aromatic odor; taste pungent. When 5 grammes of powdered Ginger are shaken with 100 millilitres of alcohol (90 per cent.) occasionally during twenty-four hours and filtered, 20 millilitres of the filtrate yield on evaporation not less than 0.050 gramme of residue dried at 100° C. (212° F.) ; and when 5 grammes are similarly treated with 100 millilitres of water, 20 millilitres

of the filtrate yield not less than 0.085 gramme of residue dried at 100° C. (212° F.). Ash not more than 6 per cent.; and after deduction of that portion of the ash which is soluble in water not more than 1.5 per cent." *Br.*

The odor of ginger is aromatic and penetrating, the taste spicy, pungent, hot, and biting. These properties gradually diminish, and are ultimately lost, by exposure. The morphology and pharmacognosy of ginger have been studied by Meyer (*Wissenschaftliche Drogenkunde*, vol. ii, p. 64) and Tschirch and Oesterle (*Anatomischer Atlas*, Lief. vi, p. 109). Kraemer and Sindall have published an article on the "Microscopical and Chemical Examination of the Different Varieties of Commercial Ginger" (*A. J. P.*, 1908, p. 303). Spaeth reports on the adulteration and detection of adulterants of ginger and asserts that the more common adulterants are flour, curcuma, linseed and rapeseed cake, cayenne pepper hulls, and extracted ginger. (*Zeitschr. f. Unters. d. Nahr. u. Genussm.*, x, p. 23.)

The use of capsicum in preparations of ginger is not infrequent. When present, it may be detected by the method described under tincture of ginger.

The virtues of ginger are extracted by alcohol. The peculiar flavor of the root appears to depend on the volatile oil, its pungency partly on the resinous or resino-extractive principle. A considerable quantity of pure white starch may be obtained from it. The volatile oil, examined by A. Papousck, was yellow, of the odor of ginger, and of a hot aromatic taste. Its sp. gr. was 0.893, and its boiling point 246.1° C. (475° F.). Deprived of water by distillation over phosphoric oxide, it consisted of carbon and hydrogen, with the formula $C_{10}H_{16}$, and therefore belongs to the terpenes. Tresh considers that the essential oil is mainly made up of a hydrocarbon, $C_{15}H_{24}$, or isomers of it, which boil at from 245° to 270° C. (473°-518° F.). (*P. J.*, No. 586, 1881.) Schimmel & Co. (*April*, 1897) state that the essential oil contains *camphene* and *phellandrene*, and hence the terpenes have the formula $C_{10}H_{16}$, as first stated. Fluckiger obtained from one hundred and twelve pounds of Jamaica ginger four and a half ounces of the oil, or about one-fourth of one per cent. He states, however, that Schimmel & Co., of Leipsie, informed him that they obtained as much as 2.2 per cent. from good ginger. (*Pharmacographia*, 2d ed., p. 637.) H. von Soden and W. Rojahn (*Ph. Ztg.*, 1900, 414) obtained a new sesquiterpene from oil of ginger by

fractioning the saponified oil. They have named it *zingiberene*. It has the sp. gr. 0.872 at 15° C. (59° F.). Those pieces of ginger which are very fibrous, light and friable, or worm eaten, should be rejected. The commercial powder of ginger is very frequently adulterated, rice starch, powdered ginger which has been exhausted in making preparations, and even brick dust and chalk, being used, and the loss of pungency made good by the addition of capsicum or mustard.

Uses.—Ginger is a grateful stimulant and carminative, and is often given in *dyspepsia* and *flatulent colic*. It is an excellent addition to bitter infusions and tonic powders, imparting to them an agreeable, warming, and cordial operation upon the stomach. It is especially valuable in *alcoholic gastritis*. In the serous type of *diarrhea*, when due to a relaxed condition of the bowel, it is a remedy of much service but should not be employed in the presence of inflammatory conditions. The hot infusion is popularly employed under the name of "Ginger Tea" for its diaphoretic effect in colds, especially when accompanied with suppression of the menses. Externally it is rubefacient. Under the name of "*Essence of Ginger*" cheap alcoholic preparations of ginger were formerly sold and used as intoxicants. A number of cases of blindness produced by such use have been recorded, the amblyopia having been due to the large use of methyl alcohol in the making of these "essences." The infusion may be prepared by adding half an ounce of the powdered or bruised root to a pint of boiling water, and may be given in the dose of one or two fluid-ounce's (30-60 mils).

Dose, ten to twenty grains (0.65-1.3 mils).

Off. Prep.—Fluidextractum Zingiberis, *U. S.*; Infusum Sennae, *Br.*; Oleoresina Zingiberis, *U. S.*; Pilula Scillae Composita, *Br.*; Pilula Urgineae Composita, *Br.*; Pulvis Aromaticus, *U. S. (Br.)*, Pulvis Jalapae Compositus, *U. S.*; Pulvis Kaladanas Compositus, *Br.*; Pulvis Opii Compositus, *Br.*; Pulvis Rhei Compositus, *U. S., Br.*; Pulvis Scammonii Compositus, *Br.*; Syrupus Zingiberis (from Fluidextract), *U. S., Br.*; Tinctura Zingiberis, *U. S., Br.*; Elixir Rubi Compositum, *N. F.*; Pulvis Aromaticus Rubifaciens, *N. F.*; Pulvis Myrciae Compositus, *N. F.*; Tinctura Antiperiodica, *N. F.*; Tinctura Antiperiodica sine Aloe, *N. F.*; Tinctura Aromatica, *N. F.*

Zizyphus. *Zizyphus sativa* Gaertn. (*Z. vulgaris* Lamarck.) *Jujube*, Fr. *Brustbeeren*, *Judendornbeeren*, G.—A shrub, or small tree, of the Fam. *Rhamnaceae*, growing on the shores of the Mediterranean, and cultivated in Italy, Spain, and the south of France.

The fruit is the part used. This consists of oval drupes, of the size of a large olive, with a thin, coriaceous, red or reddish-brown skin, a yellowish, sweet, acidulous pulp, and an oblong, pointed stone in the center. These have the name of *jujuba*. By drying, their pulp becomes softer and sweeter, and acquires a vinous taste, evincing the commencement of fermentation. They are nutritive and demulcent, and are used in the form of decoction in *pectoral complaints*. *Jujube paste* consists properly of gum arabic and sugar, dissolved in a decoction of this fruit and evaporated to the proper consistence. As a demulcent it is in no respect superior to a paste made with gum arabic and sugar alone, and the preparation formerly sold in this country under the name contains in fact none of the fruit. The fruits of two other species, *Z. Lotus* Lam., growing in the north of Africa, and *Z. Jujuba*, Lam., a native of the East Indies, possess properties similar to those of the *Z. sativa* and are used as food by the inhabitants of the countries where they grow. The *Zizyphus Jujuba* is stated by Bosisto (*A. J. P.*, 1886) to be one of the main sources of stick-lac, from which shellac is manufactured.

Zygadenus. *Death Comas*.—One or more species of this liliaceous genus, found in the Western United States, are highly toxic to grazing animals, notably to sheep. H. S. Goodell affirms that he has seen violent convulsions produced by the juice of *Z. venenosus* Watson. Slade (*A. J. P.*, 1905, p. 262) obtained an alkaloid from *Z. venenosus*, which resembled veratralbine. Heyl and others (*J. A. C. S.*, 1911 and 1913) obtained an alkaloid from the leaves of *Z. intermedius*, *zygadenine*, which resembled veratrine.