

THE PRINCIPLES & PRACTICE  
OF  
MEDICAL HYDROLOGY

R. FORTESCUE FOX



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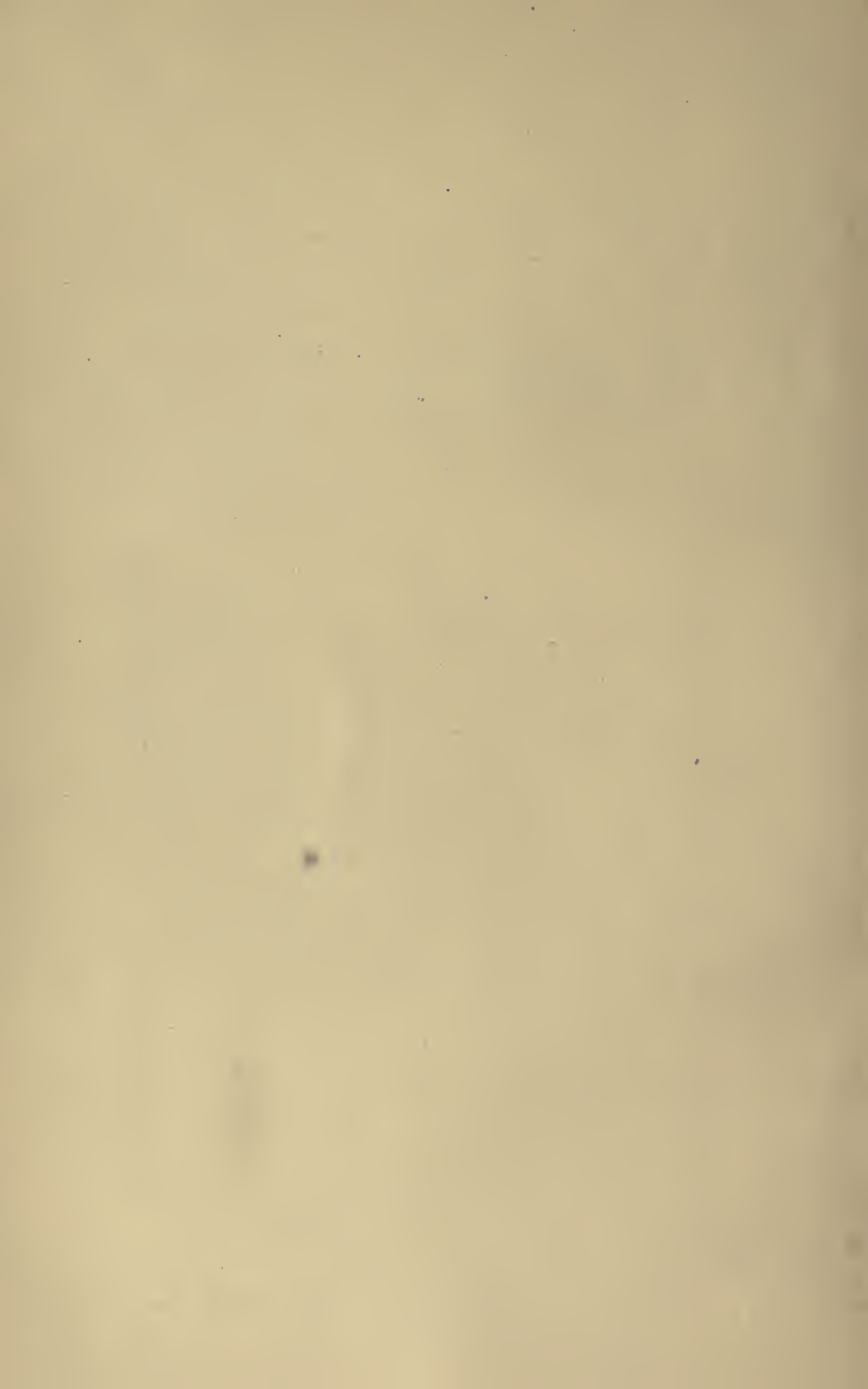


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MEDICAL HYDROLOGY

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THE PRINCIPLES AND PRACTICE  
OF  
MEDICAL HYDROLOGY

BEING THE SCIENCE OF TREATMENT  
BY  
WATERS AND BATHS

BY  
R. FORTESCUE FOX

M.D. (LOND.); F. R. MET. SOC.

LATE HYDE LECTURER ON HYDROLOGY, ROYAL SOCIETY OF MEDICINE



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## PREFACE

AFTER a long period in the extreme of unbelief, the pendulum of opinion is now everywhere moving towards belief in the value of physical agencies in medical treatment. Without some rational oscillations the clock of progress would no doubt stop, and therefore both hypothesis and criticism should be alike welcomed. Unfortunately in the past too many extravagances, both of assertion and denial, have hindered the attainment of a true doctrine.

I hope that there is nothing in the present work, however imperfect in other respects, that departs in letter or in spirit from this ideal.

My aim has been to discuss and describe the various actions both of Waters and of Baths upon the body, without more detail than may be necessary to enable medical men to apply for themselves these methods of treatment, both in acute and chronic disease. Precise directions for the exact procedures to be followed in a particular complaint are often invalidated by differences of individual reaction. Therefore even the most experienced practitioner must feel his way in the use of Waters and Baths, and be willing to be guided from day to day by the results of his treatment.

A sound knowledge of the principles of Medical Hydrology is necessary to the medical man who undertakes to apply them in practice. But I am persuaded that he who draws upon these rich resources will often be agreeably surprised at the benefit obtained for his patient, and will also (if so disposed) find an

extraordinary interest in studying and recording the varying reactions of the body to these physical agencies.

This little volume is not by any means a Guide to Health Resorts. But it is hoped that the reader, who follows the general principles of the work, may find in the Index of Waters and Baths sufficient information to guide him in the selection of spas or medicinal springs for his patient.

Certain articles and papers that I have written in the course of years upon the subjects embraced in this work, have been now more or less laid under contribution; among which may be mentioned the Hyde Lectures of 1911, delivered before the Balneological and Climatological Section of the Royal Society of Medicine; the article on "Balneology" in the *Encyclopædia Medica*; that on "Medical Hydrology," in the recent *System of Treatment*, edited by Dr. Latham and Mr. English; an address on the "Physiology of Bathing," delivered before the International Conference on School and Public Baths at Scheveningen in 1912; beside papers in *The Practitioner*, *The Child*, and the recent volume on the *Health Resorts of the British Islands*. - For their willingness that I should make such use of these materials, my thanks are due to the editors or publishers.

I wish also to record my indebtedness to the writings of Professor Winternitz, and to the work of the new school of Hydrotherapy in America, represented by Drs. Kellogg, Pratt and Hinsdale, and especially by Professor Baruch, who honourably holds the first professorship in Hydrotherapy among the English-speaking peoples.

Not a few historical references I owe to Professor Schleyer's interesting volume *Bäder und Badeanstalten*, and many of the data upon Bodily Heat are taken from Dr. Pembrey's classical work.

A special acknowledgment is due in respect to Sir Hermann and Dr. Parkes Weber's monumental work on *Balneotherapy and Climatotherapy*, to which all writers on Waters and Baths must be indebted.

In dealing with points of Etymology, and in seeking to disentangle the Nomenclature of the subject, I have had most kind and valuable help from Sir Clifford Allbutt and Dr. Norman Moore.

R. F. F.

*Devonshire Place,  
London, W.*



## INTRODUCTORY

It is the object of the present work to set forth in a systematic and compendious form the medical doctrine of Waters and of Baths. In this doctrine meet together a very new science and a very old art.

The use of Waters and Baths is probably older than any other branch of treatment. Many generations of practitioners have followed it by the light of their unaided experience. To the best of their ability they have employed these natural resources as curative measures, and with the same mingling of success and failure as we know to-day. In some of the health resorts the traditions of these men still linger, but for the most part their wisdom has died with them. Historical medicine has yet to honour these pioneers. Their interpretations may have been fanciful, and their language archaic, but—

“*Vixere fortes ante Agamemnona  
Multi.*”

Upon this ancient art now rises the light of a new science. There follows the task of applying it in practice. It is necessary that all the methods and procedures of the medical use of Waters and Baths should be tested and examined in the light of the new knowledge.

The action of heat and cold upon the various functions of the body have been in great part accurately determined. Experimental research has shown in what way both the production and loss of bodily heat are affected by these physical agencies, and how metabolism and the nerve centres and the circulation

both in deep and superficial parts, are profoundly influenced by the same agencies. The effects of water internally and externally as a vehicle of energy, have been precisely analysed. Not only so, but the qualities and actions of medicinal waters and of baths of all kinds, effervescent and saline, or containing volatile matters, or semi-solid, or gaseous, have been submitted to exact investigation.

The action of dissolved matters and of dissociated salts upon the tissues, the tonicity and radio-activity of certain waters, their physical qualities and the action of their contained gases, the presence and probably the ferment-action of colloidal metals, all form part of the new knowledge, to which geology, chemistry and physics make their contribution.

It is interesting to discover now and again that the advent of science substantiates and explains old conclusions, showing that there is more than one road to truth. This is emphatically the case with the science of Waters and Baths.

For this whole doctrine of water and waters, embracing as it does the use of water as a vehicle of energy and all the varied internal and external applications of the medicinal springs, with their differing chemical and physical constitutions, the simple designation Medical Hydrology appears to be the most appropriate.

The question of nomenclature is one of no little practical importance, and is dealt with more fully in Chapter XX.

In the present work an endeavour is made to deal with this science in its due order. The first section treats of the physiology of bathing, for an understanding of which it is necessary to study the all-important functions of the skin, with the laws of bodily heat. It also includes some practical considerations upon the use of baths in health, with especial reference to children.



The second section is occupied with pure hydrotherapy or the medical use of water as a vehicle of energy. It has seemed advisable to introduce a historical *résumé* of the subject, which exhibits its great advance in recent years. The action of water when taken internally and the general action of baths upon the body are then examined. It has been the author's wish to trace out and to emphasise the *principles* of treatment, and the reader must be referred to detailed works on hydrotherapy for a full account of the methods that are employed. A chapter on Cooling Hydrotherapy and others on the history and application of the douche and of hot air and vapour baths complete this section.

The third section is devoted to the other great division of Medical Hydrology, namely, the action and uses of Medicinal Springs. Here also a brief historical survey is introduced in order to trace as it were the evolution of the spring, and its place in the armamentarium of medicine. The various kinds both of Waters and of Baths are examined and described in detail, and a separate chapter deals with the waters of Great Britain and Ireland, considered with reference to the modifying influence of climate.

In a final section several chapters are devoted to a discussion of the *indications* for hydrological treatment in different chronic ailments and diseases. The author has added a short account of the geographical distribution, and an alphabetical index, of the principal medicinal springs.



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# MEDICAL HYDROLOGY

## PART I

### THE PHYSIOLOGY OF BATHING

#### CHAPTER I

##### THE FUNCTIONS OF THE SKIN

THE skin is the organ by means of which baths and all other surface treatments produce their effect upon the body. A knowledge of its functions is therefore indispensable to the Hydrologist. Its relation to the *bodily heat* will be more fully discussed in the next chapter.

The organ of surface treatments.

The skin is computed to have in grown persons an area of about fifteen square feet. The epidermis, as well as the *cutis vera* and subcutaneous fat, are poor conductors of heat. Therefore the investing and protecting cutaneous envelope powerfully conserves the bodily warmth.

Area.

The skin is also a vast secretory and excretory glandular organ. The amount of the daily perspiration of an adult in an atmosphere at 100° F. is estimated at 30 oz., as compared with 15 oz. of water thrown off by the lungs. It is said that the pressure of the perspiration in the sweat-glands exceeds that in the

As a glandular organ.

(1) Sweat-glands.

large arteries. A considerable amount of carbonic acid gas is contained in the sweat, estimated at about one-thirtieth of that exhaled from the lungs. The nitrogenous matter, urea, etc., excreted by the skin may amount to 4 or 5 per cent. of that contained in the urine. It is interesting to note that when the function of the kidneys fails a compensating power of the skin comes into play, and the cutaneous excretion of nitrogenous waste may be greatly increased. The process of perspiration is regulated by means of sudorific nerve fibres from the sympathetic system, which cover the entire surface of the body and terminate in the sweat-glands. Those nerves in their turn are believed to be under the control of spinal sweat centres. Emotional states, vasomotor and other nervous disorders and abnormal conditions of the blood (as in asphyxia) powerfully stimulate the sweat centres. The nervous apparatus in the glands is on its part very sensitive to temperature changes, and to the action of certain remedies, such as pilocarpine.

(2) Sebaceous glands.

The secretion of the sebaceous glands is composed of fat, to the extent of about one-half, and serves as a lubricant and protective to the surface of the body. This secretion is analogous to the lanolin derived from sheep. The sebaceous glands are very liable to become obstructed in cold and temperate climates, but may readily be stimulated by heat, particularly by radiant heat. There is no doubt that the custom of covering the greater part of the body has induced unnatural defects of the skin in this and other respects. Apart from defective glandular action, the skin has become less sensitive to heat and more sensitive to cold. We are too little accustomed to changes of external temperature, the normal "reaction to cold" (*vide infra*) is weakened, and the resistance to disease is thereby lowered.

The skin is further to be regarded as the great heat regulator of the body. The mechanism of heat regulation is essentially a system of blood-vessels covering the entire body, which can be opened or closed by vasomotor action from moment to moment either partially or simultaneously over the whole surface. The network of the circulation in the skin is said to be so capacious that it could contain one-half to two-thirds of the total circulating blood.

As the great  
heat regulator  
of the body.

Of the total daily loss of heat, about two and a half millions of calories, nine-tenths passes by the skin, by radiation, conduction and evaporation. According to the law of cooling bodies, the loss of heat at any time is proportional to the excess of the temperature of the skin over that of the external medium. Heat is rapidly lost when the skin is warm and the medium cold. A rapid initial loss takes place upon entering a cold bath, but as the contraction of the blood-vessels approximates the temperature of the skin to that of the medium, the loss is quickly diminished and the bodily heat is conserved. The passage of heat from the body, therefore, depends in the first place upon the condition of the superficial circulation. The more active this circulation, and the more blood present in the skin, the higher is its temperature and the greater the loss of bodily heat. When, on the other hand, the circulation in the skin is contracted, its temperature falls and the loss of heat is diminished.

The heat loss is also dependent upon the activity of the sweat-glands, which cool the body by evaporation. Any increase of perspiration causes an increased loss of heat, and *vice versa*. The amount of evaporation from the body at any time depends upon the relative humidity (percentage of saturation) of the air, and also on the presence or absence of wind. Evaporation is the principal method of cooling the body in hot countries. It follows that the power of free

perspiration is a matter of great consequence to health in hot countries. In dry hot countries, like India or Egypt, evaporation is at a maximum, and the unimpeded cooling of the body induces a feeling of fitness. On the other hand, in hot but humid climates, like that of British East Africa, evaporation is too often at a minimum, and the excess of bodily heat is with difficulty got rid of, and is a source of unfitness and ill-health.<sup>1</sup>

As a nervous afferent organ.

The skin may lastly be described as a nervous organ for relationship with the external world, inasmuch as it contains an expansion of the nervous system spread out over the body, which may be compared in sensitiveness to a photographic plate. This nervous network includes the various sensory end-organs for touch, pressure, pain and temperature. The skin is a great absorber of energy, as every one who has been exposed to the solar rays must have experienced. This nervous surface organ is constantly engaged in receiving and transmitting to the centres in the brain and spinal cord an infinite number of impressions from the outside world. It is true that these afferent impulses do not for the most part affect the conscious brain. There is reason to believe that in mankind the surface of the body is more sensitive and takes a more important part in physical and mental processes than in any other animal. Emphasis may be placed upon the relation of the skin to the mental activities. Not only is it developed from the same embryonic tissue as that from which the nerve centres are derived, but it is probable that in the process of evolution the functioning of the skin and nerve centres are intimately related and proceed *pari passu*.

Relation of the skin to the cerebral centres.

It is by means of the skin as an organ of relationship that the body is enabled without dangerous reduction of temperature to maintain a constant and effective relation with external conditions and the various forms

<sup>1</sup> See Halliburton's *Physiology*, 1911, p. 631.



of energy pervading the world. Upon the "reaction" or response of the individual to his environment and to these energies, the integrity of his functions both physical and mental, depend.

Another function of the skin has been defined and described by Head. This depends upon the law of the relationship of the various cutaneous areas to corresponding internal parts. It has been shown that the surface of the body is intimately related reflexly and functionally to the underlying organs, and that both are consentaneously affected and one by the other. This nexus explains the powerful effect of local surface applications of heat and cold upon certain internal organs.

Relation to internal organs, and to the gastro-intestinal mucous membranes.

The skin as a whole is also physiologically related to the gastric and intestinal mucous membranes, the vasomotor and probably other conditions of the one surface or area being associated with contrasted conditions in the other area. This fact was familiar to the ancient physicians, and is expressed in the Hippocratic saying: *Alvi laxitas cutis densitas, cutis raritas alvi densitas*. The frequent occurrence of internal catarrhs as a result of external chill finds an explanation in these principles. In addition to what has been already stated, there is furthermore an inverse relationship between the circulation in the skin and that in the kidneys (Dastre and Morat's Law).<sup>1</sup> These various relationships of superficial to deep parts are constantly illustrated in practical medicine, and form the foundation of hydrological and other surface treatments.

Like all other living tissues, the skin exhibits electro-motive phenomena. An in-going current has been described, "the current of rest," passing from the surface (negative) to the deep parts (positive). This is attributed to the action of the cutaneous glands.<sup>2</sup>

<sup>1</sup> *Système nerveux Vaso-moteur*, Paris, 1884.

<sup>2</sup> Waymouth Reid in Schäfer's *Physiology*, 1898.

## CHAPTER II

### BODILY HEAT

MAN is by nature the least protected of the warm-blooded animals, and must therefore be most sensitive to the effects of temperature, as well as to other external conditions. Nevertheless he is, without fur or feathers, nearly as warm as the birds. The temperature of cold-blooded animals, as well as that of animals in a hibernating condition, is usually a few tenths of a degree above that of their surroundings. The average temperature of some warm-blooded animals is given in the following table :—

Temperature of animals.

|                   |                   |                           |
|-------------------|-------------------|---------------------------|
| Ornithorhynchus   | 76° F.            |                           |
| Echnida . . .     | 81-90             |                           |
| Man . . . . .     | 98·14 (36·7° C.). | In rectum ·4 to ·5 higher |
| Ostrich . . . .   | 99                |                           |
| Horse . . . . .   | 100               |                           |
| Dog . . . . .     | 101               |                           |
| Ox, cat . . . . . | 101-102           |                           |
| Sheep . . . . .   | 104               |                           |
| Fowl . . . . .    | 106-109           |                           |
| Duck . . . . .    | 107-110           |                           |

Indifference to climate (in a healthy condition).

Notwithstanding his unprotected and sensitive condition, man maintains his existence over the habitable globe in every kind of climate, and often in an atmosphere many degrees colder than his body and constantly varying in temperature. The distribution of other animals is bounded by climatic conditions. Neither a tropical climate of 130° F. nor an Arctic cold at -67° F. produces any appreciable effect on the temperature of the human body. The famous experiments of Blagdon and Fordyce (*Phil. Trans.*, 1785) proved that even greater extremities

of heat can be safely endured. They entered an oven at 239–258° F., where steaks were cooking, and after fifteen minutes found no elevation of their temperature. This remarkable toleration of the body for dry heat, so different from its behaviour when exposed to moist heat, is a fact of cardinal importance in the use of baths, and will claim attention in subsequent chapters. The heat-regulating mechanism of the human body is of such a kind as enables it to preserve under all sorts of external conditions a relatively high temperature at an even level. The power of maintaining a constant temperature reaches perfection in man. “He of all animals has the most constant temperature under extreme differences of external heat and cold” (Pembrey).

In a state of health the temperature of the blood is maintained at or about 98° F. (37° C.), with a diurnal range of about 2° F. This temperature represents (in northern climates) the balance struck by the production of heat within the body and the loss of heat that is constantly taking place to the colder outside world. The temperature of the body is not, in fact, the same in all its parts. An *internal warm zone* has been described comprising the deep organs and tissues; also an *intermediate temperate zone*, and lastly an *external or cool zone*, consisting of the skin and subcutaneous tissues.

The temperature of the covered parts of the skin is placed (by Kunkel) as low as from 10° to 12° F. less than that of the blood, whilst that of exposed parts, e. g. the hands, may fall short of it by more than 20° F.

The temperature of infants and young creatures generally is less than that of adults, that of an infant at seven months being 89° F. (W. F. Edwards). The power of heat regulation is also less perfectly developed in the young.

Mean bodily temperature

Temperature of different parts of the body.

Temperature of the skin.

Temperature of young animals.

Heat produc-  
tion.

Bodily heat is produced by oxidation or slow combustion in the living tissues, particularly in the muscles, the liver and the glands. A man in health is estimated to produce from 2,700,000 to 3,200,000 calories per diem. During digestion and muscular exercise the production of heat is greatly increased. It is also, *in health*, always increased by exposure to cold and cold climates. Starvation, on the other hand, causes an enfeeblement of heat production and a progressive fall of temperature. Hence food should always be more freely given during exposure to cold. A fasting dog lost 276 kilocalories in twenty-four hours (Pembrey).

Effect of  
climate.

Effect of diet.

The production of heat is considerably affected by diet as well as by climate. In India, for example, heat production is on a comparatively low scale, and the rice taken in food produces less than half the amount of heat derived by the Esquimaux from a diet of blubber. This is one of the many interesting adaptations of diet to climate, which usually rest on a physiological basis.

Heat regulat-  
ing centres.

The central heat-regulating nervous mechanism is thought to reside in the basal ganglia of the brain. This centre normally regulates the bodily heat through its control of the skeletal muscles and those of the blood-vessels (Pembrey). In fever heat production rises, in consequence of increased tissue disintegration, and the discharge of heat is commonly diminished owing to the dryness of the skin.

Heat changes  
in hibernation.

It is interesting from this point of view to note the extraordinary variations of bodily heat in hibernating animals. There is nothing in the course of fevers to compare with these periodical natural fluctuations of temperature. The temperature of a siskin on awaking from hibernation rose 18 degrees in the course of one and a half hours, that of a bat rose 17 degrees in fifteen minutes, and that of a dormouse 22 degrees

in one hour (Pembrey and Hale White). As showing the central control of these changes, it may be added that section of the spinal cord at the fourth cervical vertebra entirely prevents these rises of temperature.

Certain drugs exert a considerable effect upon bodily heat. Curare, by paralysing the peripheral nervous organs, makes a warm-blooded animal cold-blooded. Alcohol gives rise to a *sensation* of heat from increased vascularity of the skin and activity of the sweat-glands, but may lower the temperature of the body five or six degrees or more. It also diminishes the normal reaction to cold. Pilocarpine appears to act upon the peripheral nerve organs, and phenacetin probably through the central organs. Chloroform, ether, morphia, chloral and nicotine, depress the power of heat regulation, and tend to place the animal more or less in the cold-blooded state. On the other hand, caffeine, atropine, cocaine, raise the temperature of the body. Strong muscular exercise may also temporarily raise it one or two degrees.

Effects of drugs  
on bodily heat.

Chronic disease is marked by a lower production of bodily heat, and by a want of normal reaction upon exposure to cold.

Bodily heat  
in chronic  
disease.

The daily loss of heat of a healthy man on ordinary diet has been experimentally proved to amount to about  $2\frac{1}{2}$  million units of heat. This amount would be sufficient to raise from freezing to boiling point 55 lb (25 kilogrammes) of water.<sup>1</sup>

Loss of bodily  
heat.

It is important to observe for our present purpose that in man nine-tenths of the heat lost passes away by the skin, by radiation, conduction and evaporation. The daily loss of heat has been calculated as follows.

Loss of heat by  
the skin.

<sup>1</sup> The French thermal units, calorie and kilocalorie, are the amounts of heat required to raise respectively one gramme and one kilogramme of water through one degree Centigrade.

|       |   |         |
|-------|---|---------|
| 1·8%  | by the urine and fæces,                   |         |
| 3·5%  | by the expired air,                       |         |
| 7·2%  | by evaporation from the lungs,            |         |
| 14·5% | by evaporation from the skin, . . . . .   | } 87·5% |
| 73 %  | by radiation and conduction from the skin |         |

---

100

Constant variations of cutaneous loss of heat.

Peripheral tissues as non-conductors of heat.

The blood supply of the skin is so elastic, and governed by a mechanism so sensitive, that the equilibrium of the bodily temperature is maintained within two or three degrees; in spite of the fluctuations not only of the external temperature but of heat production arising from tissue change. Only by a constant adjustment of the cutaneous loss of heat, by means of changes in the peripheral circulation and the action of the sweat-glands, can this equilibrium be preserved.

The low power of conductivity for heat belonging to the skin and to the fatty tissues under the skin prevents our rapidly growing cold, because these tissues interpose between the vital parts and the external world a non-conducting barrier. Other things being equal, the loss of heat is less in adults than in children, in large than in small animals. The ratio of surface to bulk diminishes as the size of the animal increases. In whales and other large animals living in the arctic seas, the loss of heat is minimised and their high temperatures maintained, partly by their great bulk, and partly by the thickness of their non-conducting skin and blubber. In man the average temperature of the skin is considerably warmer than in these animals, and approximates as a whole to 93° F. (34° C.), that is to say, in its various parts from five to ten or more degrees lower than that of the blood. We are protected by a cool integument against too rapid a loss of heat.

Loss of heat increased by wind and moisture in the air.

The loss of heat is markedly increased by movement of the air. In the records of Parry's Expedition in the Polar seas it is stated that a temperature of -12°

with wind was felt by the explorers to be much colder than a temperature of  $-40^{\circ}$  when the air was calm. The body is also cooled more rapidly in cold moist air owing to the great capacity of aqueous vapour for absorbing heat. Therefore it is that dry air at a low temperature, especially without wind, as at some Alpine winter stations, seems much warmer than moist air at a higher temperature, and especially in the presence of wind. Clothing, of course, checks the loss of heat by keeping the body surrounded by a zone of warm air. The temperature of the included air in ordinary clothing is about  $89^{\circ}$  F. ( $31.5^{\circ}$  C.).

Effect of clothing.

It follows that when the body is exposed to air at or about  $89^{\circ}$  F. the normal values of heat production and loss should be unaffected. Let the atmospheric medium be a little warmer and the production and loss of heat are diminished, or a little cooler and they are increased. At a certain point the normal exchange is undisturbed. This point of temperature, the *point of thermal indifference for air*, is fixed at from  $85^{\circ}$  to  $89^{\circ}$  F. We know that in some tropical countries men spend their lives in an atmosphere approaching these temperatures, and with a minimum protection by clothing. Their bodies are in a state of constant thermal equilibrium, and the delicate mechanism for the continual regulation of heat production and loss upon which we depend for our existence in colder and more variable climates is for them more or less superfluous. The "reaction of the body to cold" (*vide infra*) has perhaps never been fully developed, at all events it is not, as with us, continually in operation. Hence cold applications should always be used with caution in hot countries.

Point of thermal indifference for air.

Water conducts heat more freely than air. It has been found that in a bath about the mean temperature of the skin ( $93^{\circ}$  F.) the normal heat production and loss are unaffected. The *point of thermal indifference*

Point of thermal indifference for water.

*for water* is therefore fixed at 93° F. (34° C.). In considering the effect of baths, both in health and in disease, it should be borne in mind that baths at or about this temperature have no thermal result upon the body, whilst all other baths, whether hotter or colder, always affect the bodily heat. There are many natural waters employed for baths at such temperatures, like those of Leukerbad in Switzerland and Kawanaka in Japan. It is an ancient custom for persons to stay many hours, and sometimes for whole days or even weeks, in these indifferent or athermal baths. No temperature effects are experienced. It follows that when it is desirable for purposes of cleanliness or otherwise that baths should be prolonged or frequently repeated, they ought to be at or near the point of thermal indifference (93° F.), otherwise they would add to or diminish the bodily heat in an undesired and possibly in an injurious manner.

Athermal  
baths.



## CHAPTER III

### THE USE OF BATHS IN HEALTH

#### Practical Rules

ALTHOUGH the use of baths, hygienic and medicinal, is of untold antiquity, the accurate knowledge of their action is new, and we are only now beginning to understand the *rationale* of bathing, both for the preservation of health and for the prevention and cure of disease. Erroneous ideas and faulty practices have too often prevailed regarding baths. They are too often given, especially in schools, and even to delicate children, in a haphazard, or still worse in a routine fashion. Such practices often produce temporary disturbance and sometimes serious injury to health.

Haphazard  
use of baths  
for children.

What practical guidance as to the hygienic use of baths can be deduced from the facts that have been summarised in the preceding sections? Here, as elsewhere, it will be found that science confirms and explains the result of experience. It is clear that both heat and cold have a powerful effect upon the human body. Both of them may be stimulant, sedative, debilitating, depressant, and finally destructive to organised life, according to dose and according to duration.

Baths may conveniently be classified with reference to the temperature of the body as follows:—

- I. *Minus Baths* (a) VERY COLD, 32–60° F. (0–15° C.).  
(negative heat) (b) COLD, 60–75° F. (15–24° C.).  
(c) COOL, 75–90° F. (24–32° C.).
- II. *Plus Baths* . (a) WARM, 90–98° F. (32–37° C.).  
(positive heat) (subthermal baths).  
(b) HOT, 98–105° F. (37–40° C.).  
(thermal baths).  
(c) VERY HOT, 105–120° F. (41–49° C.).  
(hyperthermal baths).

Classification  
according to  
temperature.

### I.—Minus Baths (*negative heat*)

Rules for use of  
cool baths.

(1) Cold and very cold immersion baths should be used only by persons with active circulation and a normal "reaction to cold." The degree of cold and the duration of the bath should be proportional to the vigour of the reaction. Reaction is increased and promoted when the bather is warm before entering the bath, and when the cold is rapidly applied.

(2) A cold bath, whether in sweet or salt water (sea baths) should never be continued when the termination of reaction is indicated by the sensation of warmth giving place to what is known as the "second chill." Movement of the air (wind) greatly increases the loss of heat, and hence sea baths should only be used with caution by delicate persons and children on windy days.

(3) The brief cold "morning tub" is a good natural and physical tonic for young and healthy subjects, in winter as well as in summer. Its educative effect is seen in increased resistance to chill as well as in the cultivation of will power. Children and others with feeble reaction should not in winter time use it below 65° F. or 70° F. (the temperature of "cold water" in the summer), and never when feeling chilly (Dr. Duke of Rugby). Since muscular work and digestion both increase the production of bodily heat, a cold bath may be taken with the best advantage by delicate persons immediately after brisk exercise or a short time after a light meal. Experience shows that many otherwise healthy individuals have a defective reaction to cold, which, however, is capable of education. It is generally defective in young children and old persons. It follows from the above that only the robust should take a bath below 65° or 70° F., without previous application of heat.

(4) Cold after heat (*minus* after *plus*) is the form of bath most applicable for all ages in cold and temperate

climates. It is especially suitable for young children.<sup>1</sup> At both extremities of life loss of bodily heat is badly borne. The degree and duration both of cold and heat should be adjusted to the vigour of the individual. In school life the ideal daily bath is a brief shower, first hot and then cold, and taken when warm after vigorous exercise.

(5) Cool and cold baths when systematically employed educate the natural reaction to cold, and greatly increase the resistance of the body to fluctuations of external temperature. The common and often serious ailment known as "chill" is a result of failure of this natural reaction, from which follows diminished resistance of the tissues to the invasion of micro-organisms. The many forms of illness in cold and temperate climates depending upon "chill" as a necessary first stage would be to a large extent prevented if a healthy reaction to cold was produced in the community at large by the habitual use of appropriate baths.

Education of defective reaction to cold.

(6) Cool and cold baths are not adapted for hot climates because the reaction to cold has never been fully developed in these climates, and chill is therefore more readily produced. It is for this reason that cold baths are dangerous in the tropics.

(7) *Frictions with Oil.*—The excessive use of soap in the bath, and especially of alkaline soaps, is too common. This is injurious not only to the skin but to the general health, by removing too freely the natural fatty sebaceous matter from the surface of the body. An unpleasant dryness and harshness of the skin is the result. The use of oil frictions after the bath, as practised by the Romans, restores this protective and

<sup>1</sup> "In early infancy the bath should be at 100° F. : at six months a morning bath at 80° F. with a rather cooler sponging after : at ten months cold sponging may be used after warmth : and at four to five years a brief cold bath."—(Mrs. Langton Hewer in *Our Baby*.)

lubricant covering. The skin remains soft and flexible, and undue evaporation and chill are often thus prevented.

## II.—Plus Baths (*positive heat*)

Rules for use  
of hot baths.

(1) Warm and hot baths are at first stimulating, but very easily become depressing. In many, even in young persons, the action of the heart is quickly affected, and dangerous weakness may supervene several hours after leaving the bath. In robust persons a *brief* hot bath after strong muscular exertion promotes the removal of waste products from the muscles, and so prevents stiffness and has a refreshing effect. In the same manner warm and hot baths often remove ordinary physical fatigue. *Very brief* hyperthermal baths are of all forms of bath the most stimulating. Baths above the point of thermal indifference (93° F.) should never be long continued, and should invariably be followed by an application of cold (*minus* after *plus*). Heat should always be followed by a proportional degree of cold.

(2) When prolonged beyond a brief period, hot baths temporarily lower the tone of the circulation, the muscles and nerve centres. When habitually used (and the subsequent use of cold neglected), they produce a permanent condition of mental and physical debility. The habit of taking frequent and prolonged hot baths without after-cold is especially injurious to young persons, and should be strongly discouraged.

(3) Brief hot baths are well adapted for use in hot countries. They promote the surface circulation, and so increase the loss of heat which otherwise tends to accumulate within the body.

## III.—Athermal Baths

Baths at an “indifferent temperature,” at or about 93° F., do not affect the production and loss of heat,

and are suitable for cleansing purposes as well as for baths of considerable duration.

#### NOTE ON CHILDREN'S BATHS AND SCHOOL BATHS

Experience has shown that dirt, like famine, is the precursor and cause of many diseases, and that the skin is the port of entry of many maladies. For example, it was observed in 1908 that amongst the men frequenting the night shelters at St. Petersburg a certain type of fever was prevalent. As many as 14 per cent. of the men who were selling old clothes died of this fever in one year. The complaint disappeared when the men were ordered the cleansing douche, and the clothing and shelters were properly disinfected. Both dirt and famine act by lowering the healthy resistance of the organism. On the other hand, it has been found that if children are washed and fed, their resistance to the invasion of disease is so greatly increased that they are practically immune to many infections.

The hygiene of bathing.

In ideal conditions of housing the children of the people might obtain a daily cleansing bath at home. It is because the home bath is at present impracticable that the school bath is so essential. Germany, nearly thirty years ago, gave the world an example in the provision of baths at public schools. The *rain-bath* or *cleansing douche* is now extensively used in schools not only in Germany, but in many of the towns of Scandinavia, Belgium and France, as well as in New York and elsewhere in America. The best authorities agree in preferring this form of school bath to either the swimming pool or the tub bath, which are so much in vogue in England. The douche is simple in construction and economical of water. It is more cleansing in its effects and more invigorating than a plunge bath, and more suitable for delicate children. In many

Provision of school baths.

elementary schools it is customary for all the children to take one per week, which subtracts but little time from the daily lesson. Swimming baths, unless carefully graded in temperature, are unsuitable for delicate children; the bath is more fatiguing, and there is always a certain liability to impurity of the water and to the spread of infection.

It has also been shown that the routine use of douche baths at school has had the best effect on the physical and mental condition of the children. The desirability of making them an integral part of the educational system was set forth in a resolution passed at the Third International Congress of School Hygiene, held at Paris in August, 1910: "That it is desirable that in all establishments of instruction the necessary measures should be taken to make the use of douches obligatory, and that in all new schools the douche should form an essential part of the plans."

Medico-educational considerations.

In view of the influence of bathing upon child life, it is not too much to say that the time has come for the methods and details of school and public baths to be founded upon physiological knowledge, and definitely placed under the direction of competent medical authority. When applied to the sensitive skin of a child, heat and cold are edged tools, and cannot be used by rule of thumb.

The *rain-douche* or *shower*, first warm and then cool, and accompanied at the beginning by a liberal use of pure soap, may be accepted as the standard bath for school children. The temperature, force and duration of the douche can all be graded according to individual requirements.

For the *normal child* the requirements of bathing are twofold: (1) cleanliness, and (2) that the skin should be kept active and responsive by tonic applications of cold.

The *sub-normal child* generally suffers from languid

circulation, defective reactions and deficiency of bodily heat. For him a healthy skin is a prime necessity. Such children require a method of bathing in which the stimulation of brief heat is combined with that of cold in proper proportion and degree, in order to arouse dormant reactions and increase nervous energy and tissue change. In the case of delicate children the bath should only be taken with a certain reference to food and rest. Sub-normal children above all others require to be fortified against the invasion of disease. For this end there are no means comparable in their good results to appropriate *feeding* and *bathing*.

Bathing  
preventive of  
disease.

In the case of children already affected with chronic ailments or definite local or general disease, baths of a cleansing and tonic and sometimes sedative nature have an equally wide application.

The various skin affections due to parasites and vermin can be both prevented and cured by systematic bathing. This applies to such scourges as pediculi, scabies and ringworm.

The hygienic management of "lymphatic" and "scrofulous" and "rickety" children, with chronic catarrhs and enlarged glands, should be on the same general lines as for the sub-normal child, hot and cold stimulation of the skin and systematic increase of heat production. Many of these children are "pre-tuberculous," if not already tuberculous, and for such as these the cooling regimen of the open-air school has been already devised with great advantage.

Cooling baths  
for children.

The new medico-educational doctrine should not stop short with the open air. For a healthy child-life, whether normal or sub-normal, bathing is an essential part of the programme. It is in truth founded on the same principle as the open-air regimen. Cooling baths, like cooling airs, are powerful stimulants and act through the skin upon the entire body. But the action of baths is more rapid and more energetic and

more readily adapted to the individual conditions of disease.

Enough perhaps has been said to show the unique importance of bathing for children as a hygienic and preventive and curative practice. The practice is by no means so simple as it looks. It has to meet needs of a very variable kind. It must be, above all, adaptable and elastic. It is useless to instal in a school, or to prescribe, any rigid system of baths for children. Many complex factors enter into the physiology of bathing, both in health and disease. The science and practice of hygienic bathing is a special branch of hydrology, worthy of attentive study, and likely in the future to have a very wide application especially for children.<sup>1</sup>

<sup>1</sup> See *The Child*, May, 1913.



## PART II

### HYDROTHERAPY

#### CHAPTER IV

##### HISTORICAL

IN order to understand the position which this department of Medical Hydrology now occupies in medicine it will be necessary to trace in outline its recent history both in science and in practice.

The first  
branch of  
Medical  
Hydrology.

This chapter is therefore of an historical and introductory character.

*Medical Hydrology* is the simple but comprehensive designation for the whole science, which embraces the several factors that enter into the medical use of water and of waters.

The present and ensuing chapters are concerned with that branch of medical hydrology which has to do with the use of water solely as a vehicle of energy. To this subject, in a copious literature in many languages extending over more than seventy years, the name *Hydrotherapeutics* or *Hydrotherapy* has been consistently applied.

In order to trace even in outline the recent history and present position of this branch of medical treatment, it will be necessary to recall the events by which, first of all in recent times in this country, and afterwards on the continent of Europe, the knowledge of the operation of water upon the human economy was made known. It will be shown how the foundations of a

true scientific theory and practice were laid by an English physician in the seventeenth century, and how, at the end of the eighteenth century, Wright and Currie built upon these foundations; how this knowledge was carried into Germany; how there it took root, and grew into a goodly body of doctrine and practice founded upon experimental research; and how, in consequence, the new science and art of Hydrotherapy has taken its place in the treatment of both acute and chronic diseases. It will then be needful to consider briefly what are the rational principles of modern hydrotherapy in order to appreciate the position which it now occupies in Therapeutics; and lastly, to inquire how Great Britain compares at present with other countries in regard to its practice.

Floyer 1697-  
1722.

The medical use of water was first seriously advocated in this country in modern times by Sir John Floyer, physician, at Lichfield. His work, *An Enquiry into the Right Use and Abuse of the Hot, Cold and Temperate Baths in England*, was first published in 1697, and his *Psychrolosia, or the History of Cold Bathing, both Ancient and Modern* (published in 1722), was dedicated to the College of Physicians in London, "whose great endeavours," said he, "are to revive all practices useful to mankind, as well as to invent new ones." With much learning Floyer cites the employment of sweating baths and of cold baths by the ancients; points out that a hot regimen is required for hot countries, and a cold regimen for cold countries—a very shrewd observation, not yet fully appreciated; affirms, in opposition to the teaching of that time, that the benefits obtained from "Holy Wells" were due to the physical virtue of the springs and to God's blessing on a natural use of them, and relates in detail the beneficial operation of cold, and especially of tepid, baths under his own observation at Lichfield and at Buxton. It is interesting that the value of *subthermal* baths at

a temperature a little below blood-heat was recognised at this early date, although we are only now, after two hundred years, beginning to understand their operation.

In England Floyer's work seems to have made but little impression in medical circles, although lay writers advocated the same thesis, sometimes with more zeal than knowledge. Of these the chief was John Hancock, whose book entitled *Febrifugium Magnum, or Common Water the Best Cure for Fevers* (1723), ran through seven editions in one year. A treatise by John Wesley, the founder of Methodism, on *Primitive Physick, or an Easy and Natural Method of Curing Most Diseases* (1747), also enjoyed a very large circulation.

In Germany the observations and reasonings of the English physician fell upon fruitful soil, and his doctrine found an able exponent in Friedrich Hoffman, professor of medicine at Halle. His essay on the *Nature and Properties of Water* was published in 1761. The Hahns in Silesia, Oertel in Ansbach (1830), van Swieten, and Hufeland (1762-1839) widely extended the use of cold and tepid applications. Meanwhile a few physicians in England, among whom were Mead, Cheyne, Huxham and Pitcairn, continued to employ and to recommend similar methods.

Followed by  
German  
physicians.

In 1779 Dr. William Wright, afterwards President of the College of Physicians in Edinburgh, opened a new chapter in Hydrotherapy by presenting to the Medical Society of London his observations on the use of the cold bath in small-pox and yellow fever, made upon an expedition to the West Indies. Subsequently he introduced into Scotland the same practice in his treatment of fevers.

Wright on the  
use of baths in  
fevers (1779).

Following Wright, and in some sort inspired by him, the more famous Dr. James Currie of Liverpool published in 1797 his *Medical Reports on the Effect of Water, Cold and Warm, as a Remedy in Fever and other Diseases*. His attention, like Wright's, had been attracted to the

Adopted by  
Currie for  
typhus fever.

effects of temperature in health and disease. The work of Currie had especial reference to the use of affusions and baths in typhus fever, then a frequent and fatal epidemic disease. His curious apology for the use of such words as *reaction* and *tone* doubtless indicates a prevalent misuse of these innocent terms. Happily here as elsewhere time has removed some stumbling blocks, and these words and the realities which they signify hold a necessary place in any reasonable account of the action of baths. Currie's teaching of what may be termed *cooling hydrotherapy* (see Chapter VI), was based upon the subtraction of heat, upon the sedation of the nervous system, and the consequent mitigation of the febrile process, and as a result the increased vitality of the tissues. As with Floyer a century earlier, so with Currie; his teaching made comparatively few converts in England, but was zealously followed abroad. The methods of Currie were introduced by Franck into the hospitals of Vienna in 1803, and it is said that the typhus epidemics of 1811, 1812 and 1814 were largely treated by cool baths.

and widely  
followed on the  
Continent.

During the nineteenth century the practice of hydrotherapy rapidly extended in Europe, but it was above all in Austria and Germany, where the works of Floyer and Currie bore their first harvest, that the new treatment was most widely practised and taught. The evolution of hydrotherapy in Germany and Austria in the past century forms a singular and instructive episode in the history of medicine. The time was ripe for revolutions in treatment when Vincent Priessnitz in 1830 set up on the Gräfenburg his establishment for a water cure. This Silesian peasant, led by his own untutored genius, at first by observation of animals, formulated a regimen of simple habits, with baths and applications, which proved itself to be of undeniable benefit to many persons, especially to sufferers

from chronic ailments. It must not be forgotten that he employed vigorous exercise, unstimulating diet, and perspirations, as well as cold water both internally and externally. These methods became extraordinarily popular. Many similar institutions were founded in continental countries, and the treatment originated by Priessnitz found its way into England. An establishment was set up at Malvern in 1843 and at Matlock in 1852, and the treatment at these and similar institutions assumed a special and systematic form under the popular name of "Hydrotherapy." The movement may perhaps be regarded as a protest not only against an artificial pharmacology, but against the general therapeutic scepticism to which this pharmacology had led in the middle of the last century. For the attitude of accepted medical authorities in regard to treatment was at that period expectant and inclined to be sceptical and even nihilistic. Oesterlen, in his preface to a *Handbook of the Materia Medica* (quoted by Baruch), remarks that "Nature supported by hygiene and dietetics can accomplish what our drugs cannot. *Materia Medica* has never yielded and never can yield these positive and useful results." It was Dietl who said: "There are no true therapeutists, there are only optimistic physicians."<sup>1</sup>

Priessnitz  
and "Hydro-  
pathy,"

a protest  
against  
therapeutic  
scepticism.

An exaggerated confidence in specifics and in drugs generally had brought about this reaction, both in the medical and in the popular mind. It is evident, therefore, that the ground was well prepared for the advances of any physical method that appeared to offer a substantial hope of combating disease. Unfortunately this treatment, on the whole and in most cases, fell into the hands of irregular practitioners, with whom "hydrotherapy" became an exclusive system, and in this country the profession at large was estranged from

<sup>1</sup> See J. H. Pratt in "The Development of Scientific Hydrotherapy," *Boston Med. and Surg. Journ.*, 1904, cli. p. 201.

its employment. The new system shared the fate of every system in medicine. It was too systematic to be finally true. Enthusiasm and zeal could not make up what was lacking in knowledge and breadth of view.

The scientific claim of modern hydrotherapy has been thus expressed by Professor Winternitz :—

“That which the nineteenth century vainly sought when it awoke from therapeutic scepticism—the preventive and curative therapeutic action, based upon theoretical research, which should give to the physician the same confidence as the physicist and chemist enjoy—this hydrotherapeutics is on its way to accomplish.”

German  
research in  
Hydrotherapy.

But in Germany, upon the heels of Priessnitz, began another and a very different movement. The effects of water upon the human body were for the first time submitted to experimental research. A long series of investigations was commenced, having for their object to ascertain the effects of water at different temperatures, and of mechanical stimulation, upon the circulation, upon the nerve-centres and upon the general metabolism. The cardinal phenomena of the *reaction* of the living tissues, and especially the all-important *reaction to cold*, upon which the whole effect of cooling baths depend, were now for the first time accurately observed. A beginning was also made in describing the variations of reaction in health and disease. As a result of very many experimental and clinical studies, the indications for baths of different temperatures have been provisionally laid down, and rules of practice formulated.

Winternitz at  
Vienna.

Among a great number of workers in Germany and Austria who have contributed to this research, Hofrat Professor Wilhelm Winternitz of Vienna holds the foremost place. The name of Winternitz is indeed so closely and justly associated with the history of modern hydrotherapy that it seems fitting to give

here some account of this remarkable man. Born at Josefstadt in Bohemia in 1834, he graduated in medicine, and entered the navy at twenty-one years of age. Like his great fore-runner Wright, he was first led to apply affusions and baths in an epidemic of acute pyrexial disease upon a warship—not as in Wright's case for yellow fever, but for influenza. Gratified with his results, he studied the classical English works of Wright and Currie. Later he proceeded to the Gräfenburg with the set purpose of putting the methods of Priessnitz upon a scientific footing. It was not a small task, but he succeeded in this endeavour. By the researches and observations of a lifetime he has provided a physiological basis for hydrotherapy, and has established *inter alia* the cardinal fact that the primary action of baths is exerted upon the nervous system. In due time he was appointed Lecturer in Hydrotherapy at the University of Vienna. With Oppolzer he opened, in 1862, the first clinic and institute of hydrotherapy at Kaltenleutgeben, near Vienna. This has rapidly grown from small beginnings, and now accommodates 400 in-patients, besides a large out-patient department. Winternitz has also built and endowed a complete hospital for hydrotherapeutics in connection with the polyclinic, where thirty or forty in-patients are accommodated free of charge. He has edited for nineteen years the *Blätter für klinische Hydrotherapie*, the leading journal in this branch of therapeutics. His *magnum opus* on the *Physiological and Clinical Basis of Hydrotherapy* was completed in 1879. He has produced in the course of many years a multitude of monographs upon this subject, and in a recent paper he affirms his view that the treatment of the chronic infections, especially of tuberculosis, is not the least important work of hydrotherapy.

Turning to Germany, the "University Hydrotherapeutic Institution" was opened at the Charité

Hydrotherapy  
at Berlin,  
Munich, etc.

at Berlin in 1901, and placed under the care of Professor Brieger. In 1905 it was incorporated with the University Polyclinic, of which it became the hydrotherapeutic section for purposes both of treatment and teaching. The extent and importance of the practice may be inferred from the fact that between 5000 and 6000 persons are annually treated. At Munich the Bavarian Government has added a complete and elaborate hydrotherapeutic equipment to the University clinic. Leipzig, Heidelberg, Tübingen and Jena have also university clinics for hydrotherapy. That of Jena was founded in 1890 and has furnished opportunity for the valuable *Text-Book of Clinical Hydrotherapy* by Mathes (1903).

Hydrotherapy  
in France.

In France cold water dressings were strongly advocated in surgery by the great Ambroise Paré as long ago as 1553. They were much employed by the army surgeons in the Napoleonic wars, in lieu of the less cleanly methods then in vogue. So good were the results that the action of cold in local and general maladies attracted much attention, and formed the subject of several treatises, such as Tanchou's *Du froid et ses applications dans les maladies* (1824), and Lacorbière's *Traité du froid* (1839). Of these perhaps the most remarkable was the work of Herpin of Geneva (1844) on the action of very cold river baths. Meanwhile the astonishing results of Priessnitz were becoming known, and the French Government was petitioned in 1839 for permission to open a *Hydropathic* establishment. The matter was referred to the Academy of Medicine in Paris, and a Committee was by them appointed, who reported adversely upon the treatment as then applied. One of the petitioners, Wertheim, thereupon proposed a bedside test of the new methods, which was arranged and carried out at the Hôpital St. Louis, with a favourable result. Permission was thereafter granted by the Minister to introduce this



practice into France.<sup>1</sup> A few years later (1843) Professor Henri Scoutetten of Strasburg was commissioned by Marshal Soult to visit and report upon the hydrotherapeutic establishments in Germany. His conclusions were favourable to the methods employed, but he recommended, with proper caution, that the results should be submitted to scientific verification.

In France for more than half a century this reasonable attitude has been consistently adhered to. The establishments for water treatment that have been founded in that country, and the entire therapeutic procedure, have been placed under skilled medical direction. A lay literature and extravagant and hostile claims have not darkened counsel by words without knowledge. In France, therefore, it has happily come to pass that medical practice and research in hydrotherapy have, in the words of Winternitz, followed a "placid and unembarrassed way." This practice has, therefore, to a much greater extent than in England, taken its place as a recognised branch of therapeutics, especially in chronic and nervous affections.

The douche bath, which in its various forms has been brought to a high pitch of perfection in France, was extensively employed by Charcot. It is more than fifty years since the first institutions for treatment of this kind were set up in Paris, under skilled medical direction. There is now a similar provision for medical practitioners in most of the great towns in France, and in many cases suitable baths are attached to hospitals, which are available for the use of all medical men. Hydrotherapeutic practice has also been to a large extent grafted upon the French mineral spas—a process which is extending into England. There are also important stations, such as Divonne, which have been

<sup>1</sup> See S. Baruch, *Principles and Practice of Hydrotherapy*, 1904.

set apart entirely for the scientific practice of hydrotherapy. It is worthy of note that it was in France that Schedel first taught the recovery of compensation in failure of the heart by means of cold water applications.

Hydrotherapy  
in Italy.

Turning to Italy, which was the principal seat of medical learning at the Renaissance, it is interesting to find that as far back as 1480 the physician Michel Savonarola, the grandfather of the ill-fated prophet of Florence, in his *Tractatus de Omnibus Italiae Balneis* (1480) advocated the medical use of cold baths. He it was who is said, first of all, to have employed the "Doccia" or douche bath. During later centuries, in Italy as in England, there have been many extravagant "cures" by cold, followed by the inevitable reaction towards scepticism in the medical mind. The claims of the empirics have, unfortunately, everywhere tended to bring the use of water into contempt and desuetude. In 1805 a notable work *Della Natura delle Febbri e del Miglior Metodo di Curarle*, by Giannini of Milan, inspired by the English Currie, marked the revival of this ancient mode of physical treatment.

In Italy at the present time, as in France, hydrotherapy is extensively used by physicians. Many special stations are devoted to it, and there is a hydrotherapeutic section at most of the Italian spas. In the general hospitals it is also widely used, as in the baths at the Spedale Santa Maria Nuova in Florence.

Hydrotherapy  
used by  
Northern  
nations.

What has been said of the extension of this method in France and Germany and Italy applies to other European countries. Long ago in Belgium, Herman von der Heyden (1643) and the van Helmonts had lauded the use of cold water both in chronic and acute diseases, such as dysentery. In Holland the gradual cooling of the body in acute disease was advocated by van Housebronk of Antwerp in 1851. As regards Scandinavia and Russia, the hygienic, and

probably the medical use of cold baths and affusions, following hot vapour baths, had been a popular and traditional practice for many generations. The application of cold after heat is one of the chief forms of hydrotherapy, and is found among all northern nations. William Penn, writing to Dr. Baynard in 1683, describes the use of cold after heat in cases of fever among the North American Indians.

In the United States modern hydrotherapy was introduced soon after Currie's work was published, but—as in England—with excesses that brought about a speedy reaction. In recent years the translation of the *magnum opus* of Winternitz (1884) and the valuable work of American writers—Baruch, Kellogg, Pratt, Hinsdale and others, have brought about a revival of the practice upon rational lines. Dr. Baruch now holds the Chair of Hydrotherapy in the University of Columbia, the first appointment of this kind in America. In a recent address<sup>1</sup> he appeals to the past in order to show that the rise and fall of the recognition of water as a remedial agent may almost be regarded as an index of the progress or decadence of the medical art. He holds with the older clinicians that, through the energy of which it is the medium, water operates by assisting a natural effort towards the *restitutio ad integrum* of the diseased tissues.

Hydrotherapy  
in America.

Well-appointed establishments have been founded in several cities in America, where baths and other water treatments are given under the observation and direction of trained physicians. The example of Boston, Massachusetts, may be cited.<sup>2</sup> In 1903 there was opened in that city a small institute for hydrotherapy, as a result of the labours of Dr. J. J. Putnam, Professor of Neurology at Harvard University. It

The "Medical  
Baths" at  
Boston.

<sup>1</sup> See *Old Dominion Journ. of Med. and Surg.*, July, 1910. (Richmond, U.S.A.)

<sup>2</sup> See Pratt, *loc. cit.*

“Medical  
Baths.”

contained sufficient appliances for the douche and for simple thermal applications, whether at *plus* or *minus* temperatures relative to the body. The whole was placed under complete medical control. More than a hundred medical men in the city of Boston availed themselves of this institution for their patients in the year 1908-9. The trained attendants in charge of the baths are permitted to visit invalids for necessary treatment in their own homes. Amongst the maladies treated have been cases of heart disease, chronic parenchymatous and interstitial nephritis, obesity, arterio-sclerosis, tuberculosis, as well as mental and cerebral and spinal affections. A similar institution was founded in Philadelphia in 1909. Dr. Baruch reports that in the Medical Department of the Riverside Baths at New York more than 8000 treatments were recently given in one year, and in 1910 patients were received at these baths from thirteen hospitals and other institutions.

The foregoing *résumé* may be sufficient to show that modern hydrotherapy received its first vigorous impulsion in England more than two centuries ago : that it became in various forms a popular movement in Europe : that in the Netherlands, France and Italy, and other countries, it was advocated and followed in successive generations—sometimes with, and sometimes without, due wisdom and restraint ; and that extreme practices were followed by a reaction and scepticism as extreme and as deplorable. In later years the pendulum of opinion has swung less violently under the guidance of more exact knowledge ; and within the lifetime of men now living a whole new science of hydrotherapy has been built up on a clinical and experimental basis.

It is not necessary to touch upon the many forms of specialised, institutional and systematic treatment, in which hydrotherapy in one shape or another is

combined with dietetic, with psychical, and other modes of treatment. Many and various are the systems that abound in all countries, but it is impossible that rigid systems of any kind should in these days commend themselves to the enlightened medical mind. The present endeavour is to indicate the position which modern hydrotherapy, founded upon the new knowledge, has come to occupy in Europe and America. There can be no question but that it has taken a permanent place in medical practice in many countries.

Those who have conducted the researches already referred to unite in the statement that by the methods of hydrotherapy they can influence both acute and chronic diseases, by modifying physiological and pathological processes, not alone in one organ or tissue, but throughout the body; that by it they can check the excessive reaction of acute disorders, in harmonious association with other treatment, dietetic, medicinal or otherwise. These are large statements which, if they cannot be disproved, may not be ignored. In part they are a revival and amplification of older doctrine, of the teachings of the seventeenth and eighteenth centuries. Some have often been affirmed and never been denied in the history of medicine. What is new, and cannot fail to impress the candid mind, is the body of research that now lies behind them. It challenges examination and criticism at every point. Is it possible to disregard such a mass of evidence? The best answer to this question would be a complete experimental investigation upon English soil into the properties and uses of water at different temperatures.

It cannot be too clearly stated that the whole effect of baths of every description is founded on the *power of reaction* possessed—sometimes in a very limited and partial degree—by the disordered tissues (see

The claims of Hydrotherapy to be a controlling influence in both acute and chronic disease.

Founded on the reaction to heat and cold inherent in the tissues.

Chapter VI). Their power of response to applications of *heat* and *cold*, and the production of secondary consequences in the entire organism are the whole key to hydrotherapy. This reaction in different individuals and in different maladies, and even at different times in the same individual and in the same malady, is a most variable quantity. It follows that in practice two things are above all necessary: in each case first of all a determination, so far as may be, of the reactive power, which can usually only be made by cautious experimental methods: and secondly, a nice adaptation of the bath or application to this individual power. A dormant or defective reactive power can often be educated and strengthened to a remarkable extent, so that as treatment progresses stronger and stronger stimuli can be employed. All our external treatments make appeal to the same power that causes the newborn child or a person in syncope to open his eyes when water is sprinkled on the face.

With reference to the limits of reaction, suffice it to say that there is in every case a point at which heat or cold ceases to act as a stimulant, that is, to evoke a healthy reaction, and beyond which effects of a quite different order are produced. The first order of effects is helpful, the second order injurious and depressive. The critical moment is sometimes a point of temperature, but more often a point of time for the application of the same stimulus.

Laws of reaction: two orders of thermal effects.

The crux of bath treatment consists in the ascertainment and observance of this law, and it is made more difficult because, as we have seen, the danger-point, following the reactive power, varies from time to time in the same individual and in the same malady. Such difficulties in the application of hydrotherapy to chronic maladies can only be overcome by a close study of what may be called nervous and circulatory

responses. The disappointments, the accidents and the errors of spa practice can usually be traced to an infraction of the laws of reaction.

The effects of temperature are daily invoked in many of the most familiar procedures in the treatment of painful affections, whether local or general. It is only necessary to mention among the *plus* applications of heat and moisture, poultices, fomentations and local radiation, hot air or vapour baths; and such *minus* applications as evaporating lotions and ice-bags. The association of areas of the bodily surface with deep-seated organs formed the basis of the external treatment of the older physicians. Such an association was never doubted by them, although it was only in recent years substantiated by the researches of Head. His work has, incidentally, firmly established the rational basis of hydrotherapy as applied to local and organic disease.

The *modus operandi* of baths appears to be mainly upon the nervous end-organs in the skin, and through them upon the central nervous system. "We are in a position," says Winternitz, "by means of hydrotherapy to heighten innervation, to lower, abolish or alter it; and this at the point of application, in the central organs and by reflexion in the most varied motor and vasomotor tracts." He adds: "Thermal stimulations are therefore indicated when innervation requires to be strengthened, suspended, or altered."<sup>1</sup>

Modus operandi  
of baths:  
effect on the  
nerve centres.

Among this class of effects the first place must be given to the effect of baths upon the *vasomotor centre*. This is the key to the action of baths in fever (see Chapter VII).

The utility of baths in acute and pyrexial diseases is proven, provided they are kept within legitimate limits of temperature. That dangers should arise from

<sup>1</sup> See "Hydrotherapeutics," in von Ziemssen's *Handbook of General Therapeutics*, v. Lond., 1886.

their improper use incidentally indicates how powerful is the weapon of cutaneous treatment.

It is remarkable that whilst so strong a movement has taken place in nearly every other civilised country in favour of a mode of therapeutics resting on the best foundations of clinical experience and experimental research, in England it is still comparatively unknown. It is true that here and there methods of hydrotherapy are studied and applied by practitioners, particularly at the mineral spas, but by the general body of medical men they are for the most part not practised, or employed for their patients without the necessary exactitude, and under the direction of persons who have received no medical instruction nor technical training. Nor is hydrotherapy taught at any of the schools. British medicine cannot therefore at present compare in these respects with the practice of Germany, Austria, Italy, America and France.

But happily in medicine, as in other departments of knowledge, one nation carries on or completes what another has begun. Professor Winternitz has himself acknowledged that "the zeal of an Englishman first caused attention to be drawn to hydrotherapy, and secured a large domain for it," and in another places: "In England, where Bacon advanced the principles of induction, and where medicine first shook off its trammels of speculation and turned to simple observation, the ground for scientific hydrotherapeutics was better prepared than anywhere in Europe."

It is impossible for any candid student of this subject not to be impressed by the need for suitable institutes of hydrotherapy in this country. They might well be modelled on the pattern of the "Medical Baths" at Boston, open to the use of all medical practitioners, under skilled professional control, and served by attendants trained in the technique and in the use of instruments of precision. From such institutions the

Position of  
Hydrotherapy  
in Great  
Britain.

Need for  
"Medical  
Baths."



services of the attendants would be available outside for the treatment of acute disease. Within its walls many physicians who have to deal with chronic disorders would find new and unexpected possibilities. And the remedies would be applied as they should be applied, under their own care and observation. Moreover, the great interest of conducting a course of physical treatment, with the necessary skilled assistance, would stimulate many medical men to independent research—and would in time confer educational value upon an Institute of this kind. These are not extravagant forecasts. They are based on the proven experience of many continental cities, where the interests of the patient, of the practitioner and of medical science have alike been served by such means of treatment. It is a much felt want in most of our large towns, but especially in London.

It is true that in the western division of Glasgow there has lately been opened an establishment of medical baths, which are given by skilled attendants and under medical prescription. Somewhat similar facilities have recently been provided in the Central Corporation Baths at Bradford. There is also in London the Alexandra Institute of Baths. But there are as yet in this country none quite comparable to the foreign hydrotherapeutic Institutes, in respect to scientific precision, technical skill and facilities for instruction.

In many British Hospitals baths are more or less employed, and here and there adequate installations have been provided. As a rule they are but casually and sporadically used, whether for acute or chronic maladies. How remarkable by contrast is the zeal with which in late years phototherapy, electrotherapy, radiotherapy and treatment by massage and movements have been introduced into the hospitals and into general practice. Many of these are now both

Other modes  
of physical  
treatment.

taught and practised, for teaching and practice go hand in hand. The time has surely come to enter this plea for a much older and equally potent method of treatment, and one that has a wider range of application than any of these. At Guy's Hospital during one year 43,000 treatments were given in the new department of electro- and actino-therapy. Is it permissible to ask how many of the patients so treated would have derived equal benefit from applications of hydrotherapy, given with as much skill and precision?

New hopefulness in physical treatments.

Is it not because during recent years there have been called in aid so many physical agencies in medical treatment, both for the prevention and cure of disease, that a new hopefulness is abroad? Tuberculosis is no longer despaired of, nor even cancer. It has become clear that there is a vast field for increasing the resistance of the tissues to pathogenic invasion. That is, *par excellence*, the field of physical therapy.

So in regard to Hydrotherapy it must be acknowledged that there is a mass of evidence that diseased conditions can be controlled by applications of temperature in a watery medium. In half a century there has been gathered together in reference to this subject as goodly a body of ascertained facts as can be found in any department of medicine.

Value of Hydrotherapy

But it may be said, Shall medical men touch what has been, or may be, in the hands of unworthy professors? The sufficient reply to such a doubt is that surely the extravagant or irrational use of a remedy should not prevent us from employing it wisely. Again, it may be said by some—perhaps by the practitioner at the mineral spa: "How are we concerned with Hydrotherapy?" The answer to that is, that according to the foregoing evidence the spa physician is above all men deeply concerned with it. The study of the laws of hydrotherapy, as it has been received in the present generation, is an indispensable preliminary

an essential study for the spa physician.

to his work. They form the very groundwork of his practice. Water cannot be separated from Waters; inasmuch as the property and action of water as a vehicle of energy form the first part of the science of medical hydrology.

## CHAPTER V

### THE USE OF WATER INTERNALLY

Water essential  
to life.

WATER has always been the atmosphere or medium of primitive organisms, and remains a vital necessity for all organisms. In the human body it constitutes about 60 per cent. by weight, and it forms the greater part of all kinds of food. Water is, of course, the great solvent. The prime object of digestion is to reduce the food to the condition of a watery solution or emulsion upon the digestive surface. The mucous surface of the stomach and intestine may indeed be looked upon as an internal skin, which like the external skin lies outside the tissues. In order that the necessary absorption of nourishment may take place at this surface the food must be presented in a fluid form, and with a certain definite degree of dilution. In this process the ingested water plays a necessary rôle. It follows that there is a certain *optimum* proportion of water in and with the food, which is most favourable to the processes of digestion and absorption.

Water in  
digestion and  
absorption.

Water in  
excretion and  
elimination.

On the reverse side of the account, the processes of excretion and elimination at the surface of the kidneys and skin also depend upon the solvent powers of water. The amount of water daily passing from the body has been placed as high as 100 oz., viz. 30 oz. by the skin, 15 oz. by the lungs and the remainder by the kidneys. To make good this loss of systemic water which leaves the body by these three routes, only one avenue of ingestion (the stomach) is available. The amount of liquid taken by the mouth and the frequency of

drinking are regulated in health by a gastric sensory-motor reflex which gives rise to the sensation of thirst.

The effect of water taken into the stomach depends partly upon its temperature. The point of thermal indifference for that organ is from 97 to 100° F., and liquids at about this temperature are probably the most quickly absorbed. Cooler water increases the motility of the stomach and bowels, and so hastens the passage of their contents, and promotes defæcation. The effect of cold drinks, like cold applications and cold enemata, is, in proportion to the degree of cold, to diminish the temperature of the body, to slow the pulse and to increase arterial blood pressure. For example, a pint of water at 46° F., taken by the mouth, lowered the rectal temperature nearly 2° (Winternitz). The pulse frequency may be readily reduced by twenty to thirty beats per minute by repeated cold drinks. The temperature effect of cold (drinks) internally varies much with the state of the general circulation. If the circulation is vigorous or excited the effect is refreshing. If from fatigue or exhaustion the power of reaction is lowered the effect is depressant.

Effect of cool drinks.

Warm drinks, on the other hand, diminish gastric motility and delay the passage of contents, although small quantities of water taken *hot* may favour contraction of the stomach. The drinking of hot water raises the temperature of the body, accelerates the pulse, and lowers blood pressure. Repeated drinking of hot water may cause a permanent relaxation of the arterial walls. These effects upon the circulation are no doubt produced by a reflex action from the gastric fibres of the pneumogastric nerves. If taken when the stomach is empty, water—hot or cold—very soon goes on into the small intestine. This process is favoured by walking exercise. Here it is rapidly absorbed and passes into the portal circulation. It is believed that

Effect of warm drinks.

Absorption of water.

comparatively little is absorbed in the stomach. In the bowels it moves very quickly : water appeared at the cæcum of a horse six minutes after the animal had swallowed it. Water is readily absorbed, not only by the small intestine but by the colon and rectum.

Effect of water on secretions, metabolism and elimination.

The taking of water, especially small quantities of cold water, promotes the secretion of gastric juice as well as that of the bile and pancreatic juice, and stimulates the parotid and other glands. Although water drinking appears to have no effect upon nitrogenous metabolism, it seems to increase the absorption of fat. It also powerfully promotes the lixiviation of the tissues and the elimination of all waste products. Jacobi<sup>1</sup> has pointed out that during dissimilation, when the large molecules are broken up, the number of osmotically active portions of the cells is increased. Hence an increase of osmotic pressure and an attraction of water into the cells. This may involve a dialysing of the dissolved substances out of the cells. The water content of the tissues increases during dissimilation (catabolism) and diminishes during assimilation (anabolism).

General indications for water.

None but aqueous foods are digestible in infancy. The same is true after long fasts or extreme fatigue. During fevers and in many acute illnesses, as well as in convalescence, and in conditions of debility of the digestive organs, we return to the condition when only liquids are admissible. An increased intake of water is usually necessary in acute and pyrexial diseases and in many chronic toxæmias, to replace the water lost in perspiration and to promote the elimination of poisonous matter. It is also indicated in some congestive and dyspeptic conditions, brought about by taking an excess of over-stimulating and insufficiently diluted food. The diluent action of water partly

<sup>1</sup> On "The Osmotic Actions of Water," *Deutsches Bäderbuch*, Leipzig, 1907.

accounts for the benefit derived by this class of dyspeptics at most of the mineral spas.

The effect of the drinking of cold water, in stimulating peristalsis and in lixiviation of the tissues, accounts for its beneficial effect in many cases of obesity, of constipation, of renal and hepatic lithiasis, as well as in most conditions of chronic toxæmia.

It has been pointed out (Weber) that bakers and others working in a hot atmosphere sometimes suffer from "hydræmic plethora," brought about by an excessive intake of water or beer. This may probably be due to the fact that elimination by the kidneys or skin is sometimes unduly checked. When copious water-drinking is accompanied by free diuresis, the hydræmic condition does not occur, and the serum of the blood may become even more concentrated. On the other hand, there are chronic states of hydræmia or dropsy, with or without heart weakness, and with failing elimination, especially in obese subjects, in which the watery medium is in excess, and the intake of water should be strictly limited. Cold water is contra-indicated in states of profuse perspiration and great fatigue.

Contra-  
indications.

The waters at the various spas are usually drunk at a suitable interval before breakfast, accompanied by gentle walking exercise, and when the stomach is absolutely empty. Under these circumstances absorption is at its best, and the liquid taken should in no way interfere with the process of digestion. If, however, gastric digestion be faulty, or the stomach be dilated, the taking of liquids must be regulated according to the often-defective power of absorption. In this case water taken in any quantity *with food* is apt by diluting the gastric juices to aggravate the existing dyspepsia and dilatation.

Water-drinking  
at the spas.

In defective  
absorption.

Moreover, copious draughts should not be given without due regard being had to the power of elimination.

In defective  
elimination.

This caution is especially necessary with the abrupt change of habit that accompanies a course of spa treatment. When absorption is more active than elimination, a sudden intake of water may cause acute temporary plethora, with increase of blood pressure and even cerebral hæmorrhage. These considerations show that in the case of invalids the medicinal use of waters should be carefully graduated in respect to quantity and time of administration.

Too pure  
waters.

It is questionable whether waters free from dissolved saline matter, that is to say, waters of chemical "purity," are gratefully received by the stomach. Distilled water acts as an irritant to living epithelial cells, for example, those of the conjunctiva. The ill-effects sometimes experienced by drinking glacier water are probably due to its excessive purity. For this reason distilled water is not an ideal drink. The presence of a certain proportion of dissolved gas (carbonic acid gas or air) renders water pleasanter and more digestible, and is one of the factors of "freshness" in water.

"Fresh"  
waters.

It is common knowledge that the flowing, or in the old parlance the "living," *fresh* water of the fountain has a different property from that of the same water when still, contained in reservoirs or bottled. Hence water drawn from the tap is more acceptable than the same water boiled, and so deprived of its gas.

With reference to the relation of different waters to the human body it should be noted that the tissues are normally bathed with saline solutions—blood, lymph, the various secretions, having a certain degree of tonicity. The more nearly they approach to this tonicity (0·9 per cent. of salines), the more readily waters are absorbed by the tissues.



## CHAPTER VI

### GENERAL ACTION OF BATHS

BATHS take effect directly upon the skin, and indirectly upon all other parts of the body.

It was formerly supposed that both the watery medium and the various dissolved saline matters of baths were absorbed by the skin. This, however, is not the case and for practical purposes absorption in an ordinary bath may be limited to its gaseous and volatile constituents. In some persons the skin absorbs more readily than in others, witness the occasional absorption of carbolic acid from compresses and its appearance in the urine. In the same way sulphuretted hydrogen gas is not only eliminated by the skin, but freely absorbed by the same route in baths of natural sulphur water. Massage and frictions assist cutaneous absorption, as in mercurial inunctions, in the course of which, the metal is freely absorbed. It is recognised that many medicaments when rubbed into the skin produce the same effect as when introduced into the stomach. The absorption of free ions both acid and basic is powerfully promoted by electrical currents (Kataphoresis), and it is probable that the electrical condition of some natural waters is favourable to absorption in a bath of these waters.

Absorption in  
the bath.

Apart from absorption, the action of baths is due to the effects of moisture, pressure and heat, and different forms of mechanical and chemical energy applied to the surface of the body.

The moisture of a bath may be considered as a

Effect of  
moisture.

sedative influence combined with the stimulating influence of heat or cold. The general effect of the bath depends on the predominance of one or the other influence. Moisture softens and relaxes the skin, separates the dead epithelial scales and causes the deeper cells to swell by the inhibition of water. By mollifying the surface it thus assists the action of massage.

Effects of  
pressure.

The pressure in an immersion bath is proportional to the depth and specific gravity of the fluid. It has been calculated that the pressure upon an adult person in a bath of ordinary water amounts to from 500 to 600 kilogrammes. It tends to contract the superficial arterioles and drive the fluids to the deeper parts, and may also mechanically hinder respiration. The pressure effects in baths must not be overlooked in the case of delicate persons, particularly in cardio-vascular disorders. The embarrassment of respiration and circulation that are sometimes experienced in baths may be overcome by posture, or by not permitting the thorax to be immersed (chair-bath, *demi-bain*, etc.).

Positive and  
negative heat.

The immediate effect of sweet water baths, excepting those of an athermal or "indifferent" temperature, is to convey heat to the body or to abstract heat from it. That is to say, they act chiefly as a vehicle of heat. From the point of view of the human body, heat may be regarded as *positive* when it is above and *negative* when it is below the temperature of the skin. The physiological thermal effects of baths, positive or negative, are of the same general character whatever the form of bath may be. Immersion baths of water, of hot air or vapour, douche baths and local baths, and hot or cold packs, produce the same primary thermal effects, with many modifications and secondary effects, especially when changes of temperature are introduced.

### Effect of Baths upon the Bodily Heat

Considering first the effect of positive heat, the immediate impression of heat upon the nerves of the skin is stimulating to the nervous centres and to the circulation. Warm or hot baths cause an expansion of the superficial arterioles; blood is attracted to the surface of the body, and the skin becomes flushed and warm in the bath. The heart's action is accelerated and the arterial blood pressure diminished. Hot baths in this manner rapidly raise the temperature of the circulating blood, and at the same time prevent the normal surface loss of heat.

Effects of positive heat.

In addition to an immediate and reflex effect, it is believed that stimuli, both of cold and heat, especially those of a gentle and continuous character, produce directly in the vessel walls a movement of expansion or contraction. The unstriped muscle fibre (the "peripheral heart" of Onimus), whether of the blood-vessel, the intestine or the bladder, responds directly to thermal applications. The tonus of unstriped muscle fibre which is increased by cold is diminished by heat.

If the bath is continued, heat accumulates more and more in the body. The first stimulating effect gives place to a secondary febrile condition, and in a bath at 104° F. the temperature of the blood may rise as much as five degrees in half an hour. The circulation is quickened and excited, the muscles are relaxed, perspiration sets in, and a state of artificial fever is in fact produced.

Accumulation of heat in the body.

A condition of enervation and general debility follows, proportional to the temperature and duration of the bath. Persons who habitually take baths of this kind often suffer from a permanent loss of tone in the nervous centres and of the heart. It is said

Thermal debility.

that the fondness of the Romans for warm baths was one of the causes which contributed to the decline of the Roman power. The more exact knowledge that we have now obtained of the gradual and insidious effects of long-continued heat upon the body should make us very watchful as to its employment, especially for young persons. What is called "thermal fever" and "heat-stroke" are often caused in hot climates by exposure of the body to moist heat, by which the action of the skin is checked and heat accumulates in the body. This dangerous condition, which is often fatal, is an extreme form of what is produced by prolonged hot baths.

Effects of  
negative  
heat.

Turning now to negative heat, that is to say, to cool and cold baths, the immediate effect of such applications is a contraction of the surface blood-vessels, proportional to the degree of cold. This increase of vasomotor tone is a reflex action, protecting the body from dangerous loss of heat. The skin becomes pale from increased tonus and diminished blood-supply in the superficial parts. The intimate physiological relationship between the skin and internal organs, especially with the splanchnic area (see Chapter I), brings about a corresponding diminution of tone and increase of blood-supply in the viscera. The circulation is in a sense short-circuited. Local applications of cold illustrate the same law. For example, when cold is applied to the abdomen of a rabbit, the vessels of the *pia mater* are dilated (Schüler): and a cold sitz bath increases the circulation in the upper part of the body.

(1) On the  
circulation.

Accompanying the contraction of the peripheral circulation the action of the heart is at first accelerated, but very soon becomes slower and stronger, and the arterial blood pressure is increased. The following table (from Jacobi) shows the effect of a bath of fifteen minutes' duration and at different temperatures

upon (1) the frequency of the pulse, and (2) blood pressure—

| Temperature of bath<br>(Degrees Fahr.) | Pulse rate<br>Alteration | Increase of blood pressure<br>in mm. of Hg. |
|--|--------------------------|---|
| 108·2                                  | 35                       | 20  |
| 106·1                                  | 20                       | 10  |
| 104·0                                  | 12                       | 7   |
| 106·1                                  | 17                       | 0   |
| 99·4                                   | 8                        | 4   |
| 97·1                                   | 5                        | 5   |
| 95·0                                   | 4                        | 7   |
| 93·0                                   | 7                        | 8   |
| 90·6                                   | 12                       | 7   |
| 88·0                                   | 15                       | 8   |
| 86·0                                   | 24                       | 9   |
| 84·0                                   | 24                       | 19  |

The sensation of cold in proportion to its intensity also stimulates the respiratory centre and excites reflex muscular contractions.

When the application of negative temperature is continued beyond a certain point a very different sequence of events takes place. The striking reaction which cold induces in warm-blooded animals shows it to be a strong stimulant, within certain limits. In excessive doses it is an equally powerful and even fatal depressant. When the cold bath is too greatly prolonged, the production of heat fails to keep pace with its loss, and the temperature of the body rapidly falls. The surface vessels, particularly the capillaries, become dilated and paralytic, a condition indicated by blue-red coloration of the skin. Blood accumulates in the veins, the circulation fails and chilliness gradually passes into algidity and collapse. Death from exposure to atmospheric cold is brought about in the same manner, and analogous effects are seen locally in the phenomena of frost-bite.

Action of prolonged cold.

It is a noteworthy and suggestive fact that the

Tolerance of the body for abrupt changes of temperature.

human body is far more intolerant of continued heat or continued cold than of abrupt changes of temperature. When the surface circulation is well opened by previous hot applications, violent and extreme changes are surprisingly well borne. The northern nations have from a remote period used "sweating-baths," in which the bather is exposed first to heat and then to cold. The Russian comes out of his "sweating-chamber" at 125 or 130° F. with a red, burning skin, bathed in perspiration, and rolls in the snow or in ice-cold water with impunity. In the same manner the Japanese at Kusatzu practise cold affusions immediately after an immersion bath at 120° F. On physiological grounds we may believe that such more or less active gymnastics of the skin are well adapted for dwellers in northern latitudes (see Chapter IX).

Point of thermal indifference for water.

Baths at or about 93° F. produce no appreciable effect upon bodily heat, or upon heat production or loss. This is therefore called the *Point of Thermal Indifference* for water. It corresponds to the average temperature of the skin in healthy persons. The indifferent temperature for water has been fixed by competent authorities as follows—

34° C. or 93° F. (Leichtenstern and Riess).

34·8°–36·4° C., or 94·5°–98° F. (Wick).

35·0°–37·0°, or 95°–98·8° F. (Kisch).

The average skin temperature in a room at 20°–25° C. (68°–77° F.) is given by Oehler at 34·1° C. (93·2° F.)<sup>1</sup>

Athermal baths.

In the author's opinion the indifferent point of water is often placed too high. This may prove to be a matter of considerable importance, since baths that are supposed to be indifferent (for example, in a case

<sup>1</sup> Mathes: *Lehrbuch der Klin. Hydrotherapie*, 1903.

of cardiac or cardio-vascular disease) are really exerting an undesired thermal effect. The actual point varies somewhat for different individuals in health, and may be raised or lowered many degrees in conditions of ill-health. The determination of the indifferent point for an invalid undergoing bath treatment is sometimes a matter of great importance. It must also be remembered that even in an indifferent bath thermal action may take place, for the temperature of the skin is not the same for all parts of the body.

In sharp contra-distinction to both hot and cold baths, indifferent baths have no effect whatever on the metabolism of the body, even if continued for days or weeks. On the whole they diminish and equalise peripheral stimulation, and their action is therefore sedative.

Currie long ago observed (*Medical Reports on the Effects of Waters*, etc., 1797) that in health brief cold baths lower the temperature of the body, although the heat production is increased three- or four-fold. On the other hand, Lefevre remained *three hours* in a bath at 59° F., and only lost one degree and a half of temperature, although his loss of bodily heat during the bath amounted to 800 kilocalories. On another occasion during a bath of one hour's duration at 45° F. the body lost 530 kilocalories and 3° F. of temperature. In taking cold baths it should be remembered that the less it is protected by fat, the more quickly the body cools. Liebermeister also states that "the effect of cold water on the body surface of a healthy man under normal conditions during a long continued application does not lessen the body temperature at all. In many cases it even raises it."

(2) On the temperature of the body.

It is important to remember that whereas in hot baths the loss of heat is hindered or entirely prevented, in cold or cool baths it is enormously increased—

(3) Upon loss of body heat.

although as we have seen the temperature of the body may remain stationary. The last-named authority has given the *loss of heat* in cool baths as follows, the duration of the bath being from fifteen to twenty-five minutes and the subject a moderately fat man—

|                  |                                |
|------------------|--------------------------------|
| 40° C. (104° F.) | loss of heat about the normal, |
| 30° C. (86° F.)  | „ „ nearly doubled,            |
| 25° C. (77° F.)  | „ „ trebled,                   |
| 20° C. (68° F.)  | „ „ fivefold.                  |

## Effect of Baths upon Metabolism

### I.—COOL AND COLD BATHS

The “reaction to cold.”

The changes that take place, first in the circulation and secondarily in the body at large as the result of exposure to negative heat have been described as the “reaction to cold.” As already noticed, the immediate closure of the surface vessels is essentially of a protective nature. After a variable interval a new and complex movement or reaction sets in, in which the circulation, the nerve centres, and the general metabolism of the body are involved. This response of the living body to impressions of cold is one of the cardinal facts of physiology. Upon it is founded the whole action of baths.

Increase of heat production.

The impression of cold on the skin gives rise through the nervous system (heat regulating centre) to a great increase of heat production, brought about principally by the combustion of fats. With this increasing generation of heat the first protective contraction of the surface circulation gives place to relaxation; the blood flushes the surface and the first chilliness is succeeded by a sensation of warmth. The increased vigour of the circulation in the internal organs no doubt accounts for the muscular energy and mental refreshment that follow a brief cold bath.



The combustion of fat in cool baths of one hour's duration and at various temperatures was estimated by Liebermeister as follows—

| Temperature. | Grammes of fat. |
|--------------|-----------------|
| 95° F.       | 0·7             |
| 86°          | 9·0             |
| 77°          | 22·0            |
| 68°          | 37·0            |
| 59°          | 52·0            |

Combustion of fat.

The increased heat production is also partly due to muscular activity, including therein the shivering and tonic contraction that accompany the sensation of cold. In a bath below 60° F. there is (says Rübner), "an involuntary and irresistible desire for movement." It follows that an individual's state of nutrition as well as his diet (see Chapter II) must considerably effect his capacity for heat production and therefore his power of resisting cold. The reserves of energy, which exposure to cold can call forth, are at the best strictly limited; and in many cases small in amount.

The next table exhibits the effect of rather prolonged baths at different temperatures on the production of heat and on the combustion of fat.

Heat production conditional and limited.

| A bath of thirty minutes at . . .                                   | 60° | 68° | 77° | 86° | 95° F. |
|---|-----|-----|-----|-----|--------|
| causes a production of heat in calories above the normal . . .      | 81  | 57  | 34  | 12  | 0      |
| and corresponds to an increased combustion of fat in the bath . . . | 43  | 31  | 18  | 8   | 0·7    |
| Ditto after the bath . . .  | 9   | 6   | 4   | 1   | 0      |

In considering the effects of baths, the element of *duration* is of the first importance. The effects of *brief cool baths* on metabolism are particularly interesting. The following figures, like the last from Rübner, show how considerable these effects may be, even when the bath or douche is limited to from three to five minutes.

Effects of brief cool baths.

Bath and douche at 60° F., duration 200 to 300 seconds—

|   | Bath<br>% | Douche<br>% |
|---|-----------|-------------|
| Increase of respired air . . . . .      | 22·9      | 54·5        |
| „ output of carbonic acid gas . . . . . | 64·8      | 149·4       |
| „ intake of oxygen . . . . .            | 46·8      | 110·1       |

Another suggestive observation with reference to brief cold baths (duration two and a half minutes) has been recorded by Ignatowski. He has shown that in a healthy subject during the first minute's immersion forty-four calories were lost, but in the second period of over a minute and a half, the surface temperature having fallen, the loss of heat was not quite half so much (twenty-one calories). *Meanwhile the heat production during the bath rose to fourteen times the normal.* It seems astonishing that notwithstanding these abrupt changes of heat production and loss the general body temperature was unaffected. It is important to remember that although the temperature of the blood remained unaltered by this vigorous reaction to cold, the normal processes of tissue change and the arterial circulation were very powerfully affected.

Variable nature  
of reaction  
to cold.

The power of reaction may be feeble and inadequate or strong and adequate. It varies with age and condition and individual characters, and in the same person at different times. The signs of reaction are easy to read, and its quality can be readily measured. In health the reaction to cold is proportional to the initial stimulus of the thermic nerves. In disease its character depends on the integrity or otherwise of the nervous and circulatory functions. A rapid and adequate and increasing reaction is a first desideratum in the treatment of chronic disease by baths. Its absence or insufficiency at once places the physician on his guard.

Diminished  
reaction.

The reaction is *diminished*—

(1) when the abstraction of heat has been gradual;

- (2) when the individual is already cool before cold is applied;
- (3) when he remains quiescent during and after the bath; and
- (4) when the cold applications are excessive or prolonged.

In the last case reaction is more or less incomplete or even absent, and the subject passes into an algid and collapsed condition.

On the other hand, reaction is *increased*—

Increased  
reaction.

- (1) when the application of cold is ample and rapid;
- (2) when a mechanical stimulus is added to the action of cold; for example, the shock of sea waves, massage or the effervescence of a carbonated bath.

When the cooling has been excessive the reaction may be febrile.

It has already been shown that cold baths enormously increase first of all the loss, and secondarily—when an appropriate reaction is evoked—the production of heat. In the case of many delicate persons, and in those advanced in life, this loss of heat cannot be made good. It is only when the powers of reaction are normal and metabolism active that Nature can respond with the corresponding increase of heat production. Cold may well be regarded as a powerful stimulant, both to the circulation and to the nerve centres, provided that these are sufficiently vigorous to withstand the shock, and to reinforce the failing bodily heat by an immediate increase of combustion in the tissues.

Defective  
reaction.

With reference to the nature of these tissue changes, it is believed that so long as the body temperature is unaffected by baths the balance of protein metabolism is unaffected (Voit). The above figures must therefore

Non-nitrogenous metabolism from cold.

represent the oxidation of non-nitrogenous material. In estimating the effects of baths upon bodily energy Vinaj and Maggiore rightly emphasise the importance of individual variations. They hold that the secondary effects of cold baths upon metabolic processes in general far outweigh their immediate action upon tissue change, and constitute the main effects of these baths. It is important to observe that in the case of hot baths the limitation of increased metabolism to non-nitrogenous tissues does not hold good.

Cold baths, like massage, temporarily increase the numbers both of red and white cells in the blood, and so additionally favour oxidation in the tissues.

## II.—WARM AND HOT BATHS

Effect on metabolism.

Le Monnier of Barèges, in 1749, observed that he lost twenty ounces in weight from increased perspiration during eight minutes' immersion in the hottest source (112° F.); and on various occasions from seven to twenty-nine ounces during a bath of thirty minutes at 100° F. Hot baths stimulate glandular activity, especially that of the sudoriparous glands, and in proportion to their temperature. With reference to the relation of heat to tissue change, it has been pointed out that there is a certain *optimum* temperature for animal anabolism and katabolism. Wounds kept at a certain temperature are known to heal more rapidly than in the cold. In the rabbit, one ear kept warmer was found to grow faster than the other.<sup>1</sup>

For many data as to the effect of hot baths on metabolism we are indebted to the researches of Winternitz and his pupils. It seems that at first by its action on the skin the hot bath may produce a compensatory loss of heat. But after a time the limit of physical regulation is reached and the temperature of the body rises. The loss of heat is checked;

<sup>1</sup> Mathes, *loc. cit.*

“the minimal metabolism of the tissues cannot be lowered,” and heat is consequently piled up in the body.

The cardinal law in relation to hot baths is that metabolism rises in proportion to the heat and duration of the bath. The extent of this increase may be gauged by the fact that the consumption of oxygen during the bath far exceeds that which occurs in fevers. The increased intake of oxygen and excretion of carbonic acid gas rises to from 40 to 111 per cent. over normal, as compared with about 20 per cent. in fever. Such an increase of metabolism and of heat production seem to be quite “inappropriate consequences of overheating.”<sup>1</sup> The practical bearings of these facts are only too obvious. It is clear that in the hot bath we have a potent influence, whether for good or evil.

Proportional to the heat and duration of the bath.

It has been shown that the metabolic activity induced by cold baths falls mainly on the non-nitrogenous tissues. Under the influence of heat, when once the balance of the body temperature is impaired, the nitrogenous catabolism is also disturbed. An increased protein disintegration, with increased excretion of urea, result—at all events in many cases—from hot baths carried to this point, more particularly when the baths are repeated day by day. This important condition has been recognised and well described as “intrinsic over-heating.”

Increased nitrogenous metabolism.

It must be remembered that in hot baths the temperature of the skin rises above that of the blood and internal organs, which is entirely contrary to the natural condition. In hot air and radiation baths, this does not take place, owing to the cooling by evaporation being unchecked. The normal skin temperature is often not regained in less than two hours after the bath (Wick). This indicates that heat production

Intrinsic overheating.

<sup>1</sup> Mathes, *loc cit.*

must continue to be excessive for some time after the bath, for the abnormally vascular skin loses heat freely, and yet there is no fall of body temperature. Even as long as one and a quarter hours after the bath, Winternitz found the consumption of oxygen 29 per cent. in excess.

Effect on  
pathological  
tissues.

There is reason to believe that the increased dissociation or catabolism of nitrogenous elements induced by thermal baths affects pathological rather than the normal tissues. Such a result may indeed on *a priori* grounds be expected to occur in a condition of artificial fever. The effect of heat, local or general, in dispersing unhealthy deposits may be cited as an example of "intensive" action. The intensification of sluggish and smouldering tissue changes, with the object of bringing about a more acute and transitory phase is a principle of wide application in the treatment of chronic disease.

When discussing the effect of thermal baths upon bodily heat, it was shown that one group of effects, which may be described as primary and stimulating, was succeeded by others which were secondary and depressing or enervating. The following table (after Rübner) compares in an interesting manner the effect upon metabolism of brief hot and cold baths. The same observer has noted that after a brief hot bath heat production is diminished.

#### BRIEF BATHS

|   | At 44°C. (112°F.) | At 16° C. (60°F.) |
|---|-------------------|-------------------|
| Increased CO <sub>2</sub> , excretion . . . | 32·1 %            | 64·8 %            |
| Increased Oxygen, intake . . .              | 17·3              | 46·8              |

Unexplained  
results.

It must be frankly admitted that at present we cannot fully explain some of the effects produced by baths, both in health and in disease. It is scarcely surprising, considering the complexity of the problem

that they present. On the one hand, we have in the bath many different influences operating, the temperature and other physical qualities of the water, its chemical constituents, and the influence of pressure and mechanical stimulation. On the other hand, we have the human body under varying conditions, and with marked individual characters. In the power of reaction to outward conditions no two persons are alike, even in health. The time of day at which the bath is taken, the relation to meals and to exercise, and to states of fatigue, all modify the result. In conditions of ill-health all such differences become more marked, and individual characters are more strikingly shown.

## CHAPTER VII

### COOLING HYDROTHERAPY

#### Definition.

By Cooling Hydrotherapy may be understood the use of baths and watery applications at a temperature lower than that of the skin (say 93° F.). At the upper limit of temperature these baths are, properly speaking, *subthermal* and scarcely cooling in their action. The lower limit is fixed by the freezing-point of water (32° F.). It is convenient to use the expression *cold hydrotherapy* for baths and applications well below the subthermal range of temperature (say 80° F.). The adjective cold is here used only in that sense.

The physiological effects of low temperatures on the circulation and metabolism, through the nervous centres, have already been set forth. It remains to indicate the practical application of these principles in cooling baths.

#### Influence of duration.

The actual effects of a cooling bath must obviously depend in the first place on its *duration*. Cold baths of brief duration give rise to a vigorous reaction which increases the temperature of the body. The same bath if long continued is *anti-phlogistic*, reducing the body temperature. This statement is apparently true both in health and disease, provided that the power of reaction is not seriously impaired. Hence when given in order to moderate fever, cooling baths must be of a certain duration.

#### Cooling hydro-therapy in fever.

The employment of tepid or cooling baths in fever has been practised from the time of Hippocrates.



Asclepiades (128 B.C.) added the important observation that frictions following the bath enhanced the effect. The practice and teaching of Wright and Currie and their followers, who in modern times revived the earlier use of baths in medicine, has been referred to in a previous chapter. In many epidemics of typhus and other fevers they employed baths with much success. The Italian physician Giannini (1805) formulated rules for the use of cooling baths in fevers that may still, after the lapse of more than a hundred years, be recalled with advantage. They may be summarised as follows :—

Giannini.

(1) In asthenia the immersion to be of very brief duration; it should never reach the point of cooling down, and in no case is to be prolonged after the first shiver.

(2) No such baths to be given during the stage of general arterial spasm.

(3) In sensitive persons warmth should be applied to the cardiac region during the bath.

Unfortunately the rational and prudent practice of Giannini was set aside in later years in favour of more heroic methods, and it is to the use and abuse of these heroic antithermal methods (as will presently appear) that must be attributed the reaction from the use of baths in pyrexial diseases in this country.

During the last century the employment of baths in the treatment of acute disease received a new impetus when clinical thermometry revealed the type and degree of febrile disturbance, and especially when it was recognised that pyrexia was a reaction, often excessive and sometimes dangerous, which it should be the object of treatment to moderate and control. The true doctrine of fever has, in fact, shed a new light upon its right treatment. Fever is a paralytic state, in which heat regulation is disordered or lost. According

The doctrine of fever.

to Senator's researches into the processes of fevers (1873), *thermolysis* rather than *thermogenesis* is at fault. In any case there is a nervous disturbance or breakdown. Pembrey has shown that nervous control is *damaged* rather than lost in fever. What is the reason of this damage or disturbance? Here, again, recent knowledge of the causes of pyrexia supplies the answer. The cause consists in an invasion of pathogenic micro-organisms, accompanied by a particular toxæmia. This in its turn affects the nerve centres. The reaction or response of the organism is seen in increased metabolism and a heightened bodily temperature. It is more than probable that the increase of temperature is helpful to the body in resisting invasion, and that thus "fever is a protective mechanism" (Hale White).

Justification  
for cooling  
baths.

In this doctrine the employment of cool temperatures, with their sedative and stimulant action upon the nerve centres and their power of moderating the extreme reactions of fever, receives abundant justification. It is equally justified by experience.

Brand of  
Stettin.

It was in striking accordance with these principles—although not then established—that Ernst Brand of Stettin in 1861 advocated the use of cooling baths in typhoid fever. It should be particularly noted that Brand followed the practice of Giannini and avoided *cold* baths in fevers. The difference between cool and cold to a warm-blooded animal is vital. Brand relied upon the stimulant effects of cooling temperatures. He taught the use of baths always below the temperature of the skin, but never below 65° F. Baths at this temperature, and of fifteen minutes' duration, he employed and repeated every three hours so long as the temperature remained above 103° F., or if stupor, delirium or coma, supervened at any temperature. He also insisted upon the use of frictions in the bath in order to guard against

undue contraction of the peripheral vessels. Baruch, amongst others in recent years, has consistently advocated this sound practice, and has rightly condemned the heroic and antithermic baths that have been so much in vogue and are still unfortunately employed.

It is to be feared that this distinction is not yet sufficiently appreciated. Current English text-books contain directions for the use of much colder baths in fever, cooled by ice to 55° F., and even to 45° F. Such temperatures are profoundly depressing. In short, the utility of cooling baths in acute and pyrexial diseases is proven, provided that they are kept within legitimate limits of temperature. That dangers should arise from their improper use incidentally indicates how powerful and double-edged is the weapon of cutaneous treatment.

Legitimate  
limits of  
temperature.

The point of temperature fixed by Brand should rather be regarded as the lower limit for baths in fever. Cooling baths may often be employed with the greatest advantage in many pyrexial diseases at subthermal temperatures (80–90° F.), or just below the subthermal range. It is only in robust subjects, or when the pyrexial reaction is acute and fulminating (hyperpyrexia), that Brand's point ought to be reached or (in rare cases) exceeded.

Currie recommended long ago hot or vapour baths to be alternated with cold ablutions for fevers, a method which has much to recommend it when the sweat glands are out of action and the skin is hot and dry.

Cooling baths often avert heart failure, the result of excessive febrile reaction; an observation which may be explained by the statement of Romberg and Passler (quoted by Pratt), that heart failure in acute disease is due to paralysis of the vasomotor centre.

In heart  
failure.

Cooling baths not only contract the surface arterioles of the body, but increase the circulation in deeper

parts. By their reflex action through the nervous centres they increase the force and diminish the frequency of the cardiac systole. They should, therefore, have a beneficial effect in conditions of lowered peripheral resistance with a feeble and dicrotic pulse.

Cooling baths increase the number of both white and red corpuscles of the blood and the percentage of oxyhæmoglobin.

It should be noted particularly that cooling, and more especially cold, baths can only be used with safety when the surface of the body is warm, either on account of the natural vigour of the circulation or from applications of heat, or from vigorous exercise. In a condition of chilliness the power of reaction is in abeyance. A cold bath without reaction is a physiological crime. The ill effects of good remedies badly applied could not be better illustrated.<sup>1</sup>

Cold bath  
when the skin  
is warm.

The cold pack.

The *cold pack* was first suggested by Dr. Lucas in 1750. The effect of such applications greatly depends on the method of their employment. If free evaporation is permitted, the effect is antipyretic, like that of a cooling or cold bath. This is the case with the so-called *drip-sheet*. In proportion to the extent to which evaporation is prevented the pack becomes sedative, and increases perspiration and the cutaneous circulation.

Use of cold  
locally.

*Local cold packs*, frequently changed, were first used by Niemeyer in pneumonia, and have been employed by Winternitz in phthisis. Their action is stimulant, sedative, and antipyretic "in all febrile conditions with enfeebled circulation" (Baruch). In the local treatment of inflamed or injured parts the vascular and nervous tract *leading to* the affected part

<sup>1</sup> "The empiric Musa, after having cured, by the cold bath, Cæsar Augustus, gave his death to Marcellus by the same bath, which he had ordered, without knowing either the causes of the malady or the effect of the bath."—BELL.

should be kept cool. The vascular supply is thus diminished and the excess of nervous stimuli lowered. In local cooling treatments—cold packs, ice-bags, etc.—much lower temperatures can be properly used than in the case of baths.

With reference to the treatment of local diseases or the local expressions of systemic diseases, these *decongestive* and sedative cold applications may be compared and contrasted with the *congestive* application of heat. Cold diminishes the blood in the part whilst heat increases it. For example, Bier's method brings about a state of circulatory fluxion, according to the saying *ubi irritatio ibi affluxus*. Its whole purpose and *modus operandi* is to set up a congestion in tissues affected with local anæmia.

Decongestive  
and congestive  
treatments.

It will be seen that, speaking generally, the use of cold is therefore more appropriate for acute, and that of heat for chronic, disease.

Cold packs or ice applied to the epigastrium often powerfully stimulate the action of a dilated or failing heart, and reduce the pulse in tachycardia. They are also useful in allaying the circulatory excitement in hæmoptysis and in hæmorrhage from gastric ulcer, no doubt partly in virtue of the functional connection between the skin and subjacent organs. In the same manner cold applications subdue the excitement of the cerebral circulation in meningitis, sunstroke, and apoplexy, as well as in neuralgia and many other painful local affections with loss of vasomotor tone.

Effects on the  
circulation.

It was long ago pointed out (by Bell) that local applications of cold, as by ice compresses, have (1) a local and (2) a general effect of sedation. The general effect does not begin until the excess of heat is withdrawn from the inflamed or congested part. By removing the cold at the right moment the general sedation may be prevented.

## CHAPTER VIII

### THE DOUCHE BATH

Among the  
Greeks and  
Romans.

In the ancient hot air and vapour baths, which attained so great a pitch of luxury and magnificence, there was always some form of cold *aspersion* or *affusion*. This was the *stillicidium* of the Romans. A douche in the form of a column or shower of water descending from an elevated vessel was used in the Greek colonies in Italy about 600 B.C., as may be seen from the vase paintings of that date. The public or private baths in which these methods were employed had probably a hygienic rather than a medical intention.

First use in  
medicine.

It is said that Asclepiades, who came to Rome about 100 B.C., first introduced into medicine the use of douche and shower baths, as well as systematic massage. The Italian name, *Doccia* (Low Latin, *ductiare*, from *ductus*), indicates that this form of bath flourished especially in Italy. Its invention has been attributed to Pietro Tusignano, a physician of Bormio (1336), but long before his day—as early as the eleventh century—it is believed to have spread from Italy into other European countries and to have been employed in mediæval baths and “hot-houses.”

Revival by  
Wright.

With the revival of bath treatment in Great Britain at the end of the eighteenth century under Wright and Currie, not only cold baths but douches came into use, especially in the practice of Wright in Edinburgh. In France at the present day one of the chief procedures in hydrotherapy is described as the *douche écossaise*. Among the pupils of Cullen in Edinburgh about the

year 1787 was one Baron Joseph Despine from Savoy, a province then united to the kingdom of Sardinia. Having observed the good effects of the shower bath at that time employed by Wright and his friends, he subsequently introduced it into the baths at Aix-les-Bains, under the name of the *Scottish douche*, a name which still survives although applied to a different procedure.

In the empirical practice of Priessnitz in Silesia thirty years later the cold douche played an important part. He led the water from a mountain stream, and made it discharge from a gutter six feet above the patient's head, and this heroic douche was used in all weathers. In a later year (1843) followed the famous inquiry by the French physicians into the merits of the new hydrotherapy (see Chapter IV). As a result, the medical use of baths and douches was formally authorised in France. By the labours of Fleury and others, many refinements in temperature, pressure, and technique have been introduced in the course of years and have made the douche an instrument of precision. The *douche mobile* is now at the head of hydrotherapeutic methods in France.

Development  
in France.

The continental physicians have for a long time borne testimony to the medical value of douche baths. The latter are an essential feature in all "medical baths." It is their great merit that they can be given with any kind of water, so long as a sufficient supply is forthcoming. When massage is combined with the douche a soft water is preferable. Many of the natural thermal waters containing alkaline silicates are an ideal medium for the douche. "Medical Baths," or institutes of hydrotherapy, properly equipped and under skilled medical direction, in which the douche is given with precision, have within recent years been set up in many localities, chiefly on the Continent and in America. Whether situated in towns, on the moorland

The value of  
the douche in  
"medical  
baths."

or mountain, or by the seaside, under varying conditions of climate, these medical baths supply a much felt want, and in many cases are more appropriate to invalids than the medicinal spas.

It is a further testimony to this branch of hydrotherapy as a necessary means of treatment in chronic disease that the douche, in a great many forms, has been introduced at many of the spas, although it has no connection with medicinal waters or baths.

The action of  
douches  
general and  
local.

All that has been stated in a previous chapter with reference to the action of heat, whether *plus* or *minus* to the body, applies also to the douche. In the douche the effects of *mechanical stimulation* from the impact of the water are added to those of temperature, but there is not in the douche any hydrostatic pressure upon the body, as in ordinary baths. Both forms of bath are alike in offering a large range of stimulant and sedative actions. Again, douches have a *local action*, well stated by Bell. "By the douche we can augment all the effects of baths and confine them to particular parts. The effects are not communicated to other parts in the same manner as with ordinary baths."

Pressure of the  
douche.

The *force* or *pressure* of the douche may be great or small. It is almost *nil* in the "low pressure douches," which consist of large volumes of water made to pour over the body, usually at a temperate heat and with a minimum of mechanical stimulation. The pressure may rise to 10, 20, or 50 lb. per square inch according to the head of water, and the douche may be administered in more or less powerful jets, which are sometimes strong enough if long continued to bruise or even lacerate the soft tissues.

Forms of the  
douche.

In form the douche may take the shape of a single jet, large or small; or many fine jets, as in the *rose* or *spray bath*; or arranged in circular form round the body, as in the *douche-en-cercle* or *needle-bath*; or



finally of a *shower* or *rain bath*. These may be variously combined and applied simultaneously to different parts of the body at any prescribed temperatures or pressures.

### 1. COOLING DOUCHES

The effect upon the muscles of cooling douches at varying temperatures has been studied by Vinaj. He finds that pressure in the douche markedly increases muscular vigour and tone and enables them better to resist fatigue. Thus a douche bath at 50° F. and at a pressure of 30 lb. is said to increase the resistance of the muscles threefold. A tepid bath has no effect upon the resistance of the muscles. An ordinary cooling bath increases their tonicity and capacity for work, but this effect reaches an acme in the cooling douche.

Effect on the muscles.

With the douche as with all cooling applications, after a brief initial stage of vaso-constriction there follows a reaction, with hyperæmia, which may with strong douches and in extreme cases even amount to inflammation. It is in consequence of this reaction that sluggish nutritive processes are aroused, and absorption and retrogressive changes are stimulated. In the part treated the blood shows increased corpuscular richness, and in the body generally blood pressure is raised and the pulse is slowed. All douches under pressure tend to raise the blood pressure by mechanical surface stimulation. It has been well pointed out<sup>1</sup> that this stimulation in the douche enables some of the tonic effects of the cold bath to be obtained at higher temperatures.

Effect on the circulation

It is a matter of common experience that the action of the cold douche locally applied, for example to the extremities, may vary very much in different

Differences of reaction to the douche.

<sup>1</sup> Bain and Edgecombe: *The Physiology and Therapeutics of the Baths and Waters of Harrogate*, (1905.)

individuals. In sanguine and robust persons with good reaction the effect is refreshing. In others with deficient circulatory and nervous response the douche, although pleasant, is followed by headache and oppression of the chest. In others again, especially in weakly persons with cold skin and liability to nervous and stomach disorders, it may set up painful congestion and spastic contractions of the bowel.

Indications for  
cooling douches

The cooling douche is indicated in local inflammatory conditions, such as gout, in order to bring down the temperature of the part without general chilling. If the circulation is languid, or the inflammation already declining, the douche is contra-indicated, and in no case should the mechanical stimulation be otherwise than very gentle. It may also, and with advantage, be applied to the affected part in local neuralgias, in some forms of headache and generally in cerebral circulatory excitement, whether in meningitis, apoplexy, mania, or convulsions, in which the cold douche produces an effect similar to that of icebags, but gentler. As a rule in hydrotherapy only cold applications should be made to the head, according to the saying of Celsus: *Capiti nil aqua prodest atque aqua frigida*. Cooling douches were extensively employed by Charcot at the Salpêtrière both in organic and functional nervous disease. They are recommended in order to relieve the pain of tabetic patients, in spinal and cerebral syphilis, and for *petit mal*, migraine, hysteria and chorea. Cold to the head may sometimes be advantageously combined with a general warm bath or hot pediluvia. It is customary in France to follow the cold douche with general friction.

In chronic  
arthritis.

By their stimulating effect on nutrition, cooling douches are of great value in many diseases in which subnormal circulation and defective nutrition are prominent features. Among these are many cases of chronic arthritis, in regard to which Professor Winter-

nitz has truly said that they are the "best remedy." The same applies to anæmia, chlorosis, many forms of neurasthenia, dyspepsia and obesity. Franceschi of Lucca has praised the local action of these douches in excessive discharges, hæmorrhagic or mucous, either from the uterus or bowel, in hæmorrhoids and in pruritus vaginæ.

## 2. THERMAL DOUCHES

The *hot* or *thermal*, like the cold, douche is a powerful stimulant, and finds its peculiar application in many conditions of asthenic or hyposthenic disease. In the old but expressive phraseology, "the warm douche penetrates, softens, works, dilates and agitates the part, which "reddens and swells with the abundance of the humours which come to it by acceleration of the circulation and dilatation of the vessels."<sup>1</sup> In temperature this douche may range from 100° to 112° F. Where the water is at a considerable pressure or the temperature is high, the duration of the bath should be brief: one, two, or at most four or five minutes.

Action of the hot douche.

As a rule high temperatures are to be preferred where the intention is to remove chronic congestive and sub-inflammatory swellings. Such douches are helpful both in local and general diseases, showing a defective power of reaction, and where the cold douche would be inapplicable and injurious. Where, on the other hand, there is any heat in the affected part, any actual inflammatory reaction or acute congestion, hot douches are contra-indicated and only cooling treatments are permissible. Hot douches with pressure raise the arterial pressure and diminish both the corpuscles and hæmogoblin of the blood.

Indications and contra-indications.

It follows that this form of hydrotherapy will often

<sup>1</sup> *Baths and Mineral Waters*, by J. Bell, M.D. Phil. 1831.

be helpful for the resolution of glandular and other engorgements, also when the circulation is languid and the nerve centres debilitated and torpid and, especially when associated with friction and massage, in chronic gouty and tuberculous joints, as well as in most chronic rheumatic affections (fibrositis), whether of the joints, muscles, or nerves.

It will be seen that the douche, at varying temperatures, is to be regarded, apart from its general effects as a local treatment, meeting local excitement by local sedation, and *vice versa*.

Another valuable procedure is the douche bath *alternating* between hot and cold. This is now known in France as the *douche écossaise*. Two jets of water, differing perhaps 30 or 40 degrees in temperature, are made to play alternately upon the patient, with abrupt charges every few seconds. It was long ago pointed out that this procedure "closely adheres to the principle of organic life, which consists in the alternation of the phases of stimulation and contra-stimulation, of excitement and repose, of cold and heat" (J. Bell). It may, of course, be used in the gentlest manner and with slight contrasts, or more vigorously according to individual toleration and requirements. When other applications are ineffectual or contra-indicated, the alternating douche often succeeds in rousing a dormant power of reaction, and stimulates nutritive processes in conditions of feeble and degenerative nutrition.

### 3. THE SUBTHERMAL DOUCHE

The subthermal douche, particularly when given without pressure and with massage, is a procedure of wide application and great practical value. It is probably the most valuable bath in the whole range of hydrotherapy. The douche consists essentially of large volumes of subthermal, that is to say, of ther-

The *douche écossaise*.

Value of the subthermal douche.

mally indifferent, water pouring over the patient, either reclining or seated. To this is added general massage. The *doucheur* and *doucheuse* in the course of years acquire much skill in adjusting the amount of mechanical stimulation to the requirements of the patient. Their hands in the warm water glide over the surface of the body and grasp and manipulate the soft tissues.

In contradistinction to the douches already described this is a sedative douche. The proper place and value of sedative douches has been too little recognised. Their sedative character depends upon the absence of pressure and mechanical excitation, and upon the temperature being pitched at or about the point of thermal indifference. Either above or below a short range, of perhaps 2 or 3 degrees, the sedative character is lost, a more active form of stimulation takes its place, and the total effect of the bath is entirely altered.

This kind of douche can be safely and properly prescribed even in grave weakness, and for many cases of organic heart affection in which immersion baths would be quite inapplicable. They have a grateful and gently stimulating and sedative effect in vascular and nervous debility. (See Chapters XVI and XVII.)

The *douche massage* of the French is now extensively employed at the British spas. It is given with the patient seated, as at Aix-les-Bains, or recumbent upon a couch or water-bed, as at Vichy. The position of the patient as well as the exact force and temperature of the douche appreciably modify the effects produced. It is said that the Vichy douche in most cases raises the blood pressure, while the Aix douches slightly lower it.

Among other varieties of the douche may be mentioned the *subaqueous*, or so-called "submarine," douche, in which a jet of water is made to play upon the patient already immersed in a warm bath, usually at a lower temperature. The action of the subaqueous

Essentially  
a sedative  
application.

The douche  
massage.

The douche  
under water.

douche upon the surface of the body resembles that of massage, and should be gently stimulating and sedative. This form of bath is open to the objection that where the douche is warmer than the bath the temperature of the latter sometimes rises so as to produce an undesired thermal action, which may be foreign to the intention of the physician.

## CHAPTER IX

### HOT AIR AND VAPOUR BATHS

IN the ordinary procedures of Hydrotherapy, *Water* is the medium by which heat is imparted to or withdrawn from the body. For such a rôle it is admirably adapted by its own physical properties. Water is already in nature a great heat-carrier. It absorbs more heat than any other substance, that is to say, it has a high *specific heat*, and what it has absorbed it is always ready to impart, owing to its great conductivity. Therefore, when cooled, it has a veritable appetite for heat and rapidly withdraws it from bodies warmer than itself. This explains the unique advantage of water in all the methods of Cooling Hydrotherapy (see Chapter VII).

Water the  
medium in  
Hydrotherapy.

Watery applications may be made to the human body within very wide limits of temperature. The range of toleration extends over nearly 90° of heat, that is to say, from about 35° to 120° F.

Hydrotherapy has, however, a still ampler range of application in hot air and vapour baths. In these the vehicle of heat is air, either practically "dry," or more or less charged with absorbed or suspended aqueous vapour. In the so-called *Turkish* and other "hot air" baths, the humidity of the air is at a minimum and the influence of moisture is therefore negligible. In the *Russian* bath on the contrary the air is saturated with moisture and charged with "wet" steam, which condenses upon the skin with a thermal effect proportional to its temperature. Between these

Hot air and  
vapour as  
media.

extremes there are many varieties of hot air and vapour baths, in which the effects of heat and of moisture are variously combined, and in which one or other of these elements usually predominates.

There are many natural vapour baths in connection with hot springs, each having its own proportion of temperature and moisture—the action and uses of which will be referred to in the section on Medicinal Waters. For hygienic purposes, as well as for Hydrotherapy, artificial hot air and vapour baths can be easily devised, both for the entire body and for local application, and this has, in fact, been practised by many and diverse peoples since ancient times.

As by means of such baths the application of heat can be extended much further than is possible with water, high thermal and hyperthermal effects—both local and general—can be easily and safely obtained by their means. A conspicuous and notable action *upon the skin itself* is produced by hot air and vapour baths. It is questionable whether such powerful surface actions can be produced in any other way.

Notable action  
on the skin.

Sweating baths  
in ancient  
Greece.

Although by no means the first in point of time, the baths of ancient Greece have much historical interest, both in themselves and from the more elaborate systems to which they gave rise in after times. According to Herodotus (*d.* 424 B.C.) it was the custom of the Greeks to use a *hot air sweating bath*, followed by a cold shower. The invention of this bath is ascribed to the Lacedæmonians, and on this account the hot air chamber was later known as the *laconicum*. In the time of Cicero (106–43 B.C.) it was much used in Rome and consisted of a small chamber for hot air, where massage was given, and sometimes unguents were applied to the body, and another and cool chamber for cold affusions.

Adopted and  
developed by  
the Romans.

The Romans took their use of warm baths and *laconica* from the Greeks about the third century



before Christ, and greatly developed and extended them, especially in the use of unguents and *strigils*, or scrapers, until to a great extent they supplanted the use of cold baths that had flourished among them since the early days of the Republic. Some of the sturdier citizens, like Cato, inveighed in vain against the warm baths and the growing luxury that accompanied them. The Greek methods formed the basis of the great *public baths*, with which successive emperors, in order to please the multitude, afterwards decorated the city but enervated the State.

Hot air was much more employed by the Romans than vapour. The *laconicum*, or *calidarium*, was a dry bath, although vessels of hot water were sometimes used for sprinkling the body, in order to induce perspiration. In their vapour baths the vapour was let in through the roof by tubes. It is recorded that sweating and cooling chambers were employed in Medicine in the Capitol in the first century B.C.

Early medical use.

Quite apart from Greek and Roman influence, many widely separated peoples are known to have employed rude sweating chambers from the earliest times. The northern races, living in cold and severe climates, have always shown a special proclivity for this mode of treating the body. These races and those upon the eastern confines of Europe appear to have taken steam sweating baths from the same source, probably from some very ancient people. There were in very early times sweating baths among the Scythians. It is recorded that they set up three stakes with the points inclined together. Over this they spread a felt cover and stretched it out. They threw hot glowing stones into a tub of water and themselves stood in the middle of the tent. In this way they obtained "such a steam that no Greek bath exceeds it." The Scythians shouted with joy in this steam and took no other bath.<sup>1</sup>

Sweating baths of the northern races.

Scythian baths.

<sup>1</sup> *Herodotus*, iv. 73-75.

In Finland.

A like bath was described nearly two thousand years ago <sup>1</sup> as flourishing amongst the Finns and even as "a necessity of their lives." It is a remarkable fact that with but little alteration it continues in common use in Finland to the present day. (*Sauna* in Finnish, *badstuga* of the Swedes.)

In Iceland and Greenland.

The Icelanders and the Esquimaux tribes use a similar bath dating from legendary times. The former utilise for this purpose many of their numberless geysers and hot springs. In recent years public sweating baths, formerly much used, have been discontinued in these countries.

Early use among the Slavonic peoples.

The Jewish doctor, Ibrahim-ibor-Jakub (993), states that baths of this kind were prevalent among the Slavonic races in his day. In a Russian chronicle (1110) the Monk Nestor in his *History of the Apostle Andrew*, says that the latter found wooden bath-houses among the Slavs at Novgorod, having stone ovens greatly heated. Here the bather douched himself with tepid water, made steam by throwing water on hot stones, and in this atmosphere lashed himself with rods, so as to creep out almost dead, and be cooled suddenly with cold douches : and these baths were taken daily.

Family Russian baths.

At the present time it is still customary among many of the Slavonic races and in country places for whole families to take sweating baths. They repair to small buildings filled with steam at much higher temperatures than could be tolerated by unaccustomed persons. For most people a steam bath becomes too hot at 120° F., but these baths are taken at 122° to 133° (Bell), or even it is said as high as 150° F. The seats are often arranged in tiers, the higher places being of course hotter, and the steam is produced by pouring water over hot stones or iron shot. When sweating has set in, the bathers are switched with birch

<sup>1</sup> By Tacitus and Ptolemæus in the first and second centuries A.D

twigs. Afterwards they rub the body with fats and soap suds, frequently interspersed with more vigorous frictions and kneading. Perhaps an hour is spent in the bath, after which they run back uncovered in the cold to their houses. It is esteemed by these people as a great pleasure and a sure protective against disease.

Vapour baths were also used from early times by the Mexicans and North American Indians, as well as by the Celtic races in Scotland and Ireland. "Sweating Rooms" were still to be met with in Ireland in 1862, and a writer of that date <sup>1</sup> states that he was then informed in County Louth by a man aged ninety-two years that in his youth every respectable farmer had one of these baths for his household.

The primitive sweat baths used by the Germanic peoples were probably like those about to be described, derived from the ancient Slavs.

Among the Mahommedans the practice of bathing was powerfully fostered by religious belief. During their conquering progress through Europe they rebuilt many of the great Roman and Byzantine baths which had fallen into decay, and spread the practice of bathing amongst the common people. The Mahomedan bath was essentially a sweating bath in hot air, with which some vapour was generally mixed. The skin was well cleansed with soap, and cooling douches were extensively employed. But the characteristic feature of these baths was the extremely vigorous kneading and passive movements of the body in comparison with which ordinary massage is child's play. It is said that in these processes the articulations were often instantaneously dislocated and replaced. In Morocco they rubbed the body with a species of earth, *gazul*, which removed the dead epidermis and polished the skin, as in the East the poor still use lentil flour.

Early use in America, in Scotland and in Ireland.

Sweating bath of the Mahommedans.

<sup>1</sup> David Urquhart: *Heat a Mode of Cure*. (1865.) Edited by Sir John Fife, M.D.

Mediæval  
sweating  
baths.

The Crusaders, who are credited with introducing into Europe both leprosy and syphilis, certainly brought back the use of sweating baths from the East. In the Middle Ages baths and "hot-houses" (vapour baths) were multiplied all over Europe, and were extensively employed in the treatment of the two diseases just mentioned. For some centuries their vast number in many of the continental cities, and the ignorant pretensions of the so-called "Bath Doctors," were productive of many abuses.<sup>1</sup>

After a time, it is true, separate baths were set aside for lepers, and the baths were forbidden to persons with infectious disease.

The law of the *intensive* treatment of disease<sup>2</sup> finds a curious illustration in this mediæval experience. According to this law, heat, as in hot climates and hot baths, is one of the influences which most commonly intensifies the reactions of disease. It seems historically clear that the excessive hot-bath treatment of those days aggravated the severity both of leprosy and of syphilis, and doubtless also assisted in the spreading of these complaints. The bad use of a good remedy is an old and familiar story. In this case it was no

<sup>1</sup> In the Middle Ages in Germany the medical profession consisted of a few physicians, together with the *bathkeepers* and *barbers*. The bathkeepers were skilled and organised in guilds. Any member of the guild might take apprentices, but not more than three, and the instruction extended over two to four years. The bathkeepers began in the twelfth century, and were often of a disreputable character, although the Emperor Wenceslaus declared to the contrary in 1406. The city of Ulm, in 1489, had as many as 168 bath houses, in which, besides sweating and other baths, cupping and bleeding and the treatment of wounds were practised. Massage had been known for many years, for in the time of Charlemagne (*d.* 814) the bondmen at Aachen were made to rub down the men. The golden age of the bathkeepers extended from the twelfth to the fifteenth century. The mediæval baths disappeared in the sixteenth century, in consequence of the contagious disease and immorality to which they gave rise. See J. H. Baas: *History of Medicine*, Engl. edn., 1889.

<sup>2</sup> See the Hunterian Society's Oration, "Some Principles in the Treatment of Chronic Disease," *Lancet*, 1910.

doubt one of the causes of the disrepute and total neglect into which after an exaggerated popularity the whole practice of bathing fell. So falls every system not founded upon and guided by knowledge and moderation.

Sweating baths are mentioned by Erasmus (1465–1536) as being common in France, Germany, and Belgium at the time of the Reformation; and Montaigne (1533–1592) speaks of them as still in use in Rome. With the Reformation, says W. Schleyer in his valuable work,<sup>1</sup> baths became a place where men could meet and talk sensibly, as in the early Christian days of Rome: “ ‘There they sit in a little bath-room and talk like cats against God and the Emperor,’ writes a priest of the time. Later, wood became more scarce from the destruction of the forests, and at the end of the Thirty Years’ War baths were expensive and no longer extensively used.” Guarino-nius, physician at Steyr in 1610, gives an amusing account of the baths of his time: “In all Germany there is nothing commoner,” he says, “better known or more practised than the cleaning of the body by a sweat bath. Through this the common people and many respected citizens are kept hardy and strong. They have themselves sweated, rubbed, scoured, and washed. If any one who has nothing to do, does not know what to begin, let him order a sweat, steam or full bath, let him sit therein with his wife or a good friend, and empty one, three, or four cans of wine.”<sup>2</sup>

Introduction  
of sweating  
baths into  
England.

Sweating baths were revived in England towards the close of the eighteenth century, under the eastern name *hammam*, and in Italy as the modern *bagnio*. Dominichetti set up vapour baths medicated by herbs in Cheyne Walk in 1765; and later Mahomed opened vapour baths at Brighton, of which he had taken

<sup>1</sup> *Büder und Badeanstalten*, Leipsic. (1909).

<sup>2</sup> Quoted by Schleyer, *loc. cit.*

the design from India. Afterwards Drs. Culverhouse, Quex and Routh extensively employed them, both at Brighton and in London.

In Germany such baths were not re-introduced until about the middle of the nineteenth century, when they again became common. Consequently they formed no part of the empirical practice of Priessnitz in its third and fourth decade (see Chapter IV). When, however, the Gräfenburg system was brought over into England in 1842, it found hot air and vapour baths already established, and these have always formed a part of "Hydrotherapy" in the British Islands.

Introduction  
of the Turkish  
bath, 1856.

To Mr. David Urquhart and an Irishman, Dr. Barton, of St. Ann's in County Cork, is due the credit of the introduction into this country of the Turkish or hot air bath in its present form. The first of these was erected at St. Ann's in 1856. It was modelled upon the pattern of the Eastern baths described by Urquhart in his *Pillars of Hercules*. In the hot rooms of these baths the air, which is practically dry, ranges from about 125° to 180°, and sometimes as high as 230° in the hottest chamber. To the zeal and sound teaching of this man and his followers is mainly due the vogue which these baths have enjoyed for more than two generations. In the present day, and with far greater knowledge than these pioneers possessed, it is impossible for us to deny the great hygienic value of the hot air bath, or the general truth of the doctrine upon which it was recommended in this country fifty years ago.

Urquhart's  
teaching,  
1865.

It may be briefly summarised in Urquhart's words as follows: We live through the skin, which is a chief organ for expelling poisonous matter: all the organs obtain relief when the skin acts freely and naturally: the effluvium which belongs to impurity is given to us as a warning: perspiration is not weakening: the

working classes live by it : the circulation of the skin is so extensive that in from thirty to forty-five minutes' exposure in the hot air bath the whole of the blood probably passes through the skin and is thus exposed to the action of heat : the sebaceous glands are emptied and their contents dissolved at a temperature below 160° F. The perspiration is noxious so long as there are impurities to pass away, and becomes wholesome when they are expelled. In Central Asia the grooms test the perspiration of their horses ; if it is sticky or acrid the horse is not considered to be in condition : the purpose of *training* is to cleanse by perspiration : the *hot air bath* and training produce the same result by different means : the Greeks and Romans with their sweating chambers and exercises combined the two methods : a special value attaches to the heat rays from fire or red-hot metal.<sup>1</sup>

### Hot Air Baths

The key to the action of Turkish and other hot air baths is their freedom from moisture. The surprising tolerance of the body for *dry* heat is explained by the fact that, whilst immersion and vapour baths check evaporation, the hot air bath promotes it. Hence there is no considerable elevation of body temperature even in a prolonged Turkish bath of a heat approaching that of boiling water. Perspiration is greatly increased, sometimes causing a loss of weight of as much as two or three pounds in one hour. The coincident inhalation of dry hot air greatly augments evaporation from the lungs. The pulse and blood pressure are at first raised, but lowered when perspiration is established. Hot air baths increase the circulation in the skin, and by consequence, like other stimulating baths, bring about a *decongestion* of the deep-seated parts,

Action of hot  
air baths.

<sup>1</sup> Urquhart, *op. cit.*

liver, spleen, stomach, brain, etc. The functions of the skin are promoted by thorough cleansing and by the removal of epidermic accumulations and the contents of the sebaceous glands. After the Turkish bath, frictions and especially cold affusions restore the tone of the superficial vessels and prevent the secondary and debilitating effects of heat (see p. 16).

Effect upon  
tissue change  
in health and  
disease.

Inquiries into the effects of these baths upon tissue change have yielded conflicting results. Here, as elsewhere in Hydrotherapy and in the use of physical agencies generally, and indeed in the use of drugs as well, the reaction produced is not always the same in all individuals. Even in the same person the effects may vary at different times and in different circumstances. It is, therefore, *a fortiori* less probable that the results of experimental and laboratory tests upon healthy subjects should always agree with the results of similar procedures in various conditions of disease.

The hot air bath seems in health to produce but little immediate effect upon nitrogenous metabolism, judging by the slight variations in the excretion of urea and uric acid. Many persons suffering from defective elimination and obesity, when subjected to a course of Turkish baths, rapidly lose their excess of weight and improve in general health. On the other hand, in thin subjects in depressed conditions of health the total effect upon metabolism is very different, and on the balance of tissue changes constructive processes are powerfully stimulated. For example, in observations <sup>1</sup> made upon 216 cases of insanity subjected to a course of these baths, and upon the usual diet, 168 gained in weight, by amounts varying from  $\frac{3}{4}$  to  $33\frac{3}{4}$  lb., and 48 cases lost weight, from  $\frac{1}{2}$  to  $22\frac{1}{2}$  lb.

Indications for  
hot air baths.

Hot air baths are of utility in a variety of chronic

<sup>1</sup> The observations were made at the McLean Hospital at Waverly, Massachusetts, and are quoted by Guy Hinsdale in *Hydrotherapy*. (Philadelphia and London, 1910.)



maladies, especially where oxidation and elimination are defective. These include chronic gouty and rheumatic conditions, obesity and abdominal plethora, defective cutaneous circulation, chronic toxæmias of various kinds, some nervous affections and neuritis, as well as chronic nephritis. In chlorosis and anæmia they are believed sometimes to act favourably by increasing the richness of the blood plasma in albumin, as an effect of sweating and transudation (Scholtz, quoted by Baruch). They are *contra-indicated* in cardiac debility and tachycardia, in Graves's disease and arterio-sclerosis.

The *cabinet hot air bath* is applied to the body exclusive of the head. The action of heat is therefore mitigated, as the hot air is not inhaled. The same applies to the electric light and radiant baths, in which the thermal agency is combined with luminous and other rays.

Hot air may be applied locally in a variety of ways, the part to be treated being enclosed in a chamber at the required temperature, ranging from 150° to 200°, 300° F. or more. The aqueous vapour and products of combustion (if any) should be carried away as formed. The action is an intense cutaneous congestion, sweating and marked febrile elevation of temperature in the affected limb, and to a less extent in the body at large. The high temperature increases the lymphatic circulation and favours oxidation. Hence local disorders, both sensory and trophic, are often benefited by these baths. Intractable pain or numbness is relieved, unhealthy deposits and congestions are often removed, and the nutrition of wasted muscles or joints is stimulated. It must always be remembered that it is necessary to use cold and tonic applications after hyperthermal treatment of this kind.

Local hot air  
baths.

Hot air may be used locally with much advantage in many subacute and chronic joint affections, whether

rheumatic, gouty or degenerative (arthritis)—especially in their later stages, when the joints are swelled and movement is limited and painful—also in local tuberculous affections, indolent ulcers, and in traumatism with imperfect resolution. Hot air may also be employed to relax and restore the circulation in spastic conditions of the arterioles, and to establish collateral circulation in obliterative endarteritis.

*Douches* or currents of hot air, heated by means of electrical resistance, may be used in many painful local affections—such as peripheral neuritis and muscular rheumatism (fibrositis).

### Vapour Baths

Action of  
vapour baths.

Vapour baths, *par excellence*, restore the natural action of the skin without undue heat or excitation. They remove accumulated impurities from the surface and soften the epidermis. The absorption of water by the epidermic cells, and the enlargement of the capillaries, absorbents and veins, give a softness and plumpness to the skin (Bell). The action of the sudoriferous and sebaceous glands is more or less powerfully stimulated according to the temperature of the bath. Massage is often badly tolerated by a dry and inactive skin, but after the tissues have been mollified by heat and moisture it becomes not only much more effective but grateful.

An example of  
sympathy be-  
tween the skin  
and internal  
organs.

The sympathy between the skin and the internal organs which is exhibited in the action of the vapour bath at moderate temperatures was long ago described by Bell in his admirable treatise.<sup>1</sup> An influence partly stimulating and partly sedative, and in its right place wholly beneficial, may be here as elsewhere traced in the surface action of baths. In Dr. Bell's words: "The moderate increase in calibre and the

<sup>1</sup> *Loc. cit.*, pp. 302-3.

medium state of sensibility in which the vessels and nerves of the skin are placed by the bath are directly participated in by the vessels and nerves of the mucous lining of the lungs, stomach, intestines, etc." (see p. 5). He strongly combated the doctrine that baths acted by the drawing or driving of the blood or other fluids from one part of the body to another. The effects produced are not those of afflux or efflux, but depend on "altered conditions of the tissues brought about by impressions which modify their sensibility and the mode in which the minute vessels dispose of their contained fluids. . . . On the skin the impression is immediate, on the internal surface secondary and mediate. . . inducing consentaneous action in internal membranes and secretory apparatus."

Where the stimulant and sedative effects of heat and moisture are so intimately combined as in the vapour bath, the general effect must obviously depend on the predominance of one or the other. In all vapour baths considerably exceeding the temperature of the human body, as in thermal baths of every description, it should be a cardinal rule to follow the hot application by a proportional application of cold. Unfortunately this necessary precaution is apt to be neglected in the practice of hydrotherapy and in spa treatment—and the injurious and debilitating secondary effects of heat are consequently far too common. The gravity of this evil in the present-day use of baths must excuse the repeated reference to it. "Thermal debility" is the chief and subtle danger of hydrological practice.

The Russians, Finns, Esquimaux and others for whom this bath is a national institution (*vide supra*) offer an admirable example of the right use of cold after heat. Experience has shown that the hotter the skin, the better cold is borne. In the case of these northern vapour baths, given often at extreme temperatures,

Danger of  
"thermal  
debility."  
Necessity  
of cold  
applications.

when the circulation has been stimulated by heat and the surface arterioles well opened, extreme fluctuations of temperature are tolerated with perfect safety. The Finlander often goes from his sweating chamber at 130° or 140° F. and rolls in the snow or in ice-cold water.

Indications for  
the vapour  
bath.

The vapour bath is useful in many chronic diseased conditions, in which it is necessary to restore or stimulate the action of the skin. These conditions include the too common recurrent chill and chilliness; internal congestions with associated defective peripheral circulation; also sometimes a late stage of fevers, when the skin is dry and inactive; chronic nephritis with or without dropsy, and skin affections such as eczema, psoriasis and ichthyosis. Some rheumatic and gouty disorders with stiffness of the articulation are greatly assisted by vapour baths when douches and immersion baths fail. When skilfully and perseveringly applied, either generally or locally, they will often relieve muscular rigidity, "lumbago," and other forms of muscular and nervous "fibrositis."

Local vapour  
baths.

Vapour may in ordinary practice be readily applied to the body when recumbent in bed or when seated in a box or surrounded by a suitable curtain or blankets. In all these cases the head is excluded, which is generally advantageous in vapour baths of high temperature. The box vapour bath was employed by the ancient physicians and was used by Aretæus in the first or second century. Vapour may be applied locally as in joint affections, by means of simple apparatus like the Berthollet bath.

The use of vapours at comparatively low temperatures will be referred to in the section on Medicinal Waters.

#### NOTE ON HYDROTHERAPEUTIC INSTITUTIONS

Following the introduction of the empirical methods of Priessnitz in the middle of the nineteenth century,

a large number of "Hydropathic" institutions were founded in England and Scotland. At first many medical men devoted themselves zealously to this institutional form of hydrotherapy—which, however, tended as time went on to become more and more inelastic and systematised and less and less dependent upon medical direction. The first enthusiasm for "water cures," insufficiently founded upon exact knowledge, gradually declined. Eventually a large number of "Hydros," which were originally intended to provide hydrological treatments for the invalid, became places of resort and recreation for the healthy. And many which bear the name are not now adapted for serious hydrotherapy.

Meanwhile, upon the continent of Europe, in succession to the empirics, a new school of scientific hydrotherapy arose and now holds the field. At present, within the British Islands, there is nothing quite corresponding to the highly organised medical establishment or sanatorium of hydrotherapy met with in most of the continental countries. Of late years many such "Kuranstalten" have been founded in Germany, Austria and Switzerland, as well as in Italy and France. In their methods and principles they follow the example of the great institute at Kaltenleutgeben near Vienna, the Mecca of modern hydrotherapy. Thus there are now in the countries just named a large number of excellent "Medical Baths," where bath treatments are administered under skilled direction, in many cases with appropriate regimen and diet.

(1) In Germany and Austria, besides the establishments at BERLIN, there are : On the Rhine, GODESBERG and BENDORFF, LAUBACH, MARIENBERG, and MUHLBAD ; in the Thuringian Forest, ELGERBERG, ILMENAU, LEIBENSTEIN, and EISENACH ; REINECK, near Hamburg ; in the Baden Black Forest, ST. BLASIEN ; in the Taunus, KÖNIGSTEIN ; near Munich, WÖRISHOFEN

(the institute founded by Father Kneipp); in Austrian Silesia, GRÄFENBURG-FREIWALDAU; near Vienna, KALTENLEUTGEBEN; at Ischl, KALTENBACH,<sup>1</sup> etc.

(2) In Switzerland there are, among others, CHAMPEL near Geneva; AIGLE-LES-BAINS, RIGI-KALTBAD, SCHÖNBRUNN, SCHÖNECK, BRESTENBERG; and the Medical Institute and Kurhaus at TERRITET.

(3) In France there are numerous and well-organised hydrotherapeutic institutions, such as those in PARIS and at BORDEAUX, and especially at DIVONNE; also at AUTEUIL, GÉRARDMER and many other places.

(4) In Italy modern hydrotherapeutic methods are extensively practised by medical men at the health resorts, and at some special institutions, such as those at ANDORNO.

(5) The British Islands. Among the English "Hydropathics" that are equipped for hydrotherapy may be mentioned: Smedley's, Rockside, and Matlock House, all at MATLOCK: the MALVERN Hydropathic Establishment: Hazelwood House at GRANGE-OVER-SANDS; Craiglands at ILKLEY; Kenworthy Hydropathic at SOUTHPORT; BEN RYDDING; CONISHEAD PRIORY; BISHOP'S TEIGNTON; Langley House, DAWLISH; RICHMOND (Surrey); and the BOURNEMOUTH Hydro.

Scotland is rather rich in institutions of this kind, such as the "Hotel Hydro" at PEEBLES; the Hydropathics at WEMYSS BAY; BRIDGE-OF-ALLAN and MOFFAT; also the Glenburn Hydro at ROTHESAY, and the Kyles of Bute Hydropathic in BUTE; Streatham House at CRIEFF; and the Cluny Hill Hydropathic at FORRES.

In Ireland are ST. ANN'S HILL Hydro (near Blarney, Co. Cork), and the ROSTREVOR HILLS Hydro (near Carlingford).

<sup>1</sup> See *Climatology and Balneotherapy* by Sir H. and Dr. Parkes Weber, p. 314. (London, 1907.)

PART III  
MEDICINAL SPRINGS AND BATHS

CHAPTER X

GENERAL CHARACTERS OF MEDICINAL SPRINGS

BEFORE dealing with the different kinds of springs and baths and their actions and applications in the treatment of disease, it seems well to set forth the general principles upon which their use is founded. The present chapter is devoted to this necessary survey of their characters and qualities, and of the position which the Medicinal Spring now occupies in the treatment of chronic maladies.

The subject-matter of this work naturally divides itself into two parts. In the foregoing chapters have been set forth the principles of that first part of medical hydrology which has to do with the medical use of water as a medium of energy. It remains to examine the second part of this science—that which has to do with the properties and uses of the medicinal spring.

In England there is as yet no convenient name for this subject. Recent French writers, after Landouzy, have used the new word “*crenotherapie*” (from *Krene*, a source). The Germans with their happy power of word-finding have called it “*Heilquellenlehre*” (health-spring-lore), whilst in Italy the word “*idropinoterapia*” has been sometimes applied to the internal use of waters, and “*balneoterapia*” to their external use.

The medical use of waters is a treatment apart.

From immemorial time the use of the medicinal spring has stood apart as a separate definite method of treatment. Waters of this description exist in every country, sometimes in great numbers and almost inconceivable variety, affording scope for an equal variety of application, and in every country there is no lack of evidence that they have been approved and employed from the remotest times, not only by popular election but by medical authority. It is evident that this health-spring-lore must be regarded as a definite self-contained department of knowledge. Those who have at all examined the subject will know how extensive are its legitimate boundaries. They are not only extensive but well defined. It is necessary to have regard to facts, and in the author's opinion it would not be according to facts if any confusion were permitted to exist in the medical mind or in medical nomenclature between the medicinal spring and water *qua* water. Treatments by sweet water form a separate well defined object of study. They can be and are carried on quite apart from the spa or medicinal spring. Spa treatments, on the other hand, though they are founded upon this general doctrine, include a variety of other elements according to the specific nature of the waters and baths employed. The medical use of sweet water has been already dealt with in the preceding section under the familiar name "hydrotherapy." There remains for consideration the other great division of hydrology—the medicinal spring.

Medicinal rather than mineral.

The epithet *medicinal* rather than *mineral* is more truly descriptive of springs devoted to medical uses. Some of these contain little or no mineral matter, and the expression "mineral waters" has been already illegitimately captured for non-medical uses. It is impossible to ignore the fact that on the whole such springs have enjoyed at all times a larger measure of



the faith and confidence of mankind than any other curative method. Wisdom lies not in ignoring facts, but in endeavouring to account for them. The author enjoyed for more than twenty years the privilege of practising in the vicinity of a British medicinal water. It was at that time customary for a large number of poor persons to travel long distances every year to those waters, at great sacrifice to themselves. The unwavering confidence placed in their efficacy, which the country-people had themselves discovered about one hundred years before, made an indelible impression on his mind. Various views may rightly be held as to the cause or combination of causes that are at work in the beneficial action exerted upon so many invalids, but no tenable explanation can exclude the medicinal spring.

Nor can it be truthfully said that this faith is confined to the poorer classes, or that it was especially characteristic of remote places or of bygone times. Experience shows that the growth of civilisation and the increase of knowledge in nowise lessen the yearly recourse of all classes to waters. How great an annual migration to the spas takes place in England! Italy is not a wealthy country, but it is said that from 40,000 to 80,000 invalids annually frequent the four chief Italian spas. It cannot, therefore, be supposed that a custom having its roots in antiquity, and showing in the present time increasing vigour with the growth of exact knowledge, is likely to decline. It has the elements of permanence in its nature. It is impossible to reject the facts, whatever fate be meted out to the interpretations.

Interpretations as to the action of waters have been many and various. The older and primitive view of them, as of medicinal agents generally, attributed their virtue to miraculous powers. To the vivid and childlike mind of earlier man there seemed to be

Growing recourse to waters.

The old belief in miraculous powers

something of life itself in the spring. Always moving, renewed every moment, no wonder that it was counted among the living things of Nature, that fountains and rivers were held to be haunted, like the trees and animals and man himself, by spiritual beings. In respect to the mystic power of wells and springs, that early view has been curiously long-lived, and may still be met with, under religious sanctions, here and there. What has been called the "sprite of the spring" has long been laid. Floyer two hundred years ago explicitly rejected such a doctrine. No medical writer since his time has given it quarter. Science can have no traffic with mystic or unknown powers. It is, however, possible that the process of negation once started may go too far. Denials often outrun reason. In reason it is necessary to reject the pleasant hypothesis of our ancestors, but the facts for which it endeavoured to account cannot be so summarily dealt with. The interpretation is destroyed, but the data remain. It is, indeed, because of the increase of data that the old interpretations are discarded.

And here the inquirer is confronted by a curious fact, common enough in these days in many categories of knowledge, and one that may well give pause to the reflective mind. It is ever thus. With infinite pains he eliminates the miraculous from any subject of study in which it has hitherto had a place. He dismisses from his mind, and very rightly, all ideas of exceptional power, and sits down quietly to examine the true nature of things. He goes on step by step in a reasonable analysis; he discovers many links of causation and effect; then all at once, whatever be the direction of his research, he finds himself at an impenetrable frontier, where the mystery from which he had fled finally bars his advance. Surely it is a sorry fate for the thinker to have escaped from the sense of miracle and of the unknown in one or two

which has  
become a new  
belief.

or a few places, only to find it confronting him everywhere. The latest scientific discovery is that science is everywhere rounded by the unknown.

So in regard to the medicinal spring it has been shown that it does not depart in any way from the ordinary laws of Nature; but it has also been shown that its operation, like that of any other natural agency, can be followed and scrutinised to a certain point, beyond which lies the ultimate and baffling analysis.

Those who destroy old hypotheses are, *ipso facto*, bound to supply new ones, to save men from the chaos of unclassified data. The hypothesis of exceptional powers in the spring was fitted to the old doctrine of possession in disease. When later on disease was interpreted according to a humoral pathology, the humoral theory was applied to the medicinal spring. According to this theory, the action of waters was a very simple one—namely, the elimination of peccant humours.

Theory of  
elimination

The growth of chemistry, and the consequent investigation into the chemical nature of the various springs, upset in its turn the humoral theory by establishing the presence of a varied and more or less complicated chemical constitution for most of the medicinal springs. Hence arose the reasonable doctrine that waters acted in virtue solely of their chemical ingredients, as revealed by the ordinary methods of analysis. According to this hypothesis the action of a medicinal spring should be identical with that of a solution of the saline and other ingredients corresponding in amount to the results of this analysis.

Chemical con-  
stitution.

This simple and attractive explanation, which attributed every property of waters to their ascertained chemical constitution, was presently found in its turn not to cover all the facts. For example, it was shown that some waters, which were called "indifferent"

Physical con-  
stitution.

from a chemical point of view, produced effects out of all proportion to the quantity or quality of their known ingredients. Again, it was found that an artificial water, however similar to the natural spring in chemical constitution, did not produce the same effects. In other words, that it is impossible to reproduce a medicinal spring. But it may be said with some reason, that the same effects are not produced because the true chemical constitution is not accurately known or reproduced. If that be so, then it is clear that the chemistry of waters is much more intricate than our analyses suggest, and that in point of fact the analyses are both incomplete and misleading.

The present position may be stated thus: The chemical constitution of many medicinal springs so far as at present known does not fully account for their action in the living body. It is, however, probable that the action could, and will be, explained when the arrangement and combination of the various elements, the form in which they are presented for absorption in the tissues, and the power which one may possess in modifying the proper effect of another, have been ascertained. What the French call the hydro-mineral action would, therefore, appear to be due rather to the constitution and grouping and *dissociation* of the molecular elements of the water than to its total mineralisation. Moreover, it is now known that substances whilst in isolation may be sometimes inert, but that they become active when combined with other and different bodies. For example, iron is often therapeutically active when given in a ferruginous water of complex constitution. In the same manner alkaline and sulphurous waters seem to promote the activity of mercury in syphilis.

Not only so, but it is believed<sup>1</sup> that in thermal waters organic substances hold metallic matter in

<sup>1</sup> See Fleig, *Les Eaux Minérales*, Paris, 1909, and Ferreyrolles, Acad. de Med., 1912.

solution. According to this hypothesis, which is accepted by many French writers, many metals in these waters are present in the colloidal state; and are, therefore, insusceptible to the ordinary methods of analysis. In this condition certain metals exert a bactericidal action, and probably other intimate effects on the tissues, that are not comparable to their action in bulk. The loss of the activity of such waters when preserved for any length of time may probably be correctly attributed to the destruction of the organic matter and the deposition of the metallic elements. Colloidal arsenic has been discovered by Iscovesco in arsenical waters, and various colloidal matters have long been known in sulphurous waters. It has been shown that colloidal metallic solutions have a catalytic action. According to these views similar traces of metals in medicinal waters may be regarded as ferments. They are capable, says Albert Robin, of physiological action out of proportion to their quantity. They may, therefore, operate in doses hitherto considered as inert. They may in the tissues modify the chemical action associated with morbid states, and may, he thinks, take an important place in the therapeutics of the future.<sup>1</sup> However this may be, there are certain springs for the action of which it is difficult to account by any appeal to their chemical constitutions as determined by analysis.

There is yet another view of medicinal waters which has always had some advocates, and which has been again recently advanced. This may be called the hydrotherapeutic theory. According to this view, to which allusion has been made in a previous chapter, it is the water only which counts, and the particular qualities of the spring are negligible. No one can be less inclined than the present writer to minimise or confine the medical doctrine of water, which must

Hydrotherapeutic theory that only the watery vehicle is operative.

<sup>1</sup> *Clinique hydrologique*, p. 45. (Paris, 1909.)

always lie at the foundation of hydrology. Let the full value be freely granted to the watery element and to all its proper actions, which belong to the domain of hydrotherapy. Are all the effects thus accounted for? Let this theory be put to the test. A bath of the natural thermal water at Buxton at a certain temperature produces a particular effect: a similar but salt bath at Droitwich a second, and a natural sulphuretted bath at Strathpeffer a third. Daily experience, checked by experimental observation, establishes the fact that these and innumerable familiar procedures in spa treatment exhibit *differentia* which are super-added to something they have in common. The same remark applies to waters taken internally; for example, the waters of Bath, Harrogate, Llandrindod. This doctrine that the use of medicinal waters internally and externally is but a form of Hydrotherapy is founded on a denial of undeniable particular properties, and must, therefore, fall to the ground.

It is evident that no simple theory is sufficient to explain the action of medicinal springs. Their composition is still in part unknown to us: chemical data do not reveal to us the real grouping of the elements. We do not know their influence one upon another, nor their intimate action in the tissues.

Origin of the medicinal springs.

It has generally been supposed that all medicinal waters, like other springs, are derived originally by condensation from the atmosphere: that they fall as rain over a more or less wide collecting area: that they are absorbed by the soil or porous strata, or sink by gravitation into the many faults or fissures of the more solid rocks: that they eventually accumulate upon an impermeable bed, declining always to the lower parts and lying in depressions or pockets: and that hence they gradually rise in level and eventually force their way to the surface through fissures or erosions of the overlying beds.

Such springs derive their constituents from the rocks through which they percolate, and naturally contain the more or less soluble elements found in the sedimentary strata—the carbonates and sulphates of calcium and magnesium, the chlorides, nitrates, and dissolved oxygen. The presence of carbonic acid gas, derived from the soil, assists the solution of earthy salts. The nature of the beds through which the water passes—gypsum, rock-salt, mountain limestone, chalk, etc.—determines the mineralisation of particular sources. With reference to naturally warm and hot springs it has also been held that the same sequence has taken place, only at a greater depth, and that the temperature which they present has been imparted to the circulating water by the heat of the earth's crust, which is known to increase one degree centigrade, more or less, for every hundred feet of depth.

It has often been pointed out that a certain class of medicinal springs exhibit remarkable fluctuation in yield, as well as in their temperature and composition, according to meteorological conditions, and from one season to another. On the other hand, there is another large class of springs, usually warm or hot, that show little or no variation in temperature, composition or yield, and are entirely uninfluenced by rainfall or seasons. These latter waters are also distinguished by a definite type of chemical composition. Many geologists have long been of opinion that waters of this class are connected with volcanic action and therefore have a deep origin.

Origin of the  
thermal waters.

What is sometimes called the "endogenous theory" of the origin of mineral springs was first advanced by Elie de Beaumont in 1847. Armand Gautier<sup>1</sup> has lately promulgated the doctrine that there is an essential difference in the origin of the two classes of waters referred to above. The first class, which he

"New" water.

<sup>1</sup> *Bull. Acad. de Méd.*, 3me sér., lv, p. 337. (1906.)

terms "Waters of Infiltration," he believes to be entirely of superficial origin. The second are in his view "Primitive or Virgin Waters." He shows that they are not only connected with volcanic action, but contain the elements commonly found in volcanic matter and in the gaseous emanations of volcanoes (*fumeroles*). The elements found in these thermal waters and in those of deep origin include the haloids—chlorine, iodine, bromine, fluorine, as well as arsenic, phosphorus, silica, and very often sulphide and carbonate of sodium, and large quantities of nitrogen gas, with argon and helium. The total mineralisation of these deep sources is small in comparison with waters of superficial origin, which derive their constituents from solution of the rocky beds through which they percolate.

Gautier's researches show that igneous rocks, such as granite or porphyry, after being pounded and dried *in vacuo* at 200° C., when further heated to redness yield a considerable quantity of "water of constitution." According to him, the "virgin water" of many mineral springs takes its origin from the disintegration of these rocks at high temperatures and at a profound depth, by the combination of the nascent hydrogen with oxygen in the overlying strata. This is analogous to the formation of *new water* in volcanoes.

If these views are correct, it would not be irrational to suppose that water continually formed in this manner *de novo* under unknown conditions of pressure and temperature at a great depth might possess special properties as a solvent or in other ways. "The emergence of thermal waters upon the surface of the earth is a phenomenon of the same order," says Guéniot, "as an eruption of lava, cinders, and gas, and is in reality an attenuated volcanic eruption."<sup>1</sup>

In all medicinal springs, no doubt, much importance

Dilution and  
dissociation.

<sup>1</sup> "Résumé des travaux de l'Académie pendant l'année 1906," *Bull. Acad. de Méd.*, 3me sér., lvii, p. 37. (Paris, 1907.)



attaches to the form in which the ingredients are presented in a more or less dilute solution. It would even seem that very dilute waters are sometimes the most active. Jacobi<sup>1</sup> points out that free motility of the particles of matter is essential to active metabolic process. Water has the power of fluidifying, or rendering motile, the majority of solids. This fluidification, as in the case of vaporisation, is associated with a loosening of the mechanical and chemical structure of the particles. This process as applied to salts is described as *dissociation*. Water further has the property of taking up molecules produced in this manner between its own molecules, rendering them fluid and motile, dissolving them and increasing their chemical activity. Moreover, these separated particles or *ions*, whether bases or acids, carry a negative or positive electric charge, and do not exhibit the usual properties of the free elements. In a solution of chloride of sodium, for instance, completely ionised, neither the kathion (sodium) nor the anion (chlorine) exhibit the properties of these elements in the free state. It is noteworthy that the degree of ionisation is in proportion to the dilution of the solution. In many medicinal waters it is supposed that the saline constituents are in a state of complete ionisation.

Such considerations of the physio-chemical condition of dissolved matters shed a new light upon the action of medicinal waters, and especially on the part that may be played by extremely dilute watery solutions in the chemistry of the tissues. They suggest many interesting and undetermined questions: as to the range of active dosage and as to the most favourable form for absorption and assimilation. Recent knowledge does not appear to warrant dogmatic statements with reference to the inactivity of minute doses when presented in an assimilable form. In many cases it

Questions of  
Dosage.

<sup>1</sup> *Deutsches Bäderbuch*. (Leipzig, 1907.)

seems impossible to doubt the effect of minimal doses. In truth the problem of treatment by many medicines is now no longer a question of "how much," but how to get the medicine into the tissues. It is the conviction of the writer that this problem is often solved by medicinal waters.

Tonicity of  
waters.

Intimately connected with the presence of saline matter is the *osmotic pressure* or *tonicity* of mineral waters. According to the laws of diffusion, every solution has an osmotic pressure proportional to the molecular weight of the substance in solution. The osmotic pressure is the force of osmosis or diffusion through an organic membrane. It varies in all solutions with the degree of concentration, and in the case of salines is exactly proportional to the number of molecules and ions of the contained salts.

The tonicity of a mineral water is its osmotic relation to the blood and body fluids. As a therapeutic agent viewed in relation with the blood, a mineral water may be one of three kinds. (1) The *hypotonic* waters have a low osmotic pressure; (2) *isotonic* waters are equal in pressure; and (3) *hypertonic* waters have an osmotic pressure in excess of the blood. There are many valuable waters in all these classes. Most waters of low mineralisation are hypotonic, whilst all the purgative waters are hypertonic. It will be obvious that the tonicity of waters is an important factor in their therapeutic effect. It has been ascertained that a considerable number of natural waters, some hot and some cold, are nearly isotonic with blood-serum. One of the first physicians to employ the hypodermic administration of waters was Dr. Thermes at Argelès-Gazost in 1885.<sup>1</sup> He found that small quantities so given were equivalent in their effects to larger quantities given *per os*. Among other natural nearly isotonic

<sup>1</sup> See Garrigou: *Enseignement de l'hydrologie* (leçon d'ouverture). 1903.

waters, the arsenical waters of La Bourboule may sometimes be given in this way with much advantage, and there is every reason to credit the observation that many chronic tuberculous and pre-tuberculous conditions can be beneficially treated in this manner by diluted sea-water and other natural salt waters. Sea-water is regarded as a mixture of "primitive water" with "water of infiltration."

Since the discovery of radium considerable and perhaps exaggerated attention has been attracted to the radio-activity of many medicinal waters. This singular property has been found in the gases of many thermal sources, such as Gastein, Plombières, and Buxton : also at many spas, in the atmosphere of the bath-rooms and in the vicinity of the springs. It is premature as yet to state definitely the effects of this property, but it is worthy of remark that it may be found in considerable strength in many waters of low mineralisation—"paradoxical waters"—which experience has shown to possess an activity out of all proportion to their ascertained chemical or physical properties. Certain natural radio-active waters, as well as artificial radium emanation water, are stated by good observers to produce a definite local *reaction* in the tissues of many "gouty" invalids. If confirmed this will be a suggestive observation.<sup>1</sup>

Radio-activity  
of waters.

<sup>1</sup> In a recent *jeu d'esprit* Dr. Josenhaus thus celebrates the new doctrine at Wildbad :

#### DAS LIED VON RADIUM

Seit ur-uralten Zeiten  
Führt Wildbad Radium,  
Nur waren, es zu finden,  
Die Menschen noch zu dumm.

Seit ur-uralten Zeiten  
Heilt Wildbad kranke Leut',  
Nur waren, dies zu glauben,  
Die Ärzte zu gescheidt.

A reference to the gases contained in waters should not be omitted from this brief general survey. Relatively large quantities of nitrogen and its congeners, argon and helium, are found in many thermal and radio-active sources, as at Buxton. The somewhat peculiar and hitherto unexplained effects of these waters when used in the form of baths may probably be due to their gaseous content, derived in all probability from profound depths in the earth's crust—and deserve further investigation. Carbonic acid gas, when present as it often is in considerable quantities, powerfully modifies the effects of medicinal waters, whether in their internal or external use. The hyperæmia which it produces in the mucous membranes favours the absorption both of water and dissolved particles. For this reason it increases the diuretic effect of medicinal waters (Quincke). The effect of carbonic acid gas in the bath is of much practical importance as a special mode of peripheral stimulation. The action is discussed in a subsequent chapter (*vide* "Effervescent Baths"). *A propos* of cutaneous stimulation in medicinal baths it may be convenient to mention here the brine, peat, and mud, and the various

Gaseous  
contents of  
waters.

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Es liess den festen Glauben  
An's Wildbad sich das *Volk*  
Durch nichts und niemals rauben :  
Es *spürte* den Erfolg.

Dass Volksmund Gottesstimme,  
Glaubt der *Gelehrte* nicht,  
Leicht glaubt der nur, was immer  
Autoritätsmund spricht;

Es waren ihm die Thermen  
Bisher, "indifferent,"  
Was man in deutscher Zunge  
Auch "wurst" und "schnuppe" nennt.

Jetzt, neu'stens, glaubt an's Wildbad  
Selbst die Gelehrtenwelt !  
Nicht, weil es heilt—behüte !—  
Weil's Radium enthält.

acid baths—which powerfully affect the peripheral circulation and nerve-endings, apart from the temperature at which they are given.

Having now sketched the general properties of waters and baths, it remains to consider briefly and as a whole their clinical application.

The methods of hydrotherapy, as we have seen, are applicable alike to acute and chronic illness. The treatment that belongs to the medicinal spring, the *Crenotherapy* of the French, or in common parlance “spa treatment,” is a branch of medicine which concerns itself only with chronic disorders and morbid tendencies. The treatment resembles the malady in being gradual, and acts by absorption and by reiterated impressions. It is remarkable to what an extent the use of waters internally, and that of baths, reinforce one another, for both procedures tend to promote the same general effects. Waters act through the mucous membranes and baths through the skin. This double appeal was well understood by the early physicians. It was their aim as we have seen to rid the body of “morbid humours” and “peccant matters,” and waters and baths were called in aid for their purgative, diuretic, and diaphoretic effects. Dietetic errors, indigestion that overtaxed the power of elimination, deficiency of imbibed fluids and of bodily exercise, produced then as now a variety of disorders for which a course of waters, with appropriate diet and exercise, sometimes repeated year after year, formed the best corrective treatment. For conditions of this kind the principles of spa treatment are simple—*dilution* and *elimination*. The extraordinary solvent powers of some medicinal springs must not be overlooked from this point of view. Probably their remarkable freedom from saline matter is in this case advantageous.

Applications  
to chronic  
maladies.

Although these simple principles are far from being the whole rationale of spa treatment, it cannot be

denied that increased elimination from the bowel, the kidneys and the skin, is an essential part of it. The practice of hydrology is founded upon a humoral doctrine, which still holds the field; but that is not all. Waters and baths also operate directly upon the circulation of the blood, and indirectly upon the nerve-centres, and both directly and indirectly upon the general nutrition.

Insufficient or  
perverted  
reactions  
in chronic  
disease.

This again recalls a cardinal fact in hydrological medicine which has several times been touched upon in these pages, namely, the power of *reaction to stimuli* inherent in living tissues. In all chronic disorders of nutrition, whether inherited (diathetic) or acquired, we have to suppose that the reaction of the tissues has become inefficient or perverted. Toxic matters are formed and vicious circles established depending upon this defective reaction. Acute disease should be remedial and have a favourable course, with prompt and effectual reaction, indicated by pyrexia and often some form of critical disturbance. In chronic disease reaction is prolonged, imperfect, smouldering and ineffectual. It is more particularly to these more or less general chronic tissue disorders, which precede local and acute disease, and furnish the *soil* for specific invasions, that spa treatment has its application. It is possible by the use of waters and baths to restore the healthy reaction of affected tissues.

This can be  
modified by  
waters

It is a familiar observation that in virtue of their selective or specific action particular toxins may cause a local neuritis, arsenic set up or remove cutaneous changes, and iodine resolve deposits in connective tissues. In the same manner medicinal waters, by a similar selective action in the tissues, operate at the seat of disturbance. The curative process in chronic disease, however produced, cannot be otherwise than an alteration in the intimate nutrition of the part. Treatment of this kind has, therefore, long ago received

the name of *alterative*. What are the intimate chemical or physical changes that take place in the restoration of a tissue habitually disordered is at present unknown.

There may, however, frequently be observed a striking and suggestive fact. This is a certain *increase of reaction* which converts the chronic process into one of a more acute character. This principle is abundantly illustrated in spa treatment. What may be called an *intensive method* is at the foundation of hydrological medicine. It is a familiar observation and, indeed, a frequent complaint at many of the spas that the waters or baths increase or "bring out" the symptoms in many kinds of disorders. In gout or rheumatism certain joints or tissues, previously quiescent, become under treatment painful, tender, or swollen. Were this not so the treatment would often be fruitless. It is the duty of the spa practitioner to watch closely these changes of phase, which are salutary and necessary up to a certain point. In order to moderate the new reaction, it is often well to combine with intensive and stimulant methods those of a more sedative character. It is precisely because of the intensive action both of waters internally and of bath treatment, that their application in the field of chronic disease is so wide. The particular deviation from normal nutrition may be widespread, or practically limited to a single tissue or organ—for example, the mucous membranes, the connective tissues, the lymphatic tissues or the skin. The disturbance may take the form of a lifelong vulnerability in one or other of these parts, or it may especially belong to the period of growth or decay. It is clear that an ideal treatment of these tissue disorders should not only have power to remove or allay the disturbance that has resulted in later life, but by timely interference in early life prevent the development of a morbid inheritance by promoting healthy reaction in the tissues.

which set up  
fresh reactions  
(intensive  
effect).

New views on  
chronic disease.

The current interpretations of chronic affections have undergone considerable modification during the century that is past. Much has been learned of the activity of the cell, of its nutrition and metabolism. Something is now known about its degeneration and deviations of function. Numerous facts have been acquired with reference to the invasion of micro-organisms, and it is recognised that the condition precedent to this invasion is a weakened resistance in the tissues. It has been found that a large number of chronic disorders are due to gradual and chronic invasions, or are the results of bygone invasions of a more acute character. There is much new knowledge of microbial toxins, variously produced, frequently inducing degenerative changes of a chronic character. Gonococcal disease, influenza, catarrh, tuberculosis, syphilis, and many others have now a comparatively complete natural history. Insight is being gained into liabilities and immunities, such as the special condition of the soil peculiar to families or individuals which, far more than the ubiquitous micro-organism, determine the development of disease. And it has been shown that it is possible to modify the soil in a favourable manner so that microbial invasion is no longer possible : or, if it has already occurred, that it can be arrested or overcome. To these ascertained elements in many chronic diseases there must now be added conditions of the nerve-centres of an irritative or asthenic kind, and certain circulatory disorders, evidenced by morbid blood pressures and unequal distribution of the blood.

The conclusion of the matter is that there is now a mass of evidence as to actual conditions in chronic disease which indicates to the practical physician the lines upon which treatment can be effectually applied. Therefore the aim of his treatment must be above all *to restore the normal resistance to invasion, to promote*



*the elimination of toxins and to allay nervous irritation and disturbances of circulation.*

Then again, there is also a corresponding mass of modern evidence, as will be indicated in these pages, showing the effects of baths and waters upon nutrition, metabolism and elimination, and upon nervous and circulatory disorders.

Corresponding  
new knowledge  
of physical  
treatments.

From two sides, therefore, new light has been focussed upon medical hydrology. Waters and baths have always been sought for a great variety of chronic disorders. But what must be impressive to the candid mind is the fact that in recent times it has been established—on the one hand, that chronic disease depends upon intimate tissue disorders with consecutive circulatory and nervous disturbance, and on the other, that waters and baths by their eliminative, sedative, stimulant and intensive actions provide for this class of disorders an adequate and fitting treatment. The new knowledge of tissue changes on the one part, and of the operation of physical agencies and especially of waters and baths on the other, has brought these things into so close a juxtaposition as must eventuate in nothing less than a revolution in the accepted treatment of chronic maladies.

## CHAPTER XI

### KINDS OF MEDICINAL SPRINGS AND THEIR USES

1. THERMAL. — Mineral waters have been classified as cold or thermal. Thermal waters are conveniently described according to the temperature of the source: viz. *subthermal*, from 68° to 98° F., and *hyperthermal*, from 98° F. upwards. In England there are several such springs, of which the two chief, Bath (104° to 120° F.) and Buxton (82° F.), were known to the Romans. The others are Matlock (68° F.) and Bakewell (60° F.), in Derbyshire, and Clifton (73° F.), in Somerset. Ireland possesses one such water, Mallow, in County Cork, formerly much resorted to. There are many and varied thermal stations in France, some of which were highly esteemed during the Roman occupation. They are distributed in the Pyrenees and Vosges Mountains, and in the volcanic district of the Auvergne, and a few are met with in the Alps. Thermal waters are also found in the Rhine district of Germany, in the Black Forest, in Bohemia, Austria and Italy, and in Algiers. They abound in the Caucasus, and in Iceland the eruptive waters (geysers) attain a temperature above that of boiling water. Kamchatka, where thirteen volcanoes are still active, is said to be richer in thermal waters than any country in the world. On the other hand, the non-volcanic mountain ranges of North America do not possess waters of this class. Among the British possessions there is in the North Island of New Zealand a remarkable group of hot springs at Rotorua, and in India there are a large

number of valuable but undeveloped thermal sources. There are also famous hyperthermal baths in Japan.

A large, and from a medical point of view an important, class of thermal waters, have, on account of their very low mineralisation, been described as simple or indifferent thermals. They usually contain a considerable quantity of nitrogen and other gases and are more or less radio-active. Buxton, Wildbad, Schlangenbad, Gastein, and Plombières are spas of this kind. These waters are principally employed externally in various forms of thermal and subthermal treatment, but are also taken internally. They act partly by their heat and high solvent power and their *hypo*-tonicity, perhaps also in virtue of contained ferments (see p. 96). They assist the solution and elimination of toxic material, and stimulate the intestinal and biliary secretions and the general circulation. They are, therefore, useful in cases of inactive liver, constipation, and retention of toxins.

Action of simple thermal waters.

2. SULPHUR WATERS.—Sulphided or sulphuretted waters are found in almost every country, and there is no class of medicinal springs that has enjoyed so high a reputation from remote times.

Many *thermal* waters are sulphided in varying proportions, usually in the form of sulphide of sodium. This salt is met with in traces at Aix-les-Bains, and increases to considerable quantities in the Pyrenean spas. Among the latter, Caunterets and St. Sauveur have 0·2, Barèges 0·4, and Luchon 0·7 per mille. These proportions are considerably exceeded in the hot springs of New Zealand. There are also many thermal salt-sulphur waters, such as those of Helouan (Egypt) and Hammâm-Meskoutine (Algiers), which are almost exclusively employed for baths (see p. 135). The water of Aix-la-Chapelle is, however, taken internally.

Thermal sulphur waters.

*Cold* sulphur waters usually contain a much larger

charge of sulphur than the warm springs, especially in the volatile form of sulphuretted hydrogen. Challes, in Savoy, is a spring of exceptional strength, and contains the sodium sulphide to the extent of no less than five parts per mille. Calcium sulphide is also found in some of these waters. It would seem that the base is of little or no therapeutic importance, and that the element, however administered, depends for its effects on the organic combination to which the hydric sulphide gives rise in the tissues when in a state of heightened chemical activity.

Cold sulphur waters.

The muriated and pure sulphur springs of the British Islands are elsewhere described (p. 151). Other famous cold sulphur spas are Shinznach in Switzerland, and Eilsen, Nenndorff and Weilbach in Germany. Sulphuretted waters are generally slightly constipating, and are apt to cause a tendency to anæmia in predisposed subjects, which used to be regarded as a "blood moulting" process, due to a combination of sulphur with hæmoglobin. It is probable that some undetermined change does take place in the blood. When taken into the stomach the volatile hydrogen sulphide is rapidly diffused in the tissues and is finally eliminated by the skin as well as by the kidneys and bronchial mucous membrane.

Action of sulphur waters.

When inhaled in considerable quantities sulphuretted hydrogen is a poison, and even in small doses, if long continued, is a depressant to the heart and nerve centres. In the bowel it has an antiseptic action, which, as in the case of sulphuretted waters, is out of proportion to the degree of purgation that is produced;<sup>1</sup> and, indeed, in spite of their constipating effect. This may account for the beneficial effect of these waters in many cases of auto-intoxication.

<sup>1</sup> See R. W. Wild, M.D., on "The Action and Uses of Sulphur and Certain of its Compounds as Intestinal Antiseptics," *Proc. Roy. Soc. Med.*, Nov. 1910.

A remarkably uniform tradition has given to sulphur waters a reputation in chronic scrofulous and skin disorders, such as acne, eczema, and furunculosis, and in affections of the liver, and in certain kinds of dyspepsia. Many cases of chronic rheumatism, gout and gouty plethora undoubtedly benefit from their use. In the case of gout (see Chapter XIV), the exhibition of highly sulphuretted waters (Strathpeffer) may cause a recurrence of tenderness and pain in the tissues that have been affected in previous attacks, which points to a selective and specific action of these waters. This is a form of "intensive" action, such as is often observed both as a result of waters and baths in chronic disease. A course of sulphur waters and baths has long been regarded as assisting the specific action of mercury in syphilis (see "Sulphur Baths"). But here also, as in gout, the symptoms are sometimes aggravated or made more apparent under their use (see p. 137). Waters of this class have also been widely employed for chronic poisoning, whether by mercury, lead, or copper.

Their indications.

3. SALT (MURIATED) WATERS.—Salt springs are found in many countries in connection with deposits of rock salt or sandstones containing chloride of sodium. In salt-bearing countries the inland waters or lakes are commonly salt. Such are the Russian "Limans" and the salt lakes of Bithynia, Phrygia, Armenia, Persia, India, and those of the United States (*e. g.* Utah).

Origin of salt waters.

In sea-water the percentage of salt varies from about one per cent. in the Baltic and 1.7 per cent. in the Black Sea to three or four per cent. in the Mediterranean and the Atlantic Ocean. The water of the Dead Sea contains more than seven per cent. of salt. Sea-water is a composite body containing not only other chlorides as well as carbonates and sulphates, but the haloid elements, bromine and iodine, probably

Sea-water.

in organic combination (Armand Gautier), as well as traces of many metals.

The stronger salt waters (brines) are generally cold. Among the better known are Droitwich, in England (30 per cent. of salt), Rheinfelden and Bex in Switzerland (about 26 per cent.), Ischl in Austria (23 per cent.), and Salsomaggiore in Italy (13 per cent.). In this group must be included Woodhall Spa, in Lincolnshire, which has a weak brine (2 per cent.). Such waters can only be used externally in the form of baths or sprays (see p. 130).

Among the potable salt waters there are many *thermal* sources, among which may be mentioned Wiesbaden (5 to 7 per mille), Aix-la-Chapelle, a salt sulphur water (2·7) and Baden-Baden (2), all in Germany; in France, Bourbonne-les-Bains (5), and in Italy, Montecatini (4 to 18).

A large number of moderately salt *cold* springs are extensively used for drinking. Thus at Homburg salt waters (10 per mille) are associated with chalybeate springs. Kreuznach has the same proportion of chloride. In England Leamington has 8·5 per mille, and Cheltenham 5·6, both combined with small quantities of sulphate of soda. The *effervescing* salt waters are represented by Kissingen, cold (6 per mille), and Nauheim, subthermal, with about 12 per mille of salt.

Chloride of sodium enters into the composition of the blood serum and other body fluids, in the proportion of about 0·9 per cent. The question of tonicity, therefore, arises, especially with regard to muriated waters. Among others the following are nearly isotonic with blood serum : Tarasp, Homburg, Uriage, Marienbad, Kissingen, and Wiesbaden. Salt waters usually contain other chlorides and traces of iodine and bromine, and may be associated with carbonates and sulphates, both alkaline and calcareous, as well

as with sulphides and with iron (see Alkaline, Sulphur, Purgative, and Iron Waters).

Strong hypertonic salt waters, 4 to 5 per cent., are irritating to the intestinal mucosa and may produce inflammatory changes. They may, however, be drunk in moderate doses, where the kidneys are sound, in order to relieve hydræmia and abdominal plethora. Waters of a lower degree of tonicity (0·5 to 2 per cent.) when taken into the stomach tend to dissolve mucous deposits and bring about a dilatation of the vessels. The appetite is improved, and absorption and general nutrition are thus stimulated. They tend to liquefy the contents of the bowel and appear to facilitate the solution of the chyme.

Action of salt waters.

Free carbonic acid gas powerfully assists their action on the gastric mucous membrane, especially when the waters are taken cold. Such waters are indicated in atonic states of the stomach and bowels, especially it is believed in subacidity of the stomach, with or without catarrh; also in chronic catarrhs, pharyngeal, bronchial, vesical, etc.; in scrofula and in atonic gout. Many thin and anæmic persons are benefited by a course of mild muriated waters.

4. ALKALINE WATERS.—These waters owe their alkalinity to the bicarbonate of sodium, which is often accompanied by free carbonic acid gas. In a large and important group of alkaline waters chloride of sodium is found associated in considerable quantities with the bicarbonate, which greatly modifies the action of the water. Sulphate of soda, salts of calcium and magnesium, silica, iron, arsenic, etc., are also met with in alkaline waters (see Sulphate, Iron, etc., Waters). Alkaline springs do not occur in Great Britain. The simple alkaline waters are represented by Vichy, in Central France (4 to 5 per mille of the bicarbonate), and Neuenahr, in Prussia (0·6). Both are thermal springs rich in carbonic acid gas. Vals, in Southern

France, has cold alkaline springs, also gaseous, containing 1 to 7 per mille. All these waters are diuretic, render the urine alkaline, and increase the elimination of uric acid. They reduce the appetite, diminish the glandular activity of the stomach, but appear to increase the secretion of bile. They are, therefore, given in acid dyspepsia, in biliary lithiasis, in abdominal plethora and in obesity; also in gout, and gouty glycosuria of stout and robust subjects.

The salt or muriated alkaline waters are many of them thermal and effervescing, like Royat, Châtel-Guyon and La Bourboule, in the Auvergne Mountains, and Ems, in Prussia, and the waters of Pozzuoli, near Naples, and Gurgitello, in Ischia. The cold springs of the same class include: Tarasp-Schuls (3900 feet), in Switzerland, which is powerfully alkaline; St. Nectaire, in Auvergne; and Castellammare di Stabia, on the Bay of Naples. The medical action of this group approximates to that of the milder salt springs. They are more tonic to the stomach than the simple alkaline sources, and, therefore, helpful in chronic atonic dyspepsia, with catarrhal conditions and constipation; also in tendency to uric-acid gravel and gallstones. In consequence of their power of dissolving mucus, alkaline waters powerfully assist in the breaking up of concretions, which are held together by this substance. These waters are often given to thin and weakly persons, for whom the stronger alkaline treatment is inadvisable. The presence of iron and arsenic, as at Royat and La Bourboule respectively, is also helpful in some of these conditions.

5. CALCAREOUS, OR DIURETIC, WATERS.—These springs exhibit salts of calcium—the carbonate (chalk) or sulphate (gypsum), or both, and sometimes carbonic acid gas. Bicarbonate of sodium is sometimes associated with the calcareous salts, as well as iron and small quantities of sulphates and chlorides. Among

Indications for alkaline waters.

Indications for salt alkaline waters.



the *thermal* calcareous springs are : Bath, in England, with 1·3 per mille of sulphate and 0·1 of carbonate of lime ; Bagnères de Bigorre, in the Pyrenees (1800 feet), with 1·8 sulphate and 1·0 carbonate ; and Lucca, in Tuscany, with 1·7 sulphate of lime and 0·75 sulphate of soda ; also Chianciano, near Sienna.

Thermal  
and cold  
calcareous  
waters.

A remarkable group of *cold* calcareous springs occurs in the Vosges Mountains. They contain the sulphate and carbonate of calcium in the following proportions : Contrexéville (1·5, 0·4), Martigny (1·7, 0·1), Vittel (0·4 to 1·4, 0·1 to 0·3). The cold gaseous waters of Wildungen, in Germany, and Pougès, in France, are to be distinguished by the absence of sulphate of calcium, and by the association of the sodium bicarbonate with the carbonates of calcium and magnesium. They are, therefore, alkaline calcareous waters. Lamalou, in the Cevennes, has a similar spring containing also bicarbonate of iron.

As a class these waters are powerfully diuretic, but do not render the urine alkaline. They are absorbed rapidly, and stimulate the appetite. They are, therefore, helpful in a tonic dyspepsia, particularly in irritable functional conditions, gastralgia, and a tendency to diarrhoea. They have a great reputation in urinary calculus and gravel, the free diuresis favouring the passage of concretions. They are also used with advantage in "arthritic" (gouty) states in weakly subjects, and oxaluria, and especially in the early stages of arterio-sclerosis. In these cases there is usually a deficiency of renal elimination with retention of toxins and spastic high tension (hypertonus of the arterioles). Calcareous waters favour renal elimination and often permanently reduce high arterial tension. On the whole, they are beneficial in proportion to their diuretic effect.

Indications for  
calcareous  
waters.

6. SULPHATED (PURGATIVE) WATERS.—The stronger sulphated or "bitter" waters are not drunk at the

source, but are bottled and widely employed as medicinal purgative doses. Some, like the Spanish waters of Villacabras, Carabana, and Rubinat, contain large quantities (10 to 12 per cent.) of sulphate of sodium. There is another class of bitter waters, of which the Hunyadi Janos and Friedrichshall furnish examples, in which the sulphates of sodium and magnesium are combined with the chloride and carbonate of sodium. The presence of chlorides and of the alkaline carbonate undoubtedly tends to make the action of the sulphate more gentle, and these waters are, therefore, more adapted for prolonged use in the majority of cases.

The sulphated springs that are drunk at the source are not of course so powerfully medicated as the bottled waters, but from their milder purgative and alterative action, they hold an important place in spa treatment. There are in England numerous weak sulphated springs, now disused, of which Epsom, Beulah Spa near Norwood, and Purton near Swindon, may be mentioned; but it may be questioned whether waters of this class (pure sulphate) are so beneficial, even in small doses, as those in which these salts are combined with others.

The potable sulphated waters are found in two main combinations: (1) sulphates with alkaline carbonates; (2) sulphates with chlorides. The first combination, the "alkaline sulphurated water" is exemplified in the famous Bohemian spas. Karlsbad is a thermal water, whilst Marienbad and Franzensbad are cold. At these spas the proper effect of the sulphate is powerfully modified by the alkaline constituent. To this group might be added the thermal water of Tarasp (see "Alkaline Waters"). The second combination, the "muriated sulphated water," is represented in England by Leamington and Cheltenham. Leamington has a considerable chloride element, associated with sulphate of calcium. This should give the Leamington Spa some of the medicinal quality of the calcareous

Alkaline  
sulphated  
waters.

Muriated  
sulphated  
waters.

group of waters. Cheltenham is somewhat weaker in chlorides than Leamington, but stronger in sulphates. In France, Brides-les-Bains and St. Gervais, a sub-alpine station, are mild muriated thermal waters of the same class, but weaker in salt.

The stronger sulphated waters are hypertonic. They, therefore, by osmosis set up a determination of fluid to the gastro-intestinal mucous membrane, increasing the fluid contents, both of the stomach and bowels. They diminish the secretion of the gastric glands. The alkaline and muriated sulphated waters are believed to stimulate the liver. These waters are, therefore, employed as purgatives and cholagogues in dyspepsia with plethora, in inactive liver, gall-stones, and hæmorrhoids, especially in obese and congested subjects; also in some cases of chronic catarrh and in the more sthenic forms of gout and gouty glycosuria.

Indications for sulphated waters.

SULPHATED WATERS (MURIATED AND ALKALINE)

|   | Sulphate of Sodium. | Sulphate of Magnesium. | Sulphate of Calcium. | Chloride of Sodium. | Bi-carbonate of Sodium. |
|---|---------------------|------------------------|----------------------|---------------------|-------------------------|
| Brides-les-Bains :<br>Thermal, 1860 ft. | 1·2                 | 0·5                    | 1·7                  | 1·8                 | —                       |
| St. Gervais :<br>Thermal, 2075 ft.      | 1·7                 | —                      | 0·9                  | 1·7                 | —                       |
| Leamington :<br>Cold, 200 ft.           | 1·2                 | 0·9                    | 2·0                  | 8·5                 | —                       |
| Cheltenham<br>Cold, 150 ft.             | 2·2                 | 0·3                    | —                    | 5·6                 | —                       |
| Karlsbad Sprudel :<br>Thermal, 1230 ft. | 2·4                 | —                      | —                    | 1·0                 | 1·3                     |
| Marienbad :<br>Cold, 2090 ft.           | 4·9                 | —                      | —                    | 1·7                 | 1·6                     |
| Franzensbad :<br>Cold, 1500 ft.         | 2·8                 | —                      | —                    | 1·1                 | 0·6                     |
| Tarasp-Schuls :<br>Thermal, 3890 ft.    | 2·1                 | —                      | —                    | 3·6                 | 4·8 <sup>1</sup>        |

<sup>1</sup> Also carbonate of calcium, 2·4 per mille.

7. CHALYBEATE AND ARSENICAL WATERS.—In many countries a large number of mineral waters are medicated with the bicarbonate of iron, associated with carbonic acid gas. This gas, which keeps the iron in solution, is sometimes found in large quantities and gives to chalybeate waters their sparkling and effervescent quality. Spa, in Belgium (1000 feet), which has given its name to mineral water health resorts in general, is a famous and typical example, with 0·9 per mille of the bicarbonate of iron. Schwalbach, in the Taunus (950 feet), is nearly similar. St. Moritz, an alpine spa in the Engadine (5800 feet), has 0·04 of the same ingredient, with a little bicarbonate of sodium and magnesium. These are all rich in free carbonic acid gas, as also are Pymont, Rippoldsau, in the Black Forest, and many others. Tunbridge Wells possesses a valuable carbonated iron water (0·6 per mille), but without free gas. In Italy there are, amongst others, the alpine Santa Catarina near Bormio (5600 feet), and Recoaro near Vincenza. By a happy coincidence medicinal iron waters are often found in the neighbourhood of other mineral springs, as at Bagnères de Bigorre, Harrogate, Buxton, and Strathpeffer—the association with sulphur waters being especially frequent.

Another kind of chalybeate water contains the protosulphate of iron. In England the most remarkable source of this kind is at Flitwick in Bedfordshire (2·4 per mille), which, however, is only used after bottling. There is a considerable group of less known English waters of the same class, including Sandrock near Blackgang Chine, Gilsland Spa in Cumberland, St. Anne's Well at Brighton, Hartfell Spa near Moffat, and Trefriw Well in North Wales. Similar waters are those of Ronneby in Sweden, Sandefjord in Norway, Parad in Hungary, and Auteuil near Paris;

Effervescent  
chalybeate  
waters.

English  
chalybeate  
waters.

and the strong thermal sulphated iron water of Pisciarelli near Pozzuoli.

In addition to the foregoing, which may be regarded as *pure* chalybeates, there are various salt-chalybeate waters, like those of Cheltenham, and Haarlem in Holland. There is also a large and important group of alkaline waters, including many thermal, in which carbonate of iron is an active ingredient. Such are the thermal gaseous springs of Royat, Châtel-Guyon, Ems, St. Nectaire (salt alkaline chalybeate waters), the cold alkaline waters of Vals and Tarasp, and those of Neuenahr and Lamalou (thermal). At all these spas the medicinal effects of alkaline salts, together with those of chlorides in the case of the first-named stations, are combined with that of the iron salts. Cudowa and Reinerz, in Prussian Silesia, are also among the alkaline chalybeate spas.

Muriated and alkaline chalybeate waters.

Traces of arsenic (arseniate of soda) are met with in a considerable number of thermal springs, often associated with phosphorus, bromine, fluorine, silica, etc., and it occurs in more considerable quantities in many chalybeate waters. Arsenic is found with the protosulphate of iron in the well-known waters of Roncegno, in the Austrian Tyrol (1700 feet), as also in many of the bicarbonated iron springs, such as the alpine and sub-alpine stations of Ceresole Reale, in Piedmont (5290 feet); the Val Sinestra, near Schuls, in Switzerland; and Bussang, in the Vosges Mountains (2200 feet). The group of muriated alkaline thermal waters in the Auvergne includes one strongly arseniated spring at La Bourboule and several others, in which this element occurs in smaller quantities (Saint Nectaire, Royat, and Mont Dore). There is also a cold alkaline arsenical spring at Vals.

Arsenical waters.

Chalybeate waters, especially those that are aerated, are apt to produce, when taken internally, a sense

Action of chalybeate waters.

of warmth and exhilaration. The pulse is quickened and there may be a transitory vertigo, fullness in the head or headache. These waters increase the motor and secretory activity of the stomach and are believed to stimulate general metabolism. There is evidence to show that a proportion of iron is absorbed by the mucous membrane of the bowel. Some passes away by the bowel, and the colour of the fæces is a useful indication of the amount of absorption that takes place.

Indications for  
chalybeate and  
arsenical  
waters.

The medicinal value of this interesting group of springs, at one time over-praised, is now certainly too little appreciated. They have a wide application in conditions of convalescence and debility, in atonic dyspepsia, chlorosis and anæmia, particularly in young subjects and in advanced life. It is sometimes advisable to pave the way for a chalybeate treatment by a brief saline course or by small mercurial doses. The advantage of warming cold iron waters was long ago pointed out. The carbonated or gaseous waters are preferable in cases of gastric irritation. Atony and catarrh of the stomach and intestine, with feeble appetite, menorrhagia and leucorrhœa and consecutive anæmia and debility, anæmia from malarial cachexia and residence in the East, are among the conditions that derive benefit, not only from chalybeate waters—simple, alkaline, salt or arsenical—but also from the change of scene and diet, mountain air, and perhaps stimulating baths, which are often associated with chalybeate waters. The arsenical waters, of which La Bourboule is the type, are with some reason regarded by the French physicians as indicated *par excellence* in the lymphatic and scrofulous maladies of childhood. They are used with good result by subjects of hereditary tubercle and syphilis, especially those affected with chronic catarrhs, purulent or otherwise, enlarged glands or overgrowth of lymphatic tissues.

It is recommended that these waters be used in cases of adenoids before recourse is had to operation, and afterwards to promote the resolution of affected tissues. Among the skin affections of young subjects it is claimed that many cases of seborrhœa, lichen and eezema, due to constitutional causes, and some cases of psoriasis and ichthyosis, are cured by arsenical waters.

## CHAPTER XII

### KINDS OF BATHS AND THEIR USES

#### Thermal Baths

THE effect of a thermal bath depends in the first place on its temperature and duration (see p. 47). A third factor in the action, which is not so generally recognised, is the influence of the local climate. Thus at comparatively low elevations, and in warm sheltered valleys, baths may prove "enervating" or "exciting" to a sensitive or debilitated subject, who would on the contrary be refreshed and soothed by the same treatment at a sub-alpine spa. Atmospheric conditions profoundly modify the effect of baths. At higher elevations higher temperatures can be borne without fatigue than in the valleys, where the bath must be comparatively cool (subthermal) to produce a similar effect. The same statement applies to latitude. The temperature of the bath should, *cæteris paribus*, range higher in the north (high latitude) and lower in the south. The table opposite (after Braun) exhibits the temperatures of the springs and the elevation above sea-level of the chief European thermal baths.

Baths of this kind may be divided according to temperature into three groups, for each of which there is a well-defined therapeutic application.



ELEVATIONS AND TEMPERATURES OF  
THERMAL BATHS

|                             | Elevation.<br>Feet. | Temp. of the Spring.<br>Degrees Fahr. |
|-----------------------------|---------------------|---------------------------------------|
| Panticosa . . . . .         | 5000                | 77—84                                 |
| Loèche-les-Bains . . . . .  | 4670                | 102—124                               |
| Bormio . . . . .            | 4500                | 91—105                                |
| Gastein . . . . .           | 3315                | 78—121                                |
| Ragatz-Pfäfers . . . . .    | 1700                | 98                                    |
| Baden-Weiler . . . . .      | 1425                | 81                                    |
| Wildbad . . . . .           | 1323                | 91—104                                |
| Plombières . . . . .        | 1310                | 77—155                                |
| Buxton . . . . .            | 1000                | 82                                    |
| Hammâm-Meskoutine . . . . . | 900                 | 115—203                               |
| Schlangenbad . . . . .      | 900                 | 81—89                                 |
| Aix-les-Bains . . . . .     | 850                 | 109—112                               |
| Néris . . . . .             | 800                 | 102—126                               |
| Teplitz . . . . .           | 648                 | 83—114                                |
| Bath . . . . .              | 100                 | 104—120                               |

1. SUBTHERMAL AND SEDATIVE.—The temperature of the baths is somewhere near the point of thermal indifference ( $90^{\circ}$  to  $93^{\circ}$  F.), ranging between  $98^{\circ}$  and  $80^{\circ}$  F., or a little lower. Moreover, the climatic character, the traditions and genius of the spa, promote and intensify the sedative action of the bath. Schlangenbad, Néris, Bains-les-Bains, Baden-Weiler, Ragatz, Plombières, Buxton, are stations of this kind.

Effects of sub-thermal baths.

Subthermal baths are both sedative and stimulating, and have a very large place in spa treatment. They withdraw heat to a moderate extent, and by reducing peripheral tone invite the blood into the extremities and the skin. The cardiac action is increased in force and markedly slowed; nervous excitation, whether peripheral or central, is diminished by the massive and equable impression of the water. These baths are, therefore, indicated in irritability of the vascular and nervous systems, as well as in general debility and motor weakness, and in peripheral and incipient and reflex paralyses, in hyperæsthesia, nervous insomnia

and neuralgias. They favour nutrition, moderate senile changes, and are much used in degenerative arthritis, atonic gout and rheumatism, and nervous exhaustion and convalescence.

An able spa physician<sup>1</sup> has summarised the results of many years' observations upon the effects of subthermal baths, given at a temperature of from 82° to 90° F. Such clinical data upon the action of waters and baths have a permanent value, although no doubt the interpretation may change.

He concludes: "Such baths appear to operate by their 'physical qualities'; eruptions of a former date may reappear or present ones be aggravated: the heart becomes steadier and quieter and may diminish twenty beats in the minute, *e. g.* in Basedow's disease: after a week or ten days of bathing a 'bath intoxication' may occur, shown by fatigue and increase of symptoms, nervousness, hæmorrhages, perhaps an attack of gout: this disturbance abates in a few days, but may recur later on, indicating 'saturation point.' Complaints which remain unaltered during the bath treatment often undergo a change later: the influence of the baths upon the nerve centres is both sedative and tonic, relieving both irritation and depression: they are especially valuable when other treatments are inoperative from excessive irritability of the nervous and vascular systems:—as in many peripheral and central irritable or spasmodic nervous disorders, dysmenorrhœa, disorders of the menopause, pruritus and coccygeal and other neuralgias: they promote absorption of inflammatory residua in the pelvic organs and in atonic gout and rheumatism: lastly, they help to remove or allay disturbances of nutrition (*senectus ipsa morbus*) and contribute to maintain cheerfulness, elasticity and vigour in old age."

<sup>1</sup> The late Dr. Baumann of Schlangenbad, 1881.

The old doctrine of "thermal fever" (*poussée*) and of "critical eruptions" under bath treatments, which is here implied, is now but seldom heard of. In former times, when prolonged and excessive bathing was common, systemic disturbances of various kinds were no doubt more often met with than at present. The reader who has apprehended the series of effects that both baths and waters induce upon the body will not cavil at the statement, which it is one of the principal purposes of this work to set forth, that these agents evoke *reactions* in the tissues. The terms in which these reactions have been or are described are a matter of small consequence. The present writer not only looks upon the presence of a definite reaction as a necessary, and therefore favourable, sign in the effectual treatment of chronic maladies, but shares the belief of the older observers that no little importance attaches to the disturbances, such as those above described, that occur in the course of treatment by thermal and subthermal baths.

"Thermal fever."

*Prolonged Subthermal Baths.*—Immersion in waters at the point of thermal indifference may be prolonged for many hours or even days without discomfort. At the sub-alpine spa Loèche-les-Bains (4600 feet) baths at 93° to 75° F. are commonly prolonged for from one to six hours; and similar baths are taken at Nérís (1150 feet), Schinznach (1140 feet), Bagnères de Bigorre (1800 feet), at La Bourboule (2780 feet), at certain subthermal spas in Japan and elsewhere. Their effect is both sedative and intensive. Besides their value for some intractable skin affections, they are useful in a variety of nervous disorders, visceral, and especially entero-colic neuralgias, sciatica, spastic arterial hypertension, and occasionally in exophthalmic goitre.

Indications.

2. THERMAL AND RESOLVENT.—The somewhat higher temperature of these baths, generally at or a little

Action of thermal baths.

above blood-heat, introduces an active thermal influence. In disease a mild intensive action is set up in the tissues, and there is a liability to consecutive reaction. Bath, Gastein, Aix-les-Bains, Wildbad in Württemberg and Bormio are typical thermal spas.

These baths are stimulating in proportion to their heat, but unless of brief duration and terminated by cold applications are followed by a corresponding reaction and debility. They promote the absorption of chronic inflammatory exudations and congestions, whether rheumatic, gouty, or the result of traumatism. Thermal baths have a useful place in the treatment of cold and inactive skin, inveterate skin eruptions, torpor and inertia of the circulation or nerve centres, defective sensation or muscular movements, and many chronic painful disorders of muscles, nerves, and joints.

3. HYPERTHERMAL AND INTENSIVE.—Such baths range in temperature from  $104^{\circ}$  to  $130^{\circ}$ . They are of necessity so limited in duration that the late and enervating effects of heat should not be developed.

Hyperthermal baths freely open the surface arterial system, accelerate the pulse and, after an initial rise, diminish the blood pressure. Always taken with very short immersions, one, two or three minutes, they constitute a very useful means of treatment for many cases. The hyperthermal bath supplies the powerful primary stimulation of heat, without its dangerous reactions.

Japan and New Zealand furnish typical examples of natural hyperthermal baths. At Kusatsu the temperature of the water is from  $130^{\circ}$  to  $160^{\circ}$  F. It is reduced by splashing to  $120^{\circ}$ . Hot water is poured over the head before entering the bath, and the bather remains in the water for three or four minutes. The bodily temperature rises to  $104^{\circ}$  in six or eight minutes, and returns to normal in half an hour. Cold affusions

are used after the bath. Hundreds of syphilitic and leprous patients are submitted to the treatment.<sup>1</sup>

At Teplitz, Hammâm-Meskoutine, and elsewhere various degrees of high temperature treatment are employed. It should be applied in practice with much care. The brief intensive and stimulating effect of these baths is helpful in many of the conditions enumerated in the last section, particularly in torpid skin and circulation. The hyperthermal footbath (*pediluvium*) is a valuable form of derivative treatment in many chronic ailments, especially in poor circulation with weak heart, in neuralgia, catarrhs, and constipation; and is insufficiently employed at the British spas. These and other hyperthermal applications induce locally arterial hyperæmia and raise the temperature of the part. They stimulate the oxidising processes in chronic disease and may be used with much benefit where, as in arthritis, the arterial circulation is defective.

### Vapour Baths (Ital. *Stufe*; Fr. *Étuve*)

Steam baths, natural or artificial, have been used in medicine from ancient times. The Romans utilised the vapour of the hot springs in their *thermæ*; and there are many natural vapour baths, like the cave at Monsummano (temperature 92° to 95° F.). In the island of Ischia there are hotter *stufe*, such as San Lorenzo (124 degrees) and Castiglione (133 degrees), and a similar one at the Bagni di Nerone, near Pozzuoli. The ancient Roman hyperthermal vapour bath is still in use at Plombières. Warm aqueous vapour softens the skin, induces perspiration and increases the fullness and frequency of the pulse. Both the cutaneous and pulmonary capillaries are dilated. Hot vapour baths soften and stimulate the harsh, hard, thickened, and inactive skin. In sensitive

Action of  
vapour baths.

<sup>1</sup> See C. H. Hill in *Brit. Med. Journ.*, Feb. 2, 1907.

subjects the regulation of temperature is essential. When a sedative and tranquillising influence is sought, the moisture must predominate over the heat (as at Monsummano). It may be stated as a general law that the heat of every thermal application should bear an inverse proportion to the febrile excitement or nervous sensibility of the patient. Assolini used vapour baths below blood-heat in inflammatory affections of the throat and respiratory passages. In chronic catarrhs a more stimulating vapour—Plombières, Mont Dore, or Ems—can be employed. Natural, or artificial, vapours may also be applied locally, as at Aix-les-Bains and Luchon (the “Berthollet” bath) and at Bath and elsewhere. In addition to the indications already mentioned, vapour baths are helpful in painful rheumatic and gouty affections (lumbago, sciatica, and neuralgia), and generally in the disorders for which the more stimulating and less sedative hot air bath is employed. (See Chapter IX.)

### Salt (Muriated) and Marine Baths

Action of  
brine baths.

Although there is but very slight actual absorption by the skin, the nervous end-organs are stimulated by particles of chloride of sodium, and to this the special effect of marine and other salt baths must be chiefly ascribed.

1. **STRONG BRINE BATHS.**—The Droitwich water is an almost saturated (30 per cent.) brine. Similar strong salt waters are those of Rheinfelden (26 per cent.) and Bex (25 per cent.), both in Switzerland; Ischl (23 per cent.), in Austria; Salies-de-Béarn (25 per cent.), in France; and Salsomaggiore in Italy (13 per cent.). All these are employed in the form of immersion baths and douches, as a powerful stimulant in painful chronic myositis and fibrositis (lumbago and sciatica), and generally in rheumatic and gouty affections; also as a tonic in convalescence. The “Limans,” near

Odessa, are salt lakes, originally connected with the sea, and concentrated by evaporation. The "Liman cure," which includes very hot natural sulphuretted organic slime and sand baths, locally applied, is highly esteemed for delicate children, for chronic rheumatic affections and traumatic contractions.

2. MURIATED BATHS.—The less concentrated muriated waters, like those of Kreuznach, (1 per cent.), and Woodhall Spa in Lincolnshire (2 per cent.), have a wide application. Both internally and in the form of baths and inhalations, these waters are used for many chronic catarrhal conditions, for enlarged glands, scrofula and rickets, for chronic nasal, pharyngeal, laryngeal and bronchial catarrhs, and for chronic inflammatory and catarrhal disorders of the female pelvic organs.

3. MARINE BATHS.—The sea bath comprises several factors. There is, first, the proper effect of the salt water at the natural temperature, varying according to season and the coast. Then the element of movement in the water. This again varies from the gentlest undulation to strong mechanical stimulation, equivalent to a rapid succession of douches. The constant movement of the water, the impact of the waves and the wind are all to be taken into account. It has been ascertained that the loss of heat in water moving at half a metre per second is one-third more than in a bath of still water. On the other hand, the deposit of salt on the skin from a hypertonic bath inhibits the evaporation of sweat *after the bath*, and this, in addition to the salt stimulus of the peripheral nerves, makes the risk of "catching cold" much less after a marine than after a fresh-water bath. Lastly, the local climatic influences modify the effect, in the sense of augmenting or diminishing the stimulus. The sea bath causes an energetic primary contraction of the skin vessels with the "first chill." The circulatory and thermic reactions

Action of sea  
baths.

are more rapid than with ordinary water. Hayem has well said that reaction is the "therapeutic event most desired and sought for." It is, therefore, important for the bather to leave the water before the "second chill," indicating the failure of reaction, occurs. Sea baths are believed to diminish the elimination of uric acid but to increase that of urea. All the vital actions are stimulated; body weight is increased. It follows that marine baths have their chief medical opportunity in lymphatic and scrofulous affections, local tuberculosis of glands, bones, joints, and in whatever conditions tonic salt baths are indicated. They are inadmissible in cardiac and rheumatic and gouty cases, in renal disease, bronchitis, emphysema, asthma, and in hæmorrhagic phthisis and in other congestive states.

**Effervescent Baths** (*Carbonated or Gaseous Baths, commonly Muriated or Alkaline, "Nauheim Baths"; Luftperlbäder, Soolbäder*)

Natural effervescing waters owe their acidulous quality to varying proportions of carbonic acid gas. This gas, dissolved under a certain pressure, is uniformly diffused through the water, and exists partly in the dissociated form as ions. When the pressure is reduced, as in the bath, the gas is liberated and attaches itself in minute bubbles to the skin.

Among the *thermal* waters of this class are: Nauheim, in the Grand Duchy of Hesse (82° to 95° F.), which contains 2 to 3 per cent. of chloride of sodium; Oeynhausien, in Westphalia (77° to 91° F.), possessing a muriated water very rich in carbonic acid gas; Soden in the Taunus, and Salins-Moutier, at 96° F., with 1.3 per cent. of chloride of sodium. At Royat, in the Auvergne mountains, the Saint Mart and César Springs furnish a valuable thermal effervescing bath, slightly alkaline and salt. Châtel-Guyon, in the same

Different forms of effervescent bath.



district, has an effervescent alkaline muriated water at 89° F., which is employed for "flowing baths."

Among the *cold* waters there are effervescing chalybeate springs at Spa in Belgium, at Schwalbach, and at St. Moritz; and "gaseous iron baths" are to be had at these more or less tonic stations at subthermal temperatures. Also at Kissingen in Bavaria, Tarasp-Schuls in the Engadine, Marienbad in Bohemia, and elsewhere.

The peculiar effect of effervescent baths is due to the contained carbonic acid gas, and is to be explained by the fact that the specific heat of this gas is one-fifth that of water, whilst its conductivity for heat is only one-fiftieth that of water. The point of thermal indifference for the human skin (see p. 11) which is about 93° F. for water, is only 75° F. for carbonic acid gas, and in an effervescing bath the indifferent point must, therefore, lie somewhere between these two figures. As a rule, the cooler the water the more gas it will contain, and it is owing to the stimulation of the gas that such baths can be taken much cooler than ordinary baths. In an effervescing bath of say 90°, the body is exposed to thermic stimuli both of cold and heat, coexisting side by side on innumerable minute contiguous areas of the skin and constantly alternating upon the same area, the cold stimulus taking effect where the surface is in contact with the water and the hot stimulus from the bubbles of gas. Some of the carbonic acid gas is absorbed; and, acting upon the sensory nerve endings, and directly or indirectly upon the blood vessels, alters and increases the circulation. On entering an effervescing bath below skin temperature there is, therefore, a momentary chilliness, soon succeeded by a sense of prickling or warmth, due to the collection of innumerable bubbles on the skin. The increasing feeling of warmth soon overcomes the feeling of cold, because the relative

Action of  
effervescent  
baths.

heat of the carbonic acid gas (indifferent point 75° F.) more than neutralises the relative coolness of the water. The vaso-constrictor action of the water is antagonised by the vaso-dilator action of the gas, the arterioles relax, and there is a more or less vivid reddening of the surface. The activity of the surface action is shown by the comparative pallor of those parts of the body not immersed in the bath.

Effects on the circulation.

Following the direct effect upon the skin, there is an indirect result upon the distribution of the blood, known as "decongestion of the viscera," in obedience to the law of inverse relation between the circulation of deep and superficial parts. The heart's action becomes less frequent to the extent of perhaps four to six or ten beats less per minute, the systole stronger, and the pulse more ample, from dilatation of the artery. The effect on the blood pressure varies. It is reduced in baths above the skin temperature, where the vaso-dilator action of the gas has overcome the vaso-constriction of cold, and in all cases where the peripheral vascular dilatation is marked. At lower temperatures, any below 88° F., the blood pressure may be raised, but the action is not the same in all persons and depends partly on the duration of the bath. Many observers have noted by percussion or by the X-rays, a diminution in the cardiac area, especially on the right side, after effervescent baths.

The total effect of these baths depends not only on their temperature and duration but on their saline and gaseous contents. A brief bath is usually purely stimulant whilst a prolonged bath is sedative and tonic. Diaphoresis and diuresis are reflexly encouraged. The effect on the nervous system is that of a mild, continuous subthermal stimulation, passing into sedation. Owing to the thermic stimulation of the gas these baths appear to be warmer than they really are. Consequently their action may be said to be twofold : (1) they

Action of effervescent baths.

favour an increased loss of heat, corresponding to their actual temperature and so induce the direct and indirect results of cooling baths (see Chapters VI and VII); (2) they produce an active dilatation of the surface vessels such as results from thermal baths, but without application of positive heat or any elevation of the temperature of the body. The merit of effervescing baths, therefore, is that they combine the tonic and antipyretic effect of cool temperatures with an active peripheral stimulation. The presence of sodium chloride with the gas accelerates and enhances the peripheral effect.

In addition to cardiac affections (Chapter XVII) effervescing baths are employed for their sedative and tonic action in many conditions of nervous weakness, in the convalescence from influenza and other debilitating illness, in Graves's disease, also in anæmia, amenorrhœa, and congestive dysmenorrhœa. They are contra-indicated in advanced aortic disease and cardiac dyspnœa, but may be used with good results in many cases of angina pectoris.

Indications or  
effervescing  
baths.

### Sulphur Baths

A very large number of thermal waters are impregnated with sulphide of soda, and to a less extent with sulphuretted hydrogen. These "thermal sulphur" spas, which are mainly used for baths, are situated often in beautiful mountainous scenery, and owe their thermality to bygone volcanic action. It is, however, doubtful whether the sulphide which they contain exercises any appreciable effect in the bath, since it is not absorbed by the skin. There are, of course, in this large group of baths, many interesting and valuable individual characters, not only in the waters but in the climate and local circumstances. They include, in France, the famous Pyrenean spas: Luchon (2050 feet), Cauterets (3200), Barèges (4200), Saint Sauveur

Thermal  
sulphur spas.

(2500), Eaux Chaudes (2050), Vernet-les-Bains (2060), Amélie-les-Bains (950); also, Ax-les-Thermes (2340) and Uriage (1350); in Germany, Aix-la-Chapelle; in Switzerland, Baden (1200), Lavey (1350), Schinznach (1140) and Yverdon (1430). In Northern Italy there is the hyperthermal water of Vinadio in Piedmont (4360), possessing also a series of sulphur vapour baths or *stufe*, Acqui and Poretta; Viterbo, near Rome, and Acireale and Sciacca, in Sicily. In Austria-Hungary there are Pöstyén, Trencsin-Teplitz and Hercules Bad (*Thermæ Herculis* of the Romans) in the Carpathian Mountains, besides the subthermal Baden near Vienna. Egypt has a thermal sulphur water at Helouan. In America there are many springs of this class in California and Colorado, some employed for baths; in Canada the "hot sulphur spring" near Banff; in New Zealand at Rotorua, and many in Japan and India.

Indications for sulphur baths.

Some cold sulphur waters are extensively employed for baths in Great Britain. The muriated sulphur springs of Harrogate and Llandrindod, and the pure sulphur waters of Strathpeffer and Llanwrtyd are so used; also, in Switzerland, Lenk (3600), and in Norway, Sandefjord, and Laurvik. Sulphuretted hydrogen is a volatile gas, and is undoubtedly capable of absorption by the skin. In small quantities it stimulates, in larger quantity it irritates, the surface of the body. It is regarded as a mild antiseptic and antiparasitic, and sulphur baths have an old reputation for scabies. Pure sulphuretted waters like those of Strathpeffer, when artificially heated to a subthermal temperature, have been found of considerable service in moist irritable eczema at the climacteric epoch, as well as in localised forms of dry gouty eczema, in pruritus and in acne. Such baths, also, often permanently relieve the pains of chronic gouty and rheumatic affections.

Eczema.

Thermal sulphur baths, together with sulphur water internally, have long been employed as an auxiliary in the mercurial treatment of syphilis. They may, at all events, be regarded as "a powerful aid to the specific methods" (Weber). This treatment has been developed more particularly at Aix-la-Chapelle, at Uriage, at Bagnères de Bigorre, and at Wiesbaden. Inunctions of mercurial ointment are given by skilled rubbers after the thermal bath. No doubt waters of this kind, especially those containing alkalis, greatly improve the condition and function of the skin, and by assisting the removal of fatty matters and epithelial débris favour absorption of the ointment. But the sulphur treatment also operates in syphilis by promoting the elimination of toxins. Under the use of these waters and baths larger doses of mercury can be administered by the skin than would otherwise be tolerated. Sometimes during the treatment local syphilitic symptoms may be temporarily increased, which is not regarded as an unfavourable sign. It is in truth an example of "intensive" action, the chronic lesion becoming more acute in its progress towards cure. The treatment of syphilis in the warm, moist atmosphere of the baths is indeed tantamount *inter alia* to a change to a warmer climate. It is believed by many that warm climates may in certain cases be favourable to the cure of syphilis, promoting a more acute and rapid action, whilst in cold climates the same malady often tends to chronicity.

### Peat Baths (*Moor- und Schlamm-bäder*)

Peat, or moor, baths are prepared from the brown organic deposit underlying, often to a considerable depth, the more fibrous "fuel peat" in many northern peat mosses or bogs. This material consists largely of humus derived from the decomposition of sphagnum moss, and contains resins, silica, free sulphuric acid,

Syphilis.

Composition  
of peat.

and generally carbonate of iron and various salts. When exposed to the action of heat, formic and other volatile acids are produced. Peats are usually classed as ferruginous, saline, or sulphuretted; and at many spas are fortified by mixture with the mineral water or with "mother lye."

During the last century the use of these baths has been especially developed in Bohemia. They were first used at Franzensbad, and employed there by Dr. Poeschmann in 1810 to 1815. Not long afterwards they were introduced at Marienbad. They are now given extensively in Germany, at Pymont, Schwalbach and other chalybeate baths, at Spa in Belgium and at Ronneby in Sweden. They were first employed in Great Britain in 1889 at Strathpeffer, and afterwards at Harrogate and Buxton.

Method of  
preparation.

The area of peat deposits at Franzensbad is near a little extinct volcano outside the town. The moor is traversed by mineral springs containing iron. When first cut in the winter time it has a greyish lardaceous appearance with an odour of sulphuretted hydrogen. After cutting it is exposed to the air for several months, during which time the sulphides of iron are converted into sulphates and the moor acquires an acid reaction. The "iron mineral-moor" of Franzensbad is said to contain as much as 32 per cent. of protosulphate of iron. It is friable, of a dark brown colour, with a bituminous odour and an inky taste. When dry it is ground in a mill, treated with hot mineral water and stirred by hand. The temperature is adjusted by injecting steam into the bath. A single bath is said to contain nearly one pound of formic acid and other volatile substances.

Dr. Paul Cartellieri, the first writer on peat baths (1841) proved that the heat-conducting power of peat was less than that of water. For this reason the peat bath given at a temperature above the point of thermal

indifference (93° F.) does not feel so hot as water, and if given below that point does not abstract heat to the same extent as water does. The specific heat of peat is much lower than that of water. Upon entering a bath the layer of peat nearest to the skin rapidly cools to about the skin temperature. In the case of both mud and peat baths there is no constant changing of the particles which are in contact with the body. The layer next to the skin maintains a more or less constant temperature during the whole period of the bath, and the presence of this comparatively cool and non-conducting layer moderates and equalises the effects of heat. The point of thermal indifference for the peat bath is considerably higher than that of water, and has been placed by Kisch as high as 102°. To the thermal effects must be added the stimulation due to constant chemical action taking place at the surface of the body, the astringent effect of the iron compounds and the antiseptic action of some of the acids. Lastly, the weight and comparative immobility of the peat or mud bath and the friction of the semi-solid poultice-like mass exert a certain pressure on the surface circulation and impede muscular movements, especially those of respiration.

Action of peat  
baths.

In suitable cases peat baths may be given at temperatures ranging from 100° to 112°, and the higher temperatures are well borne if the bath is followed by cold affusion, as at Strathpeffer. When the heart's action or breathing are at all embarrassed, and always in baths of high temperature, the peat should not cover the front of the chest. A cold compress should be always applied to the head. Half baths or three-quarter baths are in these circumstances to be preferred. Local applications of peat, at from 115° to 120° F. are often used, principally as a poultice to the abdomen or as footbaths.

They furnish a convenient form of thermal treatment Indications

with marked cutaneous stimulation. They are prescribed for torpidity of the skin and circulation, in neuralgia and neuritis, especially of the peripheral nerves, in disorders of common sensation, in chronic rheumatic affections, and to promote the absorption of morbid deposits, as in pelvic peritonitis. In conjunction with chalybeate waters they are used for dysmenorrhœa and amenorrhœa in anæmic subjects, as at Schwalbach and Strathpeffer. They are also employed locally at high temperatures to the feet and legs, the arms or abdomen, either for their derivative effect, or to set up active hyperæmia in chronic arthritis, etc.

#### **Mud Baths** (*Bains de Boue, Fango, Sulphur-, or Salt-mud Baths*)

At many thermal sulphur spas soft, "butter-like" deposits are obtained from the vicinity of the springs, which are used as an application, often at high temperatures. At Pöstyén and Mehadia, in Hungary, and at the northern Italian spas (Vinadio, Acqui, Battaglia, Abano), as well as at Baden, near Vienna, a sulphuretted mud, or fango, is extensively employed. It is also imported into England for local applications, as at Matlock.

The mud bath may be given at 104° F., and at much higher temperatures (120° to 122°) applied locally. These deposits, besides containing various mineral and organic matter, often exhibit a high degree of radio-activity. Sulphuretted mud baths are extensively used at Saint Amand in France and a similar mud is obtained from river deposits at Dax, near Bordeaux. In Germany sulphur mud baths are used at Eilsen and Nenndorf, and in Sweden at Loka, in combination with massage.

A second variety of mud baths is prepared from sea, or salt, mud, such as those of the Baltic provinces,

Sulphuretted  
mud baths.



of the "Limans" on the Black Sea coast (see "Salt Baths"), and of Saki and others in the Crimea. The salt mud is heated by the sun, or artificially, to a high temperature, and plastered over the body, either wholly or partially. Similar salt muds are used at Laurvik, Modum, and Sandefjord, in Norway, at Ischl and at Arensburg, in Livonia. Mud baths are essentially a hyperthermal treatment. The actions and indications are otherwise much the same as for peat baths, but the strong salt muds, like those of the Limans are especially valued for chronic rheumatism, for scrofulous conditions, and as an accessory treatment for syphilis. The pressure exerted by the mud has been regarded as helpful for the relief of varicose veins (as at Saint Amand).

Saline mud  
baths.

### Sand Baths (*Arenation*)

This ancient method of thermal treatment consists in immersing the body, wholly or in part, in sand, heated—by the sun or otherwise—to from 110° to 130° F. Profuse perspiration ensues; the skin becomes reddened and encrusted with sand; and, the normal loss of heat being reduced, the body temperature may rise three or more degrees. These baths have been used since Roman times in the island of Ischia, and recently at Lavey, in Switzerland, and Koestritz, in Germany. They are employed sometimes, together with sun baths, for their special thermal effects in chronic diseases of the joints, especially degenerative arthritis. Cold, moist sand baths are also used as a vascular and nervous tonic in neurasthenia.

### Acid Baths

Certain thermal waters, particularly the geyser springs of New Zealand and America, are distinguished by the presence of free acids. Free hydrochloric acid is present in considerable quantities in the Lemonade

Spring, in California, at Tuscarora Sour Spring, in Canada, and in certain hot waters in Japan. One of the most remarkable of acid springs is to be found among the Oak Orchard Springs, in New York State, which is said to contain free sulphuric acid in the proportion of 40 per cent. of its total mineral content. The same acid exists, with or without hydrochloric acid, in the "acid sulphur waters" of Rotorua (New Zealand), to the amount of from 4 to 22 gr. per gallon. These waters and the geyser springs of the Yellowstone National Park (America), and of Iceland, contain large quantities of silicic acid. There is in Europe nothing comparable to this class of waters. They are not employed internally. In the bath their action is stated to be powerfully rubefacient and decongestive.

## CHAPTER XIII

### THE MEDICINAL WATERS OF GREAT BRITAIN AND THE CLIMATIC ELEMENT IN HYDROLOGICAL TREATMENT

ALTHOUGH not very considerable in point of numbers, the spas of the British Isles form an important and interesting group, and include examples of most of the well-known classes of waters.

Spas of high latitude and moderate elevation.

Upon the map they lie between the latitudes of  $51^{\circ} 20'$  in the south (Bath), and  $57^{\circ} 40'$  in the north (Strathpeffer). Some of these waters, such as the ancient Roman therma of Bath, are found in valleys; some upon plateaux, like Harrogate upon the Yorkshire Moors and Llandrindod in Wales. Buxton in Derbyshire is highest in point of elevation above sea-level, namely, 1000 feet. With reference to altitude it must be remembered that in northern countries these moderate elevations correspond in their climatic effect to much higher altitudes in countries farther south, such as Switzerland; also that the summer day increases in length with the northern latitude.

The experience of the spa physician constantly emphasises the interaction of climate and waters. The British spas as a whole offer a good illustration of this law. Not only the geographical situation of the British Isles, lying to the north and west of the continent of Europe, but the characteristics of an island climate, powerfully modify the effect of British waters. Climatic conditions are indeed often the dominant influence in hydrological treatment. Wherever a patient is submitted to the action of waters

Climate affects the action of baths.

and baths the effect of the local climate must be reckoned with. Not only the ordinary climatic elements—temperature, humidity, sunshine, aspect, winds and shelter; but the soil and the configuration of the health station, its latitude, and especially its altitude above sea-level; are all physical factors that may modify, sometimes to a surprising extent, the reaction of the invalid to spa treatment, and, therefore, its results. The modifying influence of climate in the large sense of the word is especially noticeable in the case of baths. It is well known that thermal bath treatment can often be tolerated by delicate persons and invalids in a comparatively cool and dry air, because the increase of bodily heat can be freely thrown off. On the other hand, in a hot and humid valley climate, the loss of bodily heat is checked, and hot treatments are consequently less well borne.

Differences of  
reaction.

It is a familiar observation that baths similar in every respect may produce widely dissimilar results, according to the reaction or response of the patient, and that this reaction is easily affected, in one direction or another, by climatic conditions. Very different reactions will be obtained from immersion baths, for example, taken at blood heat in July;—at Wiesbaden, upon the plain of Lombardy, at Bormio at an elevation of 4500 feet in the Italian Alps, at Buxton and at Laurvik on the Christiania Fjord. The climatic factor must sometimes even be the governing one in the choice of waters and baths. The bath may be truly said to provide a temporary climate for the skin, but in order that it should produce an *optimum* effect certain definite external physical conditions are necessary for each case. Different countries and localities provide these conditions in great variety, and it is in the selection of climate as well as of waters that the wisdom of the physician is shown.

The British health resorts differ widely from those

of the European continent in regard to these external conditions. They are situated nearer by as much as 5° to 10° of latitude to the Polar Circle than the great spas of Germany and France. The invalid is mainly concerned with the summer climate of the spas, since that is usually the season for waters and baths. A glance at the isothermal lines upon the map of Europe will show to what extent the various health resorts differ in respect to summer temperatures. In the table overleaf the British spas and those of continental Europe are arranged according to the average temperature of July, which is nearly equal to the summer temperature.

The British summer climate.

With reference to the elevation above sea-level the atmospheric temperature should diminish about 1° Centigrade for every 180 metres of altitude. Many spas at a considerable elevation are themselves enclosed by mountains, and in the valley climate so formed the temperature readings are often comparatively high. In a well-ventilated and less-sheltered situation the contrary is the case. It will be seen from the table that the summer temperatures in the case of the great majority of the European spas range between 60° and 70° F. This is of itself a sufficient range of temperature to powerfully affect the action of baths, the effects of which will also be modified by the influence of altitude and the local climatic conditions. In these last respects the spas of Europe exhibit wide differences.

It is interesting to note that in July the north coast of Ireland, with its fine and bracing resorts, is on the isotherm of 58° F., and that the temperature of the Outer Hebrides averages 55°. Meanwhile, a little farther north, the readings on the coast of Norway stand at about 54°, and those at the North Cape at 50°. The isotherms indicate that in summer the north coast of Ireland and the west coast of Scotland are cool in

Cool and bracing coast climate.

| Temperature. |    | July Mean Temperatures of European Spas<br>(with altitudes)  |
|--------------|----|--|
| C.           | F. |  |
|              | 55 | *St. Moritz 12° (5800)   |
| 13           | 56 |  |
|              | 57 | *Lenkerbad, Switz. 13.7° (4600)  |
| 14           | 58 | *Strathpeffer 14.0° (200)  |
|              | 59 |  |
| 15           | 60 | *Gastein, 14.8° (3430)   |
|              | 61 | *Marienbad 15.4° (2090); *Tarasp (Schuls) 15.5° (3890); Caunterets 15.6° (3200)  |
| 16           | 62 | Harrogate (500); Trefriw; Bormio, N. Italy, 15.8° (4500)<br>Llandrindod (700); Buxton (1000); Woodhall Spa; Laurvik, Norway, 16° |
|              | 63 | *Wildbad 16.3° (1410); *Franzensbad 16.7° (1500); Schwalbach 16.8° (950)   |
| 17           | 64 | Bagnoles de l'Orne 16.7° (530); *Karlsbad 16.9° (1230)   |
|              | 65 | Droitwich; Bath (100); Leamington (200); Cheltenham (150)<br>*Aachen 17.1° (530)   |
|              | 66 | *Bagnères de Bigorre 17.7° (1805)  |
| 18           | 67 | Plombières 17.9° (1300)  |
|              | 68 | *Wiesbaden (380) and *Baden in Black Forest (650) 18.0°  |
|              | 69 | *Ragatz 18.2° (1700); *Teplitz (730); Contrexéville (1150) and Vittel (1100), 18.6°  |
| 19           | 70 | Néris (1150) and *Royat (1480) 18.9°; Schinznach, Switz. 18.7° (1140)  |
|              | 71 | Pymont (420); Spa, Belgium (1000)  |
|              | 72 | *Kreuznach 19°; Luchon 19.2° (2050)  |
| 20           | 73 | Evians-les-Bains 19.4° (1240); Pougues 19.5° (650); Vichy 19.6° (736)  |
|              | 74 |  |
|              | 75 | Uriage 20.3 (1350); Aix-les-Bains (860); Salins Montiers 20.4° (1600)  |
| 21           | 76 | Homburg (600); Nauheim (400); Schlangenbad (900); Ems and the Rhine Spas   |
|              | 77 |  |
|              | 78 | Lamalou 21.6° (620)  |
| 22           | 79 |  |
|              | 80 | Bex (Switz.) (1400)  |
|              | 81 | Hercules-Bad, Hungary (500)  |
| 23           | 82 |  |
|              | 83 |  |
|              | 84 | Levico, Austria (1700)   |
| 24           | 85 |  |
|              | 86 | Salsomaggiore (520); Montecatini (920); Battaglia  |
| 25           | 87 |  |
|              | 88 |  |
| 25.6         | 89 | Castellammare, Bay of Naples, 26°  |

\* At these stations the figures have been calculated from actual observations extending over various periods of years. The others are taken from the Isothermal Maps of Europe, with the proper correction for altitude in each case. (By the courtesy of M. Angot, of the *Bureau Central Météorologique of France* and Dr. Hellmann of the *Meteorological Institute of the Kingdom of Prussia.*)

comparison with the eastern parts of the British Isles, and much cooler than continental Europe. It is, therefore, not surprising that many invigorating summer health-resorts may be found upon these coasts.

These local conditions are no doubt partly to be attributed to the comparatively cool waters that in summer wash our western shores. On the coast of Scotland the north Atlantic currents may be 6° or 8° cooler than the sea at Dover, and nearly 20° colder than the Mediterranean. No such influences mitigate the heat of the continental summer. Except upon the coast-line of France and Spain, the cooling effect of the Atlantic is not felt, and consequently during the hot season the land surface is apt to become more and more heated.

Contrast with continental climate.

Another influence that profoundly modifies our island summers must not be forgotten. This is the distribution of barometric pressure. During the summer season areas of atmospheric depression (cyclones) frequently pass along the west coasts of Britain, and are no doubt apt to bring with them unsettled weather. At the same time the cooler airs and rainfall lower the atmospheric temperature. Meanwhile, over the continent of Europe and northern Africa there is usually a more settled condition of high atmospheric pressure (anti-cyclonic system), with less precipitation of moisture and higher temperatures.

From all these causes the British summers are relatively cool and fresh, with frequent changes of temperature. The comparatively low range of temperature stimulates heat production and metabolism in the body whilst its frequent oscillations tend to educate the reactive part of the skin.

Such are, briefly, the comparisons between an island climate and a continental one. But it is clear that there must be a considerable variety in climatic

conditions among the British spas. Some of them, such as Buxton, Harrogate, Llandrindod, and Llangammarch enjoy a climate such as is commonly associated with the eastern and northern parts both of England and of Scotland—that is to say, of the kind that has been generally described as “stimulant,” “tonic,” or “bracing.” They have but little shelter, there is a free movement of air and the summers are relatively cool. These spas are all situated high on moorlands or in mountainous country.

On the other hand, Bath, Leamington, and Cheltenham in the west of England, and Lisdoonvarna and the other Irish spas, share with the country in which they are situated a climate of sedative quality. Their summer climate approximates in temperature to the continental type although more humid, and has been described from its effects, upon many individuals as “enervating,” or “relaxing.” There is no doubt that such is the effect produced upon persons, whether invalids or not, who require the invigoration of strong or tonic air. In the same manner the many health-seekers for whom a soft or sedative air is required find a keen or bracing air too exciting and often injurious. The two types of climate are in truth matched by two corresponding types of chronic disorder, and no doubt also by types of physical temperament or constitution. For example one patient says, “I like hot or stuffy places,” or “I am fully alive only in warmth”; another, “I am never well but in bracing air,” or, “I am always better in the winter season.”

In addition to the above more typical stations, there is an intermediate class of localities in Great Britain which are partly stimulant and partly sedative. At these places the climatic influence differs with the individual reaction, and often according to the season. Frequently the total effect is partly stimulant and partly sedative, a complex which may prove highly

Local climates  
in Britain:  
(1) Tonic,  
(2) Sedative.

Intermediate  
climates and  
their  
indications.



valuable in states of combined nervous exhaustion and irritation in middle and later life. Among other such spas in Britain are Strathpeffer, Bridge of Allan, Llandrindod for some cases, Woodhall Spa, and Matlock Bath. Lastly it should be added that the expressions *sedative* and *stimulant*, as here used, are comparative terms, for there are no British spas wholly stimulant or wholly sedative, but most of them may be regarded as having a preponderance of one character or the other.

Such briefly are the broad differences of climate that separate the spas of the British Islands from those of continental countries. It has been shown how the British spas should themselves be grouped in the climatic scale and further, that these secondary differences between the stations correspond to fundamental types of malady and temperament—that is to say, for *optimum* results it is necessary that the invalid should be matched by the health resort, with reference to the external physical condition that we call climate.

The analysis may even be carried a stage further. It can be said with absolute truth that each spa has, or should have, its own *individuality*, traditions and “genius,” and its own proper methods of treatment. These are the true *differentia* of the spa. Hence it follows that it is a vain and fruitless ambition for any locality to introduce and exploit all the methods of other places. The home industry may be in danger of being smothered with foreign goods. It is not the number of treatments that counts, but their *quality*, and the skill and discrimination with which they are applied. Those who resort to a spa acknowledge its individuality when they say that the place and the treatment exactly suited them. Of these individual characters, not only of waters and of climate, but of traditions and methods of treatment, the best British

Individuality  
of the health  
resort.

spas possess a full share. It is to be hoped that they will be always recognised and cherished.

It remains to consider in more detail what are the individual actions and uses of the different waters and baths of the British Isles. They may be conveniently grouped as follows:—

### I.—THERMAL AND SUBTHERMAL WATERS

Bath.

BATH, the *Aqua Sulis* of the Romans, not only by the temperature of its waters, but also by its mild and equable climate, is well adapted for thermal treatment. The waters contain calcium sulphate and carbonate, with four grains of nitrogen gas per gallon. Bath is a typical thermal spa. In summer, the treatment is only suitable for comparatively robust persons, but in winter time, as well as in autumn and spring, Bath is an admirable resort for weak and debilitated persons, especially in the middle and later periods of life. Many painful chronic rheumatic and gouty ailments are relieved by the baths, and the processes of vascular and nervous degeneration are arrested or mitigated. Sub-inflammatory and congestive gouty states of the connective tissues, and the resulting irritable weakness of the nerve centres and circulation, often subside under the sedative influence of these baths. Douches are here combined with massage as at Aix-les-Bains and Vichy. The considerable proportion of sulphate of lime in these waters (1·3 per mille) must not be overlooked, for this ingredient makes them not only diuretic but tonic to the gastric mucous membrane.

Buxton.

In contrast with the thermal and sedative treatment at Bath, BUXTON offers a more stimulating and sub-thermal treatment. The town has an open situation at an elevation of 1000 feet, and the climate is comparatively bracing. The natural temperature of the

waters (82° F.) is well adapted for subthermal baths. They contain bicarbonates of calcium and magnesium, with considerable quantities of free nitrogen gas. Comparatively prolonged and flowing baths are sometimes used, and might, perhaps, be more employed with advantage. Baths of long duration at indifferent temperatures produce a more massive and tonic effect than brief baths at a greater heat, and prove very helpful in many cases of vascular disorder (*e. g.* high blood pressure), and in the debility attending and following long-continued illness. A reaction, marked by an increase of articular and other pains, and by general and constitutional disturbances (vertigo) is sometimes observed at Buxton. Chronic rheumatic and gouty ailments, and some forms of neurasthenia, for which a warmer treatment is advisable, often do well at Buxton, and the climate is well adapted for cold hydrotherapy. The Buxton treatment, in which climate is an important factor, is well adapted to conditions of weakness the result of chronic disease.

MATLOCK BATH, with a subthermal water at 70° F., enjoys a climate well suited for hydrological treatment. The baths are given within the hotel establishment, and may be visited throughout the year. Like others of the same class the waters are very feebly mineralised (0·47 per mille, chiefly lime salts), but are interesting as containing a colloid substance, which gives them a pleasant and unctuous quality in the bath, and one well adapted for the douche-massage.

Matlock Bath.

## II.—SULPHUR WATERS AND SALT SULPHUR WATERS

At HARROGATE, the chief English sulphur spa, this element is combined with salt. The "Old Sulphur Well" contains as much as 0·7 per mille sodium sulphide, with 37 volumes of sulphuretted hydrogen. Harrogate is fortunate in the possession of an extensive

Harrogate.

group of sulphur springs, in which the proportion of salt varies from 3 to 13 parts per mille. Some of these springs are, therefore, hypertonic with reference to blood serum, which contains about 9 per mille of salines; and are consequently purgative in their action (see "Salt Springs"). Certain other of these springs, having but little salt, contain carbonates of calcium and magnesium, and exert if anything an astringent action on the intestinal mucous membrane. Associated with the sulphur waters are also chalybeate sources, in which the iron is found as carbonate, sulphate and chloride. It will be seen that there is, therefore, at Harrogate, a considerable range of therapeutic action. The sulphur waters may be employed in gout, particularly in full-blooded persons, provided the kidneys are sound; in dietetic dyspepsia, in constipation with or without hæmorrhoids, in many toxæmias and chronic catarrhs and irritation of the colon, and for "congestion and inaction of the liver."

The modern installation of baths, like that of Vichy, makes a very widely extended provision for human ills. They are, however, of good effect for many varieties of rheumatic and nervous disorder (fibrositis, neuritis, etc.). An important feature in hydrological treatment at Harrogate is the influence of the dry and bracing climate, and comparatively cool summer (July temperature about 60° F.), as well as the open and elevated situation upon a table-land.

Llandrindod.

LLANDRINDOD, in Mid Wales, has also salt, or muriated, waters, some of which contain sulphuretted hydrogen (1 to 14 vols. per mille). The proportion of chloride of sodium (1·1 to 4·7 per mille) places these waters among the *hypotonic* group, with reference to the fluids of the body. They present in fact a natural saline solution in a convenient and assimilable form. There is also a muriated chalybeate water. The action and uses of Llandrindod waters are those of mild muri-

ated springs (see "Salt Waters"). They are gently aperient and more strongly diuretic. The clinical application embraces the large class of disorders of defective elimination and nutrition, catarrhal dyspepsia, constipation and jaundice. Some authorities, following Widal, have questioned whether strongly muriated water should be prescribed in gouty kidney, in Bright's disease, or in œdema. This is still an undetermined question. Cases of general debility and neurasthenia, with which dyspepsia is so often associated, often do well at Llandrindod. In these cases the hydrological treatment is powerfully seconded by the invigorating climate.

MOFFAT must also be placed among the salt-sulphur waters, being mineralised by sodium chloride (0·9 per mille) with 3 vols. of sulphuretted hydrogen. The place is pleasantly situated in Annandale, in the south of Scotland, and enjoys an agreeable and sheltered climate suitable both for summer and winter visitors. The actions and indications for the waters are the same as at Llandrindod, and the climate is appropriate for cases in which pain and nervous irritation are a prominent feature. Moffat.

BUILTH (Brecknockshire), 400 feet, also has a muriated sulphur water.

Standing in rather marked contrast to the salt-sulphur waters above described are the so-called "pure sulphur waters" of the British Isles. These are distinguished by a relatively large proportion of sulphuretted hydrogen gas, and by the absence of sodium chloride and other salines. At spas of this kind one may, therefore, expect to find the typical therapeutic effect of the sulphide. Sulphur waters without chlorides.

STRATHPEFFER SPA, in the north of Scotland, is the type of this group. The two strongest wells contain as much as 40 and 69 vols. per mille of sulphuretted Strathpeffer.

hydrogen, but only from 1 to 1·6 of total solids. The Morrison well is rich in lime salts (0·9 per mille), principally sulphate of lime, a fact which gives it a special action. The Cromartie spring is, on the contrary, weak in calcareous salts, although it is the strongest sulphuretted water in Britain and should be drunk in small quantities. Waters of this class should always be taken absolutely fresh from the well. They are powerfully diuretic, but slightly constipating. They are indicated in gout, especially in weakly and debilitated subjects, even in the presence of kidney affection. The presence of albuminuria is no bar to their use. They are also valuable in chronic rheumatism, in atonic and catarrhal dyspepsia and in gouty eczema. The chalybeate well contains 0·03 per mille of the carbonate of iron. The neighbourhood of extensive deposits of peat suggested many years ago the employment of peat baths, and this mode of thermal treatment was here first used in Great Britain. Strathpeffer is a quiet and restful spa. Sulphur baths and douches are also much employed for rheumatism and skin affections. Neurasthenia and climacteric disturbances, and especially the disorders and debility of age, are often helped by the sheltered, cool and bracing climate, with its tonic-sedative pure northern air.<sup>1</sup>

Llanwrtyd.

LLANWRTYD (700 to 800 feet) in South Wales, is also a quiet spa, and has a strong sulphuretted water (36 vols. per mille), well adapted by its abundant yield for immersion baths. It is used with success both internally and externally for chronic skin affection : eczema, psoriasis, seborrhœa, etc., also for gout and gastric dyspepsia. Like Strathpeffer, Llanwrtyd has an old reputation for scrofulous affections. The climate is pleasant and equable, but "more sheltered and less bracing than Llandrindod" (Weber). As at most

<sup>1</sup> Excepting Laurvik and some others in Norway, Strathpeffer is the northernmost of the European spas.

other sulphur spas there are useful accessory chalybeate waters containing protocarbonate of iron.

LISDOONVARNA (430 feet) is situated in County Lisdoonvarna. Clare, "amidst undulating healthy moorlands" (Weber), and within a short distance of the west coast of Ireland. It is consequently the westernmost of the British spas. This remote and quiet Irish spa is, therefore, well under the Atlantic influence, the climate being mild, equable and tonic-sedative. It offers weak sulphuretted waters, having five or six volumes of sulphuretted hydrogen per mille and little or no solid ingredient. The indications are the same as for other sulphur waters with a preference for gouty and digestive disorders. The resources of the place have, however, been hitherto but little developed.

The same remark may be made of LUCAN, another Irish sulphur spa in the valley of the Liffey, eight miles from Dublin.

### III.—SALT (MURIATED WATERS)

Strong salt waters or brines abound in England, and are in many places employed for baths.

DROITWICH, in Worcestershire, has a saturated brine, Droitwich. containing 307 parts per mille of salt, or ten times as much as sea-water. The particular effect of marine and salt baths is ascribed to the stimulation of the nervous end-organs by crystalline particles in and upon the skin. The Droitwich brine baths offer a typical *surface treatment*. They act both as a stimulant and revulsive in painful chronic myositis and fibrositis (lumbago and sciatica), and generally in rheumatic and gouty articular affections. The treatment is also valued as a tonic in convalescence. Post-arthritic and traumatic stiffness and contraction are assisted by the Droitwich baths, with which active and passive movements can often be combined, with considerable

mechanical advantage owing to the density of the water. It should be remembered that repeated powerful external stimulation is the key-note of this treatment. Many persons who cannot bear the whole bath may often be relieved by local hyperthermal applications. At present in this country there is nothing quite corresponding to the salt-mud of the Crimean resorts. NANTWICH and NORTHWICH, in the salt districts of Cheshire, have also strong brine baths, and similar baths are given at SALTBURN-BY-THE-SEA and at MALVERN, STAFFORD, and other places.

Coming now to potable salt waters, although the British Islands can boast no *thermal* sources, such as those of Wiesbaden and Aix-la-Chapelle, and none effervescing like that of Kissingen, they are well supplied with *cold* salt waters. Some of these contain, besides chloride of sodium, calcium or barium salts, and traces of iodine and bromine, and thus offer a considerable variety in their composition, action, and uses.

Woodhall Spa.

WOODHALL SPA, in Lincolnshire, enjoys a dry and rather warm summer climate, favourable to thermal treatment. The waters are hypertonic, with 20 per mille chloride of sodium, and a certain amount of calcium and magnesium. They are chiefly indicated in atonic conditions of the stomach and bowels, with or without catarrh, and in scrofulous affections. Employed externally, they are useful in sub-acute and chronic rheumatism, and baths of this character are believed (as at Kreuznach) to reduce the size of uterine fibromata and so to relieve pressure and hæmorrhage. Experience supports the opinion that this, as well as other forms of thermal treatment, are capable of reducing morbid effusions and deposits. When vaporised, or pulverised, the water is also employed locally for chronic rhinitis and pharyngitis.

It has long been known that marine climates and



salt baths were beneficial for smouldering and chronic tuberculosis of the glands, bones and joints, and that soft drinking waters were inadvisable in such cases. Not only from experimental, but also on *a priori* grounds it would seem probable that muriated waters, in which lime salts (chloride, sulphate, or carbonate) are contained, might be of real value in the treatment of glandular and "scrofulous" affections. So it has proved. The fact has been recognised at Kreuznach and other continental salt spas. But although this form of tuberculosis is equally prevalent in the British Isles, and suitable waters are at hand, but little use has been made of them for this purpose. It may well be that hydrological treatment may yet prove itself to be of the first importance in combating the tuberculosis of young subjects, and rank before sanatoria in their case.

Salt waters and baths in tuberculosis.

Besides Woodhall Spa the following are salt waters with which lime salts are effectively combined :—

BRIDGE OF ALLAN, near Stirling, in Scotland. This is nearly isotonic water, containing a large quantity of chloride of calcium (4·4 per mille), with some sulphates and carbonates. Hitherto it has been chiefly employed in dyspepsia, venous engorgement and catarrh. The climate is equable and sheltered, and suitable for winter as well as for summer resort.

Bridge of Allan.

LEAMINGTON, in Warwickshire, enjoys the warmer climate of the English Midlands, with a low rainfall. Leamington is a pleasant place of residence, and the baths are open throughout the year. The waters here also are nearly isotonic with blood serum. In addition to sodium chloride nearly 10 per mille and alkaline sulphates, they contain a considerable amount of the calcium sulphate (gypsum), which no doubt gives them their diuretic quality and renders them tonic to the gastric mucous membrane. These waters are gently

Leamington.

aperient, and are employed *inter alia* for dyspepsia and disordered liver, particularly in persons from hot climates.

Ashby-de-la-Zouch.

At ASHBY-DE-LA-ZOUCH, in Leicestershire, there is a hypertonic salt water, also enriched with sulphate of calcium (2·5 parts per mille) and recommended for “scrofula” and rheumatism.

Llangammarch.

LLANGAMMARCH, in Mid Wales, may be classed among the salt spas, although its mild muriated and calcareous water is distinguished by the presence of barium. The essential ingredients are the combined chlorides of sodium, calcium, and barium (the latter nearly 0·1 per mille) presented in an assimilable form. They should be helpful where these chlorides and the calcium salts are indicated. The water is also employed with due care in subthermal baths for cardiovascular cases, and the barium salt taken internally is regarded as a cardiac tonic. Llangammarch is a restful spa, with a bracing and moorland climate, and comparatively cool summers. It is, therefore, well adapted for the treatment of many circulatory disorders.

Cheltenham.

Lastly, CHELTENHAM, formerly much frequented, is not the least interesting member of this class. The waters contain a moderate amount of salt, combined with sodium and magnesium sulphate. One of the springs also contains sodium bicarbonate, and is believed to be the only “alkaline water” in the British Isles.

#### IV.—IRON WATERS

The sulphur spas Harrogate, Strathpeffer, and Llandrindod have also chalybeate sources containing the carbonate of iron. Among other British waters of this class, the following may be mentioned :—

Tunbridge Wells.

TUNBRIDGE WELLS, in Kent, at one time shared the laurels of fashion with Bath. The waters contain 0·06

per mille of the carbonate of iron, but without free carbonic gas. The climate is invigorating and dry, with open country at an elevation of from 400 to 500 feet.

FLITWICK, in Bedfordshire, has a remarkable spring containing the persulphate of iron (about 2 parts per mille). The waters are only to be had bottled.

TREFRIW is situated on the river Conway, in North Wales, amidst beautiful mountain scenery. The water is of much interest, containing a considerable quantity of protosulphate of iron (2·4 to 5·4 parts per mille) together with lime salts and silica. It is used internally and also for baths, and can be prescribed in cases for which an assimilable form of iron and calcium salts is indicated. The climate is mild, and treatment can be followed throughout the year.

Trefriw.

#### V.—PURE SOLVENT WATERS

Although not to be described as “mineral,” certain almost pure waters are truly “medicinal” on account of their high powers as solvents. In England the St. Anne’s Well at Malvern is one of these. Like others of its clan it acts by lixiviation of the tissues and promotes the powers of elimination.

Malvern.

# PART IV

## INDICATIONS FOR HYDROLOGICAL TREATMENT

### CHAPTER XIV

#### GOUT

Sensitiveness  
to waters and  
baths.

GOUT, both in the subacute and chronic form, is usually amenable to hydrological treatment. There is, however, not uncommonly an extreme sensitiveness both to baths and waters, and exaggerated reactions are often met with. Much discretion is, therefore, needed in adapting the treatment to the case in hand. For many gouty persons baths are contra-indicated, and treatment at the spa must be confined to the internal use of waters, with dieting. For others, a suitable course of baths alone will secure a long immunity from symptoms. This is equally true whether the gouty manifestation be orthodox and articular or, as is so often the case, especially in women, located in the digestive, circulatory, cutaneous, bronchial or nervous tissues. There is, in short, no disorder in which it is more necessary to consider its individual and particular character.

The following observations upon the clinical varieties of gout as met with at health resorts, and their treatment by waters and baths, are primarily derived from prolonged experience at a British sulphur spa.<sup>1</sup>

Acquired gout. It will be observed that the subjects of acquired gout are commonly men of a stout and plethoric

<sup>1</sup> See *Journal of Balneology and Climatology*, 1895 and 1897.

habit. There is very often a history of bygone rheumatic attacks or of rheumatic fever. Menservants, and coachmen in particular, seem to be prone to rheumatic fever in youth, which is often followed in later life by chronic gout in the feet and perhaps deposits of urate of soda in the hands. It might be called an occupation disease, localised in the extremities by exposure and damp, and powerfully predisposed to by the over-stimulating diet, especially in meat and alcohol, in which menservants usually indulge.

Chalk-stones have undoubtedly become far less common in the past twenty years. Some gouty deposits in the neighbourhood of joints are not composed of urate of soda. Large uratic deposits, excepting in menservants, are now more often met with in hereditary gout than in the acquired disease. The same remark applies to uratic gravel and oxalates, which one sees in the subjects of hereditary gout, even in young children, and but seldom in the stout, full-blooded people who are responsible for their own troubles.

In contrast to these last the sufferer from hereditary gout is a tall, spare, wiry man, of great nervous energy, delicate digestion, subject to eczema, often abstemious and active in his habits, and yet manufacturing in a mysterious way quantities of uric acid. In the acquired disease, unless visceral degenerations have set in, dieting dispels the gout, for the income is in excess and the expenditure is deficient. By dieting is signified a reduction in the intake of sweets, stimulants and nitrogenous foods, and an increase in diluents. Since dieting relieves it, this gout is evidently a *diet disease*, according to Hutchinson's *dictum*. On the other hand, the subject of hereditary gout is often already overdieted; nutrition is suffering; the income may be already below the expenditure, or is at all events dangerously near that point. Whatever will cure that condition dieting certainly will not.

Hereditary  
gout.

For both these contrasted types of gout the treatment by medicinal springs is admirably adapted. The ill-effects that are sometimes, and truly, attributed to the use of waters and baths in gout generally arise from the attempt to apply a routine treatment in all cases. Both British and foreign spa physicians have sometimes offended in this respect. Experience has too often shown that a routine treatment by waters and baths, with reduction of dietetic supply and augmentation of waste, whilst it removes the gouty symptoms from one man, increases them in another.

Effect of  
sulphur waters  
in gout.

In each case of gout a nice question of diagnosis is therefore presented. Is this a dietetic disease, probably acquired? Or is it, on the other hand, dependent upon some perversion of intimate tissue changes, probably inherited?

In the second class of cases sulphuretted waters like those of Strathpeffer appear to have an almost specific effect. It would seem that sulphur, in the form of an alkaline or hydric sulphide in natural waters exerts a definite alterative action (see Chapter XI). Its solution and dilution are doubtless favourable to absorption and assimilation. In this diathetic or inherited form of gout no available means for the improvement of nutrition may be neglected. The diet must be adjusted in quality, amount, and the frequency of food to the individual's digestive capacity. Frequent and nourishing meals, with much variety in the nature of the food, are usually advisable, especially during the course of waters; and stimulants, including wines, are not to be excluded from the dietary of elderly and debilitated subjects. A certain major had his first attack of gout at twenty-one years of age when serving in the first Carlist War. He survived the articular phase and late in life fell into depression with anæmia and weak digestion. For

Use of stimu-  
lants.

many years he drank sulphur waters annually for a month and for the remainder of the year a moderate allowance of good port. Under this regimen he regained his health and retained it until well over eighty years of age.

The spa regimen in all these cases must be favourable to nervous repose, and must keep the patient much in the open air. Sometimes, but not always, a gentle course of baths is indicated, particularly the sulphur bath and the warm massage-douche. The latter, when properly administered without fatigue, favours nutrition in a remarkable manner.

An attack of gout is not infrequently induced by a course of waters and baths. A certain patient many years ago forsook Strathpeffer on account of an accident of this kind, and became a yearly visitor to Homburg, which suited him perfectly. And yet, in conversation with many gouty patients, Homburg is mentioned quite as often as any other place as the spa "which brought out the gout so badly." The truth is that a large number of persons are at times on the verge of an acute attack and the first visit to waters of any kind may precipitate them into it. Such patients often have irregular gouty seizures, which are easily provoked. They should be encouraged to persevere with waters, in spite of the severe reactions induced. Experience has repeatedly shown that perseverance with sulphur waters has not only led to great improvement in the general health, but that the gouty paroxysms have become much less frequent and more regular, and in many cases have entirely ceased.

Medicinal baths and douches are contra-indicated when articular gout is either active or threatening. The state of the digestive system affords the best guidance in the use of sulphur waters. If in small doses they persistently induce flatulency, discomfort

Attacks induced by treatment.

Condition of the digestive organs guides the use of waters.

or pain, an attack in the joints may be apprehended. The paroxysm is nearly always heralded by dyspeptic symptoms and by flying pains. If it is going to occur, it will nearly always take place within ten days from the commencement of the treatment. This period is therefore a time for watchfulness, especially with a first course of waters.

In a previous chapter it has been pointed out that the reaction of the gouty tissues to sulphur waters is an example of "intensive action." It may be taken to indicate the *selective action* of sulphur in the gouty tissues, and is therefore clinically, within limits, a favourable sign. The treatment of gout by medicinal waters ought not to be commenced within a month or six weeks of an acute attack, and care should be taken not to prescribe more than can be easily digested. Baths should not be persevered with if the gouty joints show increased tenderness or pain.

#### GOUT IN WOMEN

The female descendants of gouty parents seldom exhibit the acute gout, whilst the males often do. The difference in reaction to the same *materies morbi* is no doubt due to the modifying influence of sex. There is often a striking sequence in gouty manifestations and liabilities. A lady aged fifty-one was sent to drink sulphur waters for "duodenal catarrh invading the bile ducts." Her father died young after podagra, and on her mother's side she came of an old English lineage marked in every generation by gout in its most "regular" and sthenic form. At nine years of age she had scarlet fever severely, followed by permanent deafness, at fifteen catarrhal jaundice, and during youth much coldness of the extremities. The digestion remained apparently good for the first thirty years of life. A severe nervous breakdown

Sequence of  
symptoms.



occurred at forty-one. Three years later at the premature climacteric, there followed acute eczema intertrigo, and "erysipelatoid eczema" frequently recurred. After the menopause began digestive troubles, with acute neuralgia, headaches, and liver attacks. The patient, an authoress, thin, sallow, nervous, energetic, is always chilly and often takes cold. The skin is dry, the bowels constipated—and there are no joint symptoms.

In this type of case warm sulphur waters and peat or other thermal baths always help. The action of the skin and kidneys improves, there is less liability to chill and some "return of animal heat." It should be noted that the restoration of the normal activity of the skin and thereby of "life warmth" (to use this lady's expression) should be one of the main objects of treatment in feminine gout; and it is by effecting this object that baths in their various forms are of such inestimable service.

Use of peat  
baths.

Large numbers of women of gouty family suffer from catarrh of the stomach and bowels, frequent chills and coughs, or painful attacks referred to the throat or ear or eye, painful dyspepsia, cervical or spinal neuralgia, etc. As a rule articular implication supervenes after the menopause, but in a few cases under repeated treatment by waters, these symptoms die away without any localisation having taken place. It is surprising how almost suddenly the small joints may become affected in those who have long suffered from other gouty symptoms. A lady with a family history of gout suffered from intractable indigestion for many years. One morning in July, the patient being then forty-seven years of age, she woke up and found her finger joints quite swollen. They have remained so ever since.

Supervention  
of articular  
symptoms.

It is worthy of note that it is the terminal joints (*second* row of interphalangeal joints) that suffer most

The joints  
commonly  
affected.

Gout and  
rheumatism  
compared.

in feminine gout. In a small minority of cases, one or two or more of the first-row joints are alone affected; but this occurs as a rule somewhat earlier in life than last-joint gout, and only where the gouty element is very pronounced. Affection of the first-row joints would seem to belong to rheumatism rather than to gout. Therefore the spindle-shaped enlargements of this series of joints met with as the result of rheumatic fever, or of chronic rheumatism (from cold or damp), or occasionally in cases of arthritis, are to be clearly distinguished from gouty changes. It is interesting that the same, that is the terminal, phalangeal joints that are commonly *enlarged* in feminine gout are very often *atrophied* in the generalised arthritis of young subjects.

The curious symptomatology of feminine gout is often best described in the patient's own words: "In an hour the hands may be so swollen that I cannot put on my gloves; there is burning in the palms of the hands whilst heat and cold alternate in the soles of the feet." The same person stated in the following year: "The whole system gets into a state of restlessness and misery, and then it comes out in the hands."

As in middle life the hidden tendency may be revealed by the disturbances incidental to the climacteric, so in a later phase of life the lapse of time seems to unmask and augment it. In both cases articular localisation is found, but senile gout often affects the phalangeal joints without distinction of series.

The sequence of symptoms observed in a chronic disorder affords sufficient proof of an underlying cause, as from the growth of a plant one infers the root. The state of the crop at any date must depend on the season, the climate and the soil. So the form and symptoms of gout depend on the time of life, the

external conditions and the individual characters already adverted to.

The chief *alternations of symptoms* observable in gout fall naturally into three groups : first an exchange as between the skin and mucous membrane ; secondly, as between the skin and joints ; and thirdly, as between the mucous membrane and joints. It is not uncommon for dyspepsia to precede eczema for many years, and to disappear, or be greatly abated, when the eczema is developed. On the other hand, eczema seldom or never gives place to dyspepsia, and acute eczema in the gouty is often accompanied by dyspeptic symptoms.

Common alternations of symptoms in gout.

In regard to acute gout and eczema, alternations occur in both directions. As regards the mucous membranes and the joints, dyspepsia or migraine in women often disappear when the hands become affected. The localisation of gout, whether in the joints or in the skin, tends to relieve disturbances of a more general character.

The principal features of the gout in women, which at all the health resorts is one of the most prevalent of complaints, may be thus stated—

Characteristics of the gout in women.

- (1) Liability to other disorders in youth, especially to certain specific fevers and to the sequela of fevers.
- (2) Liability to rheumatic fever.
- (3) Liability to rheumatism, probably dependent upon (4).
- (4) Liability to affections of the mucous membranes and in particular to contract chill.
- (5) Disorders of circulation, especially in the skin.

Whilst local heat generally accompanies the enlargement of joints, the general condition of the gouty patient is, as a rule, one of chilliness, or "want of animal heat." The

Liabilities of  
gout in women.

cutaneous functions are very much in abeyance, which furnishes a valuable indication for treatment.

- (6) Liability to skin affections and particularly eczema. In early life gouty eczema is moist and localised; it is still moist and more generalised about the climacteric epoch, and becomes dry and localised in later years.
- (7) Liability to neuralgias and nervous affections. All facts point to the conclusion that there is a nervous factor at the root of all gout. Although the periodic articular attacks occur but rarely in women, the symptoms that replace them often partake of a paroxysmal or periodic character. Of this nature are many headaches and neuralgias, the dysmenorrhœa of young subjects, the migraine, lasting many years and disappearing at the climacteric, and sometimes spasmodic asthma.
- (8) Natural course. The normal and favourable course of gout in women is to become less and less generalised and more and more localised; the circulating poison, whatever it may be—derived very probably from intestinal auto-intoxication—undergoing gradual diminution. The unfavourable course is marked by acute inflammatory complications, affecting superficial or internal organs, the *materies morbi* being increased.

The normal course may be arrested at any stage. The sequence from general to local may not occur, or only partially and after long delay, in consequence of the gouty *materies* remaining permanently or for a lengthened period undiminished in amount.

If the above outline represents the natural history of gout, the object of treatment should be to effect

the gradual and progressive elimination of the circulating *materies*, and so to promote the natural course of the complaint. Elimination  
treatment.

One of the most effectual means to this end is repeated recourse to waters and baths, which are all in different ways eliminative in their action and command the three routes for the removal of toxic matter—the bowels, the kidneys and the skin.

For robust, congested or obese gouty subjects aperient waters are generally indicated. These include the sulphated and alkaline thermal waters, such as those of the great Bohemian spas (Karlsbad, Marienbad), and the muriated and sulphided waters of Harrogate and Llandrindod (cold), and of Uriage (thermal). A three or four weeks' course of such waters is cleansing to the gastro-intestinal tract and stimulates the activity of the liver.<sup>1</sup> The powerful action of simple sulphided waters (Strathpeffer, Llanwrtyd, Shinznach, Lenk) both in regular and irregular gout has been already referred to. These waters many of them contain lime salts and probably act partly by free diuresis. Where the action of the kidneys is defective, with a tendency to uratic gravel, recourse may also be had to the alkaline and calcareous waters of the Vosges spas—Contrexéville, Martigny and Vittel. Warm muriated waters like those of Wiesbaden and muriated alkaline waters like those of Homburg (cold), and Royat and Châtel-Guyon (warm), are appropriate in atonic gout and gouty eczema.

Bath treatments are of value in gout by tending to restore the functional activity of the skin. Aix-les-Bains, the original home of the massage-douche, Buxton and Bath in England, and many of the simple thermal waters like Wildbad and Baden in the Black Forest, and thermal sulphur waters like Luchon in the Pyrenees, are all helpful, particularly for external Stimulation of  
the skin.

<sup>1</sup> See Bain and Edgecombe, *loc. cit.*

treatments. But it should always be remembered that hot baths rather increase the local manifestations of gout, and may in weakly subjects seriously enfeeble the heart. They are therefore to be used with caution.<sup>1</sup>

<sup>1</sup> An interesting observation was made long ago at Bath by Dr. William Oliver, one of the shrewdest spa physicians of his age. Writing in 1764 (*Essay on the Use and Abuse of Warm Bathing in Gout*) he states his belief that warm baths dissolve gouty deposits and throw poisonous matter into the circulation. Unless free evacuation is secured repeated bathing may, therefore, be not a little injurious. He concludes very truly that heat, whether in the bath or after the bath, too long continued or too frequently repeated, is dangerous in gout.

## CHAPTER XV

### RHEUMATISM AND ARTHRITIS

MANY forms of baths are beneficial in the affections of the joints and fibrous tissues that in predisposed persons gradually supervene upon exposure to cold and damp and traumatism.

Indications in acute fibrositis.

For more acute cases the sedative effects of moist heat in sweating baths, and especially in vapour baths, local or general, are the most appropriate. The vapour can readily be applied, as in the Berthollet apparatus, to the shoulder, arm or other affected part, with a view to relieving nervous irritability and muscular spasm. Heat and moisture and rest are the cardinal points in the treatment of fibrositis.

Various forms of sedative hydrotherapy may be used in or near the patient's home in acute cases, with the best results. Such cases should never be subjected to stimulating treatment or sent to spas or health resorts until the acute condition has subsided. This applies to all forms of "muscular rheumatism," sciatica, lumbago, neuritis and to all joint affections with either local heat or general elevation of temperature. Hot air and electrical radiation baths are inapplicable in acute and recent cases.

In subacute rheumatic affections thermal treatment must be gentle and tentative. If employed at all it should be used with the greatest caution, and if possible at sedative health resorts. As travelling usually

aggravates these complaints persons so affected should not be sent abroad.

Stimulating  
treatment in  
chronic cases.

In chronic cases the treatment may be more stimulating. For stiffness and adhesions, the result of bygone inflammation, a highly stimulating thermal treatment may be employed, and local applications made of brines, peats, muds, vapour and hot air, in a steadily ascending scale of temperature.

Among chronic rheumatic patients many, perhaps most, are benefited by foreign spas and climatic stations. It is true above all that climatic treatment is essential in chronic rheumatism. That is why very often the foreign spa is to be preferred to the British. The rheumatic invalids recommended to foreign spas exchange an insular for a continental climate, and that is no slight advantage in chronic joint affections. After all, rheumatism, like catarrh, is largely a climatic disease. It has a definite geographical distribution : there can be no reasonable doubt that it has a definite climatic cure. There are many cases of chronic rheumatism that could be more effectually treated by residence in an appropriate climate, such as that of many of the hill stations in India, than by any form of hydrological treatment.

Climatic  
treatment  
usually  
helpful.

It is by the judicious combination of climatic influence with spa treatment that the best results are ordinarily obtained. Each health resort, whether at home or abroad, possesses a certain medical individuality, of which not only the nature of the *waters* and the methods employed in the *baths*, but the various *climatic characters* form an integral part. The atmosphere and genius of the place may be quiet and restful, or stirring and stimulating.

Individual  
characters.

The individuality of the spa is matched by another individuality in the patient. His age and temperament, his present power of reaction—often excessive or defective—and the whole condition of health, both mental



and physical, necessarily enter into it. It is therefore useless to choose a health resort with reference only to the name of the disease. There are usually many stations to which sufferers from a particular ailment have resorted with benefit. As a rule, disappointment and failure may be traced to a want of correspondence between the individual characters above noticed. The sufferer has not gone to the wrong water, but to the wrong place, or at an inappropriate stage of his malady. It is the duty of the physician to estimate how much treatment can safely be applied at a given moment, and what powers of reaction are available in his patient. It has been well said that "the determination of the individual reaction constitutes the greatest problem of balneary practice."<sup>1</sup>

Again, sometimes an otherwise appropriate treatment is barred by a condition of nervous exhaustion, and a period of rest before the spa cure becomes imperative. These considerations, which are a commonplace in all hydrological treatment, are of especial importance in the choice of a foreign spa. It is noteworthy that a course of bath treatment on the Continent is more often indicated in men than in women, because in men a change of atmosphere and absence from business and professional cares is often not easily obtained without going abroad.

The following are some of the conditions for which waters and baths, and other forms of physical treatment, may be properly called in aid :—

1. *Convalescence from Rheumatic Fever.*—Every convalescent from rheumatic fever should at the proper time take a course of hydrological treatment. Baths are not always indicated, but the eliminative and alterative influence of certain waters, especially certain cold sulphur waters, powerfully promotes resolution

Waters should be used after acute rheumatism.

<sup>1</sup> *Cliniques hydrologiques*, p. 90. (Paris, 1909.)

and tends to prevent relapse. This treatment can be obtained as well at the British sulphur spas (Llandrindod, Strathpeffer) as at any foreign station. The employment of baths after rheumatic fever is liable to be followed by cardiac debility, and the effect of temperature should be carefully watched.

2. *Insidious Progressive Polyarthritis of Young Subjects*.—This condition, doubtless infective, is accompanied by a profound debility, and can but seldom be submitted to any form of spa treatment. On the other hand, a prolonged change of climate may help to arrest the disease. For a sojourn in summer a dry, warm and sunny place should be chosen. Upon the east coast there are several good climatic stations with low humidity and a dry soil—such as Herne Bay and Westcliff-on-Sea, and in Scotland Fortrose and Nairn. A hilly or moorland summer resort, if dry, such as Goathland, suits some cases, or the forest regions of the Taunus Mountains or the Black Forest. For winter there are resorts like Arcachon or the hinterland of the French Riviera. The sea-shore itself is in winter generally unsuitable.

3. *Results of Acute or Sub-acute Infective Arthritis*.—These cases are to be distinguished from the last by their definitely infective character, the relatively small number of the joints affected, and the more favourable prognosis. After the acute and pyrexial stage has subsided, great benefit can be obtained by gentle hydrological treatment. Many thermal waters are helpful. In the winter or spring such patients may go to Bath, Wiesbaden or Dax, and in the spring to Aix-les-Bains or the more highly situated Vernet-les-Bains. For the summer there are many suitable thermal resorts, such as Buxton in England and Wildbad and Baden-Baden in the Black Forest, and Luchon and Cauterets in the Pyrenees. Muriated waters, like those of Droitwich and Woodhall Spa, Kreuznach

Climatic treatment for infective arthritis.

Results of infective arthritis.

and Salsomaggiore, are also helpful in these cases. It is generally expedient to forsake the British climate in winter, in favour of some warm, dry and sunny region.

4. *Arthritis supervening in Middle Life.*—This is a very common condition in women. The fact that it is always associated with faulty metabolism or defective elimination clearly marks it out for treatment by waters and baths. A wide range of hydrological treatment is offered, according to the type and temperament of the individual. Cases in which there is a gouty mixture are usually amenable to sulphur waters taken internally. Such are the muriated sulphur waters of Harrogate and Llandrindod, and the pure sulphur spas Strathpeffer and Llanwrtyd: in France Aix-les-Bains and Challes at low altitudes, and the mountain spas, Luchon, Cauterets and Barèges; also the waters of Lenk in Switzerland. Alkaline-saline waters (Marienbad), particularly when combined with appropriate thermal treatment, such as peat or moor baths, increase elimination and promote the resolution of the articular swellings. For persons of a plethoric type and hepatic derangement, with or without obesity, stronger alkaline waters such as those of Vichy and Neuenahr, or the hot saline springs of Karlsbad, are often more appropriate. Thermal baths of one kind or another, such as the douche-massage at Aix and Vichy, or sulphur, peat or mud baths, are nearly always helpful.

In chronic degenerative arthritis, whether of gradual onset or the result of an acute invasion (such as rheumatic fever, gonorrhœa, primary acute or septic arthritis or acute gout), the object of treatment must be to favour elimination of toxic material, promote the failing nutrition of the part, and finally to correct deformities and restore function. All forms of chronic arthritis are at one stage or another amenable to spa

Arthritis of middle life usually amenable to spa treatment.

Various forms of chronic arthritis.

treatment. It should, however, be carefully adapted to the case in hand, and to the stage and phase of the complaint. In the early or sub-inflammatory stage, which may be extended for years, only a sedative or sub-thermal bath is appropriate, such as the low-pressure douche with massage. At a later stage, when inflammatory reaction has subsided and degenerative changes are marked, the arterial circulation in the joint is apt to fail, and local thermal or hyperthermal applications are beneficial, by stimulating the nutritional and circulatory activity. Such cases do well at thermal spas (Aix-les-Bains, Bath, Luchon) where the administration of the douche has been made an especial study and tradition, and the bath is given only by skilled and experienced attendants. Much care is needed to avoid over-heating, as many of these subjects are liable to cardiac debility following upon a course of baths. Baths and douches are often given too hot in cases of arthritis. The author has often found brief *cold* douches or the *douche écossaise* of value in the arthritis of young and middle-aged subjects. Bathing stations at a certain altitude (1000 to 3000 feet) should as a rule be preferred for weakly subjects, since experience has shown that the same treatment is less debilitating at these elevations than at lower levels and in sheltered valleys. A relatively northern latitude also modifies the effect of baths in a similar manner.

Hot baths often  
injurious

Senile  
arthritis.

5. *Arthritis supervening in Later Life.*—Painful joint affections, the result of exposure or traumatism in later life, must be regarded as belonging to the group of senile local disorders due to failure of nutrition. The gradual diminution and loss of arterial blood supply in the affected joints is followed by degenerative change, impairment of movement and muscular wasting. A great many elderly people are benefited in health, and the general nutrition and circulation are promoted,

by recourse to a dry, sunny and warm climate. If at the same time there can be taken a course of baths, gently stimulating and sedative in their action, this favourable result will be powerfully promoted. Natural subthermal baths, at a temperature a little below blood heat, often exert an action of this kind in elderly subjects; they relieve pain and stiffness, and by their effect upon the general circulation and nutrition incidentally promote the repair of damaged joints. Such patients often do well at Strathpeffer or Llandrindod, at Schlangenbad and Wildbad in Germany, and at Nérès and Plombières in France. In senile arthritis a summer "cure" with subthermal baths in pure but sedative air may relieve pain, assist nutrition and defer atrophic changes.

6. *Chronic Rheumatic Disorders, properly so called.*— Rheumatism.  
 These are the painful sub-inflammatory affections of the fibrous tissues already referred to, widely distributed in the muscles, tendons, nerves, fasciæ and joints, and of which the localisation is determined by accidental circumstances. It is notable that in all of them the nerves or nerve endings are implicated. There is also a remarkable sensitiveness to atmospheric changes, climate and locality, which is the true stigma of rheumatic disorders.

A cardinal rule of treatment divides rheumatic cases into two classes: viz. those which require a sedative and those which require a stimulant and intensive treatment. This practice is better observed on the Continent than in England, particularly in France.

(a) Cases of sciatica or cervical, brachial or lumbosacral neuritis, or of muscular rheumatism or neuralgia, in which there is much pain or sensitiveness, are as a rule correctly treated by natural thermal and subthermal baths such as those of Bath, Buxton, Nérès, Bagnères de Bigorre, or Plombières. Sometimes a

sedative effect is obtained by prolonging the bath at subthermal temperatures for one or several hours, as practised at Nérís and Loèche-les-Bains in Switzerland. Natural vapour baths at a moderate temperature are also employed as a sedative and gently intensive treatment, as at Luchon and at Monsummano in Italy. The latter spa has obtained some reputation for the treatment of sciatica and painful rheumatic affections, as also have the strongly stimulating brine baths of Droitwich. The warm vapours of thermal springs are also often applied locally, as at Bath and Aix-les-Bains. In all these cases not only are cold applications forbidden, but very hot baths and douches are also contra-indicated. When the general condition has been improved, and pain and sensitiveness have been allayed by sedative baths, it is customary to employ low-pressure or under-water douches, as at Bath, Aix-les-Bains and Plombières, as well as gentle massage, but in many cases only subthermal baths are used throughout. It is obvious that often these disorders, like dyspepsia, are symptomatic and should be treated from the point of view of causation.

Stimulating  
measures.

(b) In rheumatisms of a more chronic and obstinate character, especially where the peri-articular fibrous tissues are involved, a stimulating and intensive bath treatment is indicated. An old and well-grounded tradition has placed chronic rheumatism first among the indications for sulphur waters and thermal baths. A course of sulphur or sulphur-muriated waters may often be taken internally with much advantage (Strathpeffer, Harrogate, Luchon, Cauterets, Aix-la-Chapelle, Wiesbaden). Stronger salt baths, like those of Buxton, Bex and Salsomaggiore, are sometimes helpful. All forms of external thermal treatments are more or less applicable to chronic rheumatism. In England Bath in winter and Buxton in summer may be prescribed. The natural flowing thermal baths

of the Black Forest (Wildbad and Baden-Baden) combine an appropriate stimulating surface treatment with a climate suitable for rheumatic persons. The same applies to Teplitz in Bohemia. The douche-massage is extensively employed in these cases at many of the French spas, whilst at Strathpeffer, Franzensbad, Marienbad and Schwalbach hot peat baths are found to be helpful. Vapour baths also at relatively high temperatures, such as those in the island of Ischia, at Plombières, and in the warmer cave of Monsummano, provide a powerful intensive stimulation in chronic and intractable cases. The hyperthermal baths of Dax near Bayonne, of Gastein in Germany, and especially those of Hammâm r'Ihra in Algiers, exert a still more powerful resolvent and stimulant effect in cases of obstinate rheumatic swellings and stiffness. The last-named spa is appropriate for treatment in winter and spring. Whole baths at hyperthermal temperatures must, however, always be used with caution.

Of late years *local* hyperthermal applications have been increasingly used for chronic localised rheumatic affections, since they are much better borne than whole baths. Dax and St. Amand in France have valuable natural hyperthermal mud baths as well as Pöstyén in Hungary. Fango, a volcanic mud, exported from Italy, is much used for the same class of patients at the German spas and in England, as well as at the original homes of this treatment, Battaglia and Acqui in northern Italy. For those to whom a more northern latitude is indicated the natural mud baths of Laurvik and Sandefjord on the Christiania Fjord may be visited with good result in sciatica and muscular rheumatism.

The singular quality of radio-activity belonging to many of these natural muds is believed to reinforce the thermal effect in rheumatic affections. Many recent observations suggest that rheumatism as well

Hyperthermal  
local applica-  
tions.

Radio-active  
muds.

as gout may be amenable to the influence of radium emanation. At the German spas, particularly at Kreuznach, the emanation is much employed both internally and externally for rheumatic and gouty cases. There is, however, at present but little evidence that the remarkable benefit obtained by many rheumatic persons from simple thermal waters is to be attributed mainly to their radio-activity. The *modus operandi* of these waters is still imperfectly understood.

To summarise briefly the more valuable therapeutic methods employed in rheumatic affections, these include :—

Methods of  
treatment.

(1) Diuretic, alkaline and purgative waters, employed for their detoxicating and eliminative action.

(2) Sulphur and muriated waters, employed for their tonic and alterative action in indolent and torpid subjects.

(3) Subthermal baths and douches, given for their sedative effect on the nervous system and because of their favourable influence upon the circulation and nutrition in conditions of debility and depression.

(4) Thermal baths, given for their more or less intensive effects.

(5) Natural vapour baths, both for their sedative and stimulant action.

(6) Local thermal treatment by moor (peat) and various mud baths (*fango*, etc.)—sometimes raised to high temperatures (130° F.).

We find also at many of the spas as adjuncts to the above natural methods : (*a*) radium emanation water used internally and externally ; (*b*) hot-air and light baths and the hot-air douche ; (*c*) massage, vibrations and mechano-therapy, particularly for the later stages of rheumatic affections and to restore movement and overcome deformity ; and (*d*) electro-therapy for the associated muscular wasting.



It may be added that diet is somewhat too little regarded in the treatment of rheumatism, particularly at the foreign spas, and that importance is everywhere and rightly attached to a prolonged *after cure* in a dry warm climate, following the bath treatment in all serious cases.

## CHAPTER XVI

### NERVOUS AND MENTAL AFFECTIONS

APPLIED externally to the body, waters act immediately on the peripheral nervous expansion. This vast mechanism is of all nervous organs the most extensive. Since every surface impression is reflected in the nerve centres, it is not surprising that the most powerful stimulant as well as sedative action can be exerted upon them through the skin. This applies both to the cerebral and to the spinal nervous system.

In nervous disorders, both local and general, *functional disturbance* undoubtedly varies from time to time. It must vary with the phase of the complaint—whether incipient, irritative, acute, recurrent, chronic, or in an atrophic or negative phase. The presence or absence of gross organic lesion does not materially alter these facts.

From the point of view of hydrological treatment, it is necessary to recognise three separate phases or conditions. These are (1) irritability, (2) exhaustion, and (3) atony. These conditions may be variously combined and alternated. For example, the atony of one part of the nervous system may be associated with the over-action of another, and nervous erethism soon induces exhaustion. On the whole in every case, at any given time, the balance of the functional condition inclines towards irritability or atony. This fact is of cardinal importance in treatment by baths and waters.

Rationale  
of treatment.

Classes of  
functional  
disturbance.

With reference to the action of baths in nervous disease, it is needful to bear in mind what has been ascertained of the laws of thermal stimulation. The same degree of heat does not, however, produce the same thermal action in all persons. There is a rather wide margin of variation.

The point of thermal indifference varies in different persons and at different times in the same individual and in the same illness. The importance of slight differences in the heat and duration of thermal applications is hardly sufficiently realised. Baths differing one, two, or a few degrees in temperature, *plus* or *minus* to the point of thermal indifference, produce sometimes widely different effects upon the nerve centres.

The matter is further complicated because the action of a bath at any degree of temperature is followed by a reaction in the contrary sense, with the phenomena—vasomotor, cardiac, and physio-chemical or metabolic—that have been described in a previous chapter (see Chapter VI). The whole effect of a cool bath (*minus* thermal) upon the nerve centres will depend upon the duration and intensity of the *action*, and of course upon the integrity of the power of *reaction*, which is clinically a very important matter.

Complex action  
in the nerve  
centres.

So also in the case of *plus* thermal applications, their total effect upon the nerve centres depends even more on their *duration* than on their *intensity*. A temporary artificial fever with more or less excitement of the circulation and lowering of vasomotor tone and blood pressure, is followed by a favourable reaction in the contrary sense. But if the action is too prolonged or too often repeated, the vasomotor tone is permanently lowered, and a condition of "thermal debility," with enfeeblement of the nerve-centres and heart, will result.

Both *plus* and *minus* thermal baths are powerful nervine stimulants, if suitably adjusted in respect to

their intensity and duration. There is, however, one remarkable difference in their *modus operandi*. Cold usually operates medically on the body by the *reaction* it produces, but heat if properly applied, by its primary and immediate *action*. It is, therefore, of the greatest practical importance that the reaction to cold should by every means be favoured and promoted, while the late effects or reaction of heat should be as carefully avoided.

In practice we have a very long range of temperature, *plus* and *minus* to the body, within which in health brief applications of heat are entirely stimulant. In disease this range is much abbreviated; nevertheless *plus* or *minus* stimulants, and especially *plus* followed by *minus*, are applicable to many conditions of great weakness and debility.

Sedative  
actions.

Another action of baths of great importance in nervous affections takes place at certain *subthermal* temperatures. We have already seen that in baths at about skin heat no marked action or reaction takes place. In subthermal baths the heart is slowed, the peripheral circulation promoted and equalised, and a massive and equable impression of temperature and moisture replaces a multitude of varying cutaneous sensations. The whole effect is powerfully sedative, and the subthermal bath, unlike those of more extreme temperatures, can be continued for an indefinite period of time without any fear of reaction or resulting debility. It is a cardinal physiological fact that baths within a certain narrow range of temperature, of which the upper limit is well below blood heat and the lower limit not far below the temperature of the skin, have a marked sedative action upon the nervous system. This fact is of great importance in practical medicine, since the sedative action is exerted not only upon the peripheral and central nervous systems, but through them upon the circulation and the general nutrition.

The hydrotherapeutic armamentarium for dealing with nervous affections comprises, therefore, first of all, the *plus* and *minus* thermal applications of a stimulant nature, acting directly and indirectly and extending over a wide range of temperature; and secondly, the equally important subthermal baths confined within the narrow range that lies between the heat of the blood and that of the skin.

The various other forms of hydrological treatment that are applicable to nervous affections will be incidentally referred to under the illustrative cases. Many different spas and climatic resorts are of great value in nervous cases, but apart from the health resort there is a great deal that can and should be done by means of baths and similar applications. Very often it is inadvisable, for various reasons, that the patient should leave his own home and the care of his medical adviser. Stimulant and sedative baths in different forms can be given at any place which is provided with simple hydrotherapeutic appliances and a sufficient supply of hot and cold water, and of course the services of trained attendants. It is truly surprising that so few towns in England afford facilities for the practice of scientific hydrotherapy by medical practitioners. The installation of suitable medical baths and douches presents no insuperable difficulty in any of our cities, and would open up new and unexpected possibilities in the treatment of acute and chronic disease by the general practitioner.

Simple hydro-  
logical treat-  
ment of great  
value.

The following are among the nervous affections that are favourably affected by various forms of hydrotherapy and spa treatment.

### I.—HYSTERIA AND HYPOCHONDRIASIS

Tonic or sedative hydrotherapy according to the indications may be employed with much advantage

in hysteria and hypochondriasis. In these conditions as a rule some particular physical impression has become habitual and exaggerated, and therefore morbid. The *plus* and *minus* thermal baths, the alternating douche, the long-continued subthermal bath, flowing at a constant temperature, and in cases of great debility the hot or cold pack, are all forms of hydrotherapy which make a powerful impression through the skin upon the nerve centres. It is by repeated impressions of this kind in a great many of our cases that the habitual morbid sensation may be overcome, on the principle that two things cannot occupy the same place. It would be well sometimes to add an even more vigorous surface treatment, such as that employed by the Finns and Laplanders in their hot air and vapour baths. In these the bather is thoroughly switched with birch twigs in order to develop a good reaction, and when scarlet with the effect of the heat and switching is made to plunge into snow or ice-cold water. We must admit that there are cases in which, perhaps involuntarily, some exaggerated and too persistent symptom has come to occupy the mind and attention of the patient that could be well treated on these principles. Proceedings seemingly heroic are often surprisingly well borne by delicate persons, as in the following case—

Stimulating  
surface  
treatment.

*Case 1.*—A married lady, æt. nearly 45 years, had been an invalid for many years, and had taken the baths at Nauheim for cardiac trouble. She complained of “nervous depression, cobwebs in the head, dimness of vision, torpor of the sensorium, mental apathy, palpitation, weak digestion, inability to walk.” With a little persuasion she was taken every day in a bath-chair to the douche-rooms at Strathpeffer and given a general douche, with brisk alternations between 110° F. and cold. After the bath she was encouraged

to walk home. Having taken a course of this treatment she went to the moors for systematic exercise.

There are in truth many conditions of nervous and mental debility for which a highly stimulating surface treatment is always one of the most effectual of remedies.

## II.—RESULTS OF ORGANIC DISEASE: OLD HEMIPLEGIA AND INFANTILE PARALYSIS: TABES DORSALIS

Old hemiplegias and monoplegias are often benefited by subthermal baths or douches, with or without massage. The peculiar effect of subthermal temperatures (between skin and blood heat) is seen in these cases in the improvement of the circulation and of the general nutrition, and in the relief of pain and spasm. The irritative condition that often accompanies paralytic lesions is allayed, and muscular power more or less restored. The influence of a well-chosen climate may often reinforce the effect of the baths. Many such patients should take their baths under a sedative climatic influence. Such may go to Bath or Wiesbaden in winter, or Aix-les-Bains or Schlangenbad in the summer months. Others will do best under a similar treatment in the more tonic, but still sedative, climates of Nérès, Plombières, or Strathpeffer. Prolonged warm baths, especially in natural thermal water (Nérès, *e. g.*), combined with appropriate exercise and massage, are often beneficial in old hemiplegia and infantile paralysis. Subthermal baths are also helpful for the lightning pains and crises of tabes dorsalis. At Oeynhausen in Germany and at the French spas Lamalou and Bourbon d'Archambault, the bath treatment of tabes is skilfully combined with methodical muscular exercises.

Choice of actions for different conditions.

## III.—NEURITIS

Eliminative  
treatment.

The toxic condition underlying neuritis always demands internal eliminative and alterative treatment. Bath treatments alone are insufficient. Therefore a course of diuretic, saline, sulphur, or muriated waters—Contrexéville, Carlsbad, Marienbad, Strathpeffer, Harrogate, Llandrindod—should be given according to the general indications. Much judgment is requisite in the employment of baths. In the early congestive or sub-inflammatory stages of neuritis, thermal baths should be carefully avoided. Sometimes sedative and subthermal treatments may be allowed, as at Bath and Buxton. At a later stage more stimulating baths are helpful, and especially peat baths, whole or partial, as at Franzensbad, Marienbad and Strathpeffer. Thermal mud-baths, as at Laurvik and Pöstyen, and applications of fango may be given in the later stages both in brachial and peripheral neuritis and in sciatica. For the last-named complaint, the hot brine baths of Droitwich have obtained a good reputation.

Several of the ordinary hydrotherapeutic measures are applicable to neuritis. Subthermal baths may be used in the early stages, and the hot and alternating douche and local electric radiation baths for the more chronic cases. In acute conditions and in some cases of alcoholic neuritis, subthermal baths can with advantage be prolonged for several hours daily.

## IV.—NEURALGIA

What has been said as to the need for increased elimination in neuritis applies also to many cases of neuralgia. It is not uncommon to meet with persons in whom the habit of pain, chiefly in the head or spine, has become intractable by ordinary remedies. Such patients are sometimes the despair of their medical attendants. In the French institutes of hydrotherapy



it is customary to treat these conditions by the cold spinal douche or by cold following heat. The two following cases illustrate this practice.

Cold hydro-therapy of great value.

*Case 2.*—A married lady, æt. 53 years, suffered from posterior cephalalgia and gastric neurosis, evidenced by attacks of vomiting, and also some colon irritation for which lavage had been given at Plombières. She had undergone many illnesses and led an invalid's life. The neuralgic element was the dominant one. This patient showed an unusual tolerance for cold, and took with much benefit daily the cold general and spinal douche, prolonged for as much as two and a half minutes.

*Case 3.*—An unmarried lady, of nervous and gouty family history, æt. nearly 40 years, complained of megrim of a severe type, spreading from the right parietal region to both temples and accompanied by palpitations and throbbing in the head, constriction of the throat, dimness of vision and sickness, and followed by troublesome defect of memory and loss of her natural powers of enjoyment. During many years these attacks resisted all the usual remedies, including high-frequency currents. A course of spinal douches commencing so hot as to cause vivid redness of the skin, and then quickly reduced to cold to the limit of toleration, has relieved this condition more than any previous treatment.

#### V.—NEURASTHENIA

Baths and waters provide a useful accessory treatment for many cases of neurasthenia, particularly for those of the common and less severe type. Numerous sufferers from neurasthenia frequent the spas, and often derive benefit from spa treatment. But the three weeks' course of waters or baths should always be supplemented by an "after-cure," preferably at a

Sedative influences of paramount importance.

moorland or mountain station. Doubtless the absence of irritating influences and the presence of a refreshing and soothing environment is the essence of the treatment. Hence the change from towns to mountainous regions or to the shade and stillness of great forests is so grateful and beneficial. One of the ablest of the young engineers in India, oppressed with labours and responsibilities, having pierced the mountain and completed his scheme of irrigation, fell into neurasthenia. He recovered, after a retreat of three or four months in the jungle, stalking tigers and sleeping in the open.

Hot baths injurious.

In neurasthenia, which is a condition of debility, no advantage can be expected to follow from hot baths, which are, indeed, likely to be injurious. Cold hydrotherapy is often appropriate, especially the brief cool douche and the cold sitz bath, and very hot pediluvia may be given in atonic conditions of the cerebral circulation. The following cases may be regarded as typical of severe neurasthenia in later life and in early manhood. In both of them cool and alternating douche baths promoted recovery, to which of course absolute rest, change of scene and other tonic measures contributed.

Middle age neurasthenia and depression.

*Case 4.*—A medical man, of a nervous but long-lived family, engaged in arduous practice, after the death of a relative had a troublesome attack of labyrinthine disorder at 45. This passed off, and he went on fairly well until nearly 60, when after an accident in the hunting-field he began to suffer from severe right-sided headaches and mental and nervous depression and insomnia. He rapidly lost weight, and was completely incapacitated from work. At this time he complained of severe right-sided and vertical headache, left-sided tinnitus, occasional staggering, insomnia and burning sensations and perspiration. Considering his condition one might have supposed that he was suffering from serious central or malignant disease. The

patient attributed—and as it proved, truly—the whole illness to toxæmia and a relaxed condition of the sympathetic nervous system. The treatment taken at Strathpeffer comprised rest, feeding, massage, daily hypodermic injections of strychnia rising to 15 minims of the liquor, and douche baths. Five months later he wrote that he was back at his practice, doing a good deal of surgical and night work, and that no one could see that he was nervous. He had regained one and a half stones of weight and was sleeping and eating well. The tinnitus and some headache however remained. Again, after five and a half years, æt. 66 years, he kindly reported that he was wonderfully well, still at work; rather irritable, nervous, and restless at times; and still troubled by tinnitus and occasional vertigo. He was taking more relaxation, in hunting and travel, and he added that he found it best to live very plainly and sparingly, abstaining from alcohol, smoking only two cigars and taking meat but once daily. Such an experience of an accomplished member of the medical profession is unfortunately too common.

Irritative and  
toxæmic.

*Case 5.*—A man, æt. 35 years, a mining engineer in the booming days of South Africa, where he had spent eighteen strenuous years, suddenly broke down. He had numbness and pain in the right side of his head, neuralgic pains in the spine, shoulders, ears, and legs; a throbbing sensation at the umbilicus, anorexia, a paper-white tongue, sleeplessness, tremor, and complete prostration of the mental and physical powers. Rest, feeding, massage, with cool and warm douching, were used for three weeks with good results.

These records illustrate the *irritative* type of neurasthenia. There is also the languid and atonic type, for which a more stimulating hydrological treatment is indicated, and for which cold and hot douches and brief hyperthermal baths may be employed. There is,

The congestive  
type.

further, the *congestive* type, in which an effectual eliminative treatment is required. In truth a toxic condition often underlies all three forms of neurasthenia, and therefore it is that a brief course of waters may properly form part of a much longer tonic and recuperative treatment. Llandrindod and Strathpeffer both offer an appropriate hydrological treatment, combined with a sedative and tonic climate, favourable in conditions of nervous irritation. The baths of Nérís, Schlangenbad, and Plombières are also helpful in this class of cases.

#### VI.—VASOMOTOR DISORDERS

Disturbances of the fine balance of the vasomotor system are doubtless present in all nervous disorders, of which, indeed, they constitute an integral part. Excessive action with vasoconstriction and deficient action with vasodilatation, appear to be attributable not only to affections of the vasomotor centre but to disturbances of the peripheral nerves. Whether the vasomotor centres or the peripheral mechanism be at fault, the result is seen in an irregular distribution of the blood and increase or diminution of blood pressure. These phenomena are often confined to particular areas. What has been called by Solis Cohen "vasomotor ataxia" underlies many of the symptoms of neurasthenia, and may be one of the elements in the causation of neuralgia and neuritis. We recognise constrictor and dilator states. Areas of arterial dilatation may coexist with areas of arterial constriction, as in migraine. It is to vasomotor insufficiency that we must attribute the chilblains and "beefsteak hands" of our younger patients, as well as vascular crises of many kinds, and probably also angio-neurotic oedema and Raynaud's disease in its occasional severe and frequent larval forms.

"Vasomotor  
ataxia."

There is no treatment to which the many and varied forms of chronic vasomotor disorder are so amenable as hydrotherapy. By *plus* or *minus* thermal stimulation we can relax or contract the entire vascular system at will. Experience shows that repeated stimulation of this kind produces a cumulative and lasting effect. Many atonic and spastic conditions respond to appropriate reiterated impressions.

Often amenable to hydrotherapy.

It has long been observed that young subjects of gouty family sometimes exhibit a chronic contraction of the peripheral vessels associated with internal congestions and catarrh. This is probably a toxic vasomotor affection.

*Case 6* is typical of many in which highly stimulating baths are helpful. A young lady, *æt.* 29 years, of gouty and nervous descent, had suffered from congestion of the lungs and recently from menorrhagia. She was stout, anæmic, and a victim to frequent catarrhs. The circulation in the skin was always defective. She complained of sensations of chilliness like cold water or ice upon the body, and muscular stiffness and pains. This patient was treated with hyperthermal baths, rising one degree every day to 115° F., and from two to three minutes in duration.

Affection of peripheral circulation.

*Case 7.*—A married lady of gouty family, *æt.* 45 years, had suffered for many years from indigestion, constipation, headaches and occasional quinsies. Her chief complaints were “poor circulation,” flushing and redness of the nose and hands and catarrhs. Slight exposure to cold produced a painful sensation of chilliness, and blotchy erythemas were common. The organs were healthy, the blood pressure low. This patient derived much advantage from hyperthermal baths at her own home during two winters, from 112° to 115° F. These baths were taken in the reclining position and the chest was only partially covered. Evian water was also taken as an eliminant. Such

Hyperthermal baths.

baths may sometimes, in cases of poor circulation, be pushed to 118° or 120° F. with good results. The brief immersion (one to two, or at most two and a half minutes) gives time for the primary stimulant effects of heat, but not for the later reaction and debility.

Spastic  
arterial high  
pressure.

There are many cases of contracted circulation in older subjects, due to a chronic spastic condition of the peripheral arterioles and accompanied by high blood-pressure, in which the chief indication is to open up the cutaneous vessels. This can sometimes be effected by hot pediluvia, given as at Mont Dore, and sometimes by brief thermal or by more prolonged subthermal baths. Many other spastic conditions, such as vasomotor angina and spastic dysmenorrhœa, can be similarly relieved by baths that restore the normal distribution of the blood by inviting it to the surface. Marked benefit in some cases of high arterial pressure and in the slighter forms of angina may result from prolonged subthermal baths, given as at Leukerbad.

Defective  
vasomotor  
tone.

Hydrological treatment is also of advantage in the contrary condition of defective tone. At the middle period of life, in men as well as in women, a certain climacteric disturbance may manifest itself in many ways. Heats and flushings and erythema and various vascular crises are common in women, and neurasthenia often with labyrinthine disturbance, in men. There may be also in both sexes a degree of thyroidism running on to Graves's disease, especially in women. Cooling hydrotherapy has an undeniable controlling power in these paretic vasomotor conditions. It may, according to individual indications, be employed at home, or at bracing climatic stations, or at spas, preferably in the mountains or in northern latitudes. A course of cooling baths in a northern latitude, with a restful and open-air life, have often proved of benefit in cases of Graves's disease.

### Psychasthenia and Mental Affections

The statement that there is necessarily a mental element in all disease, and that it becomes obvious and practical in many chronic disorders, is almost a commonplace. And yet by some practitioners with a keen eye to physical shortcomings the fact may not be so realised as to make it enter into the problem of treatment.

The converse statement is no less true, that there is always and of necessity a physical factor in mental affections. It is impossible to suppose that the brain as the organ of mind can fail in the balance of its mental functions without some fault in nutrition. Some subtle if unknown change upon the physical side must precede and accompany the mental symptoms.

Physical factors in mental illness.

The mental side of "physical illness" is an old doctrine, which has often been taught and acted upon. There have never been wanting practitioners who held that it was sometimes more important to support, encourage, soothe, or occupy the mind than to deal with physical conditions. This is the true and common-sense psychotherapy, and the province of every medical man. He may not be able directly to change the patient's mind, but he can change the physical and mental impressions to which it is exposed. He can replace them by other and new impressions by his own will and choice. He can cause a new series of perceptions to grow up, with a fresh play of thought and imagination. He can take away the distress of monotony and even alter the whole outlook upon life.

Mental factor in bodily illness.

To the understanding practitioner, who realises and grapples with the mental phases of disease, this is often the best and most hopeful part of his work—most hopeful because sometimes it achieves its purpose in spite of hopeless physical conditions.

Physical factors  
easily over-  
looked.

On the other hand, the physical side of "mental" illness is perhaps more likely to escape recognition. The disturbance seems perhaps out of proportion to any possible bodily trouble. It may be connected with an obscure evolutionary or dissolutionary phase, at puberty or the climacteric, or in the degenerative period; or, in predisposed persons, follow upon shock, emotional disturbance, worry, or strains that are quite easily borne by other people. The scarcity of physical signs seems to afford little justification for physical treatment. If this applies to definite mental illness it is a *fortiori* true in slighter mental disorders.

The physical changes that *precede* the disturbance are usually hidden. Those that *follow* it are generally obvious enough. It is impossible to overlook the reaction of the mind upon the body: the depressed condition of all the functions, digestion, circulation, muscular energy, that accompany melancholia; or the nervous restlessness, exaggerated reflexes and high blood pressure in cases of mental excitement. If the physical factor throughout mental maladies were more generally conceded, physical treatments would be more commonly employed, and by their means a new hope would be introduced.

In this department of medicine, perhaps more than in others, when ordinary remedies seem to fail the door is opened wide to extraordinary ones. Every kind of influence is sometimes brought to bear pell-mell in mental disorder. Psychical influence is brought in to overcome physical obstacles, and physical influences may be unduly pushed against psychical obstacles. Nowhere are the sense of proportion and fine judgment of the physician more necessary. Surely the true doctrine is to recognise frankly the existence of both planes or categories of fact—the parallelism that Hughlings Jackson taught, and to acknowledge a physical cause in all disease. From this it follows



that the practitioner will admit as remedies, in their right place and proportion, all wholesome influences, whether physical or mental, that can either, on the one hand, by the eliminating of toxins or the restoration of circulation and metabolism, contribute to restore the healthy functions of the brain; or, on the other, by instilling true and encouraging thought, lift up or tranquillise the mind. It will be generally admitted that in the treatment of mental maladies but little reliance can be placed on the curative effect of drugs. It is even questionable whether tonics do not sometimes spur exhausted nerve centres, and sedatives add to an existing depression.

Physico-mental  
treatment  
indicated.

At the present time every degree of mental "disability and inability" are commonly met with. They range from "brain-fag," the result of overwork and worry, with combined irritability and depression at one end of the scale, to serious acute and fulminating neurasthenia and psychasthenia at the other. The depressed and irritable mind is as a rule incessantly harping upon one string. How many people habitually follow the lines of one narrow and intense occupation and suffer naturally from *occupation psychoses*. In time they lose the power both of rest and of more extended living. For such persons it is imperative that the "daily round" should at least from time to time be made to cease. Its narrow range of impressions should be replaced by new impressions drawn from a wider field, but not impossible or wholly uncongenial to the individual. The new mental diet may be at first difficult of assimilation and it must be presented in moderate portions and in a digestible form. Hence the varied menu, both physical and mental, of the health resort. Hence also, alas! the tendency for some health resorts, catering for a jaded and narrow appetite, to degenerate on the mental side into a doubtful kind of variety entertainment.

Degrees of  
disorder.

Hydrotherapy  
a valuable  
aid.

In all chronic nervous and mental disorders some simple hydrotherapeutic measures are to be recommended, not indeed as a complete and specific treatment, but as a necessary element in the management of such cases. In these maladies, whether slight or severe, bath treatments in some shape or form go hand in hand with other remedies.

It may be said that there are, or should be, three degrees of hydrological treatment.

The medical  
baths—home  
treatment.

In the first degree, that is in slight cases, recourse should be had to the *medical baths*. Here, under the direction of the patient's own medical man, a suitable hydrotherapy can be given from day to day, without interfering in other respects with the routine of his ordinary home-life and occupations. Undue mental depression and irritability, neuralgias, insomnias and the slighter forms of neurasthenia are examples of the conditions that can be adequately dealt with in this manner.

The health  
resort treat-  
ment.

The second degree of hydrological treatment is that of the *health resort*. Here the patient is removed from his surroundings of home and business; from the narrow and jarring monotonies of his life, and placed in new and favourable surroundings. He is not as a rule separated from his friends, and he enjoys the ordinary social life and recreations. But to these are added such treatment by waters and baths as are appropriate to his condition. There is here not only the removal of reiterated and irritating impressions, but the substituting for them of other reiterated impressions, stimulating or sedative according to the choice of the physician. This change of "atmosphere" is of the essence of health resort treatment. It is powerfully seconded by baths having the same general influence.

In the third degree of hydrological treatment the patient is removed from his daily manner of life

and from his friends, and placed in the rather narrow atmosphere of the *sanatorium*. This mode of treatment should be comparatively exceptional, and reserved for those whose mental and nerve centres are so far disordered as to unfit them for the exertions of ordinary life, or for those in whom mental and physical rest and restoration are imperatively needed.

Sanatorium  
treatment.

In all these three degrees bath treatment directly co-operates. In the first place it is according to its character directly stimulating or sedative; and so reinforces the other elements of health resort and sanatorium treatment. Moreover, like all other good remedies it has also a mental value in the field of suggestion. Under the hopeful influence of the spa physician or in the sanatorium it is, therefore, not only a physio-therapy but a true psycho-therapy.

In consequence of an untoward result of baths in one or a few cases, their use in mental disease has been sometimes discouraged and even discontinued in certain institutions, where they had previously been employed with much advantage. Upon the same principle many drugs and almost every form of treatment, including the surgical treatment of disease, might be abandoned. It has been already pointed out in this work that heat and cold are edged tools, and must be employed with knowledge and discrimination. But with the careful use of the thermometer and with adequate nursing facilities, no risk whatever attaches to the use of suitable baths, even in conditions of great debility.

Risks of baths  
in mental  
cases.

The employment of temperatures at or above blood heat requires much care in any kind of illness. It is only with "hot baths" that any risk is encountered.

Sir Thomas Clouston,<sup>1</sup> whilst admitting that the "ordinary hot bath" had a powerful effect as a sedative and hypnotic, and that in two cases its

<sup>1</sup> In Hutchison and Collier's *Index of Treatment*, 1911.

“sedative effect in an attack of mania was immediate and permanent,” emphasises the risk of fatal cardiac failure. It has been abundantly proved that “thermal debility” and cardiac failure only result from *thermal* temperatures (see Chapter VI), and that baths at *subthermal* and *indifferent* temperatures are on the contrary stimulant to the heart and sedative to the nerve centres.

Value of sub-  
thermal  
baths.

At the German psychiatric clinics the subthermal range of temperature is employed—and the baths are sometimes prolonged for hours, or days. For example, at the Heidelberg clinic Dr. Ernst Beyer<sup>1</sup> prescribed baths maintained at the temperature of 95° F. The patient divides his life between the bath and bed, spending his day in the bath and the night in bed. This procedure is kept up for days or weeks, the meals being given in the bath. He regards observations on the pulse and respiration as unnecessary. Such baths are valued for their sedative influence in mania and in the excitement of alcoholism and of some epileptics, and are found to promote the healing of bedsores. No restraint is used. Similar methods are much employed at Munich, where Dr. Kræpelin frequently prescribes simultaneous cold applications to the head (the so-called “cold turban”) if congested, and cold affusions and rubbing at the termination of the bath.

Rationale.

Experience has proved the sedative and tonic value of subthermal baths. The treatment is still to some extent empirical, as but little is known of the pathology of insane states. A hyperæmic or an anæmic state of the brain is assumed,<sup>2</sup> and according to the doctrine of hydrotherapy these conditions may be, perhaps more readily than by any other means, controlled by

<sup>1</sup> “Application of the Prolonged Bath in the Cure of Mental Disease,” quoted by Dr. H. Sainsbury, *Journal of Mental Science*, vol. xlvi, p. 497.

<sup>2</sup> Review of R. Thompsen in *Journal of Mental Science*, vol. xlvi, p. 596.

baths. Herein lies the rationale of the use of baths in insomnia.

In the milder forms of melancholia enormous benefit is derived in many cases from a course of waters and baths at various spas, chosen according to the physical condition, whether of rheumatism, gout, dyspepsia, anæmia, etc., which commonly coexists with mental symptoms.<sup>1</sup>

Spa  
treatments.

Hot air and vapour baths have been often employed in mental cases. Their effect upon nutrition and body weight has been already referred to (p. 84).

Dr. Robert Jones has favoured the author with the following notes on the results of the Turkish Bath at the Claybury Asylum :—

“ The Turkish bath came into use for the male patients on 11th October, 1910, and for the females on 9th November, 1910. Since then it has been used for 76 female patients on 614 occasions and for 87 males on 720 occasions. The patients have not all been of the most recoverable type. It has not been used by any member of the staff during this period, with the exception of one nurse who suffered for some time from rheumatism of a somewhat chronic character and for which she had been under special medical treatment and had been granted special sick leave by the sub-committee.

The Turkish  
bath in  
mental  
affections.

“ Of the patients, 24 of each sex recovered, a proportion of 27·5% males and 31·5% females, which, considering that many were of an unfavourable type, is satisfactory. The bath has been of great therapeutic value for patients suffering from certain forms of insanity, viz. those of a stuporose and melancholy type in males and those associated with disturbances of the menstrual functions in females.

“ Several patients have referred to its value to them,

<sup>1</sup> Clouston, *loc. cit.*

Sedative  
effect in  
insomnia and  
irritability.

and in more than one instance among women the mental recovery has been attributed by the patient herself to its use. The Turkish bath tends to personal cleanliness and wholesomeness, and it helps to induce an attention to self in those who are heedless and indifferent to personal appearance.

“The inactivity of the skin is well known to be a symptom in many persons who are mentally affected. There are four great eliminating systems in the body: the skin and lungs are two of them, and through these channels the accumulation of fatigue and waste products from tissue destruction may be eliminated. If these channels are inactive, then the accumulated impurities become toxins within the body which must have a deleterious effect upon sensitive nerve structures which really control thought and action. There are two valuable remedies brought into play in the use of the Turkish bath: one the effects of heat which induce a more active circulation in the skin, thus suffusing it with more blood and so aiding elimination; then there are the effects of massage, which is an equivalent to muscular exercise, giving rise to activity of muscles but resting other portions of the body.

“One of the most valuable effects of the Turkish baths is to assist natural sleep without drugs. It certainly is a restorative agent for the irritability and the restlessness of the supersensitive person whose ‘nerves’ are run down; and for these reasons I welcome its use as an aid to treatment.”

It should be observed that although great heat is used in the Turkish bath it is always *followed by cold*. In depressed patients the circulation is often so feeble that cold applications are not admissible until the peripheral vessels have been well opened by heat (*minus* after *plus* bath). In conditions of excitement the state of the circulation is very different.

In mania and delusional insanity heat is often injurious, but local or general cold affusions are often grateful to the patient. At the McLean Hospital at Waverly, in Massachusetts, Dr. Tuttle had a patient suffering from the delusion of demoniacal possession. Realising his improvement under cooling hydrotherapy, he wrote: "Your baths are excellent to reduce cerebral excitement. You can't fight the devil with fire. He is in his element there; but he is mortally afraid of cold water."<sup>1</sup>

Cold baths in congestive conditions.

<sup>1</sup> Hinsdale, *loc. cit.*, p. 43.

## CHAPTER XVII

### CARDIAC AND CIRCULATORY DISORDERS

As in the case of most chronic ailments, so more particularly in circulatory disorders, indications for waters and baths cannot be sharply defined. They depend to a great extent, like the choice of a spa, upon the individual rather than upon the name of his disease. The patient's age and general condition, and especially his degree of reaction to waters and to thermal stimuli, a most variable factor, must all be taken into account.

#### I.—VASOMOTOR DISORDERS

(See also p. 192)

There are various types of vasomotor disorder which are amenable to spa treatment. They are marked by unequal distribution of the blood, areas of congestion and atony coexisting with cold areas of arterial spasm. (1) *Neurasthenic vasomotor conditions*: these are characterised by excessive sensitiveness of certain vasomotor areas. They are common in middle life and at the menopause, especially in gouty subjects. The bath treatment is essentially subthermal and sedative. Quiet sedative spas upon wooded hills, in tranquil surroundings, such as Schlangenbad, Nérès, Royat, Gastein and Buxton, or Bath in winter, are indicated; but very high elevations and high temperatures are to be scrupulously avoided. (2) *Sluggish vascular reactions*, with chilly skin, usually associated with "internal catarrh" and indigestion. Many young persons,

Affections of  
middle life.

Affections of  
young persons.



especially those of gouty or tuberculous inheritance, exhibit this condition, with deficient oxidation and want of bodily heat. Stimulating thermal applications (both cold and hot) are here indicated, especially peat baths (Schwalbach, Marienbad, and Strathpeffer), and hot and cold douche baths and brief hyperthermal baths. (3) *High arterial pressure*, either from *hypertonus* or early arterio-sclerosis. Arterial hypertension of toxic origin, alimentary, gouty, or due to tobacco smoking, or to renal inadequacy or nephritis, may often be relieved by hydrological treatment directed to its cause. In stout and plethoric subjects sulphated or alkaline waters are indicated (see Chapter XI); in dyspeptic or gouty individuals of a spare habit, the muriated waters may be beneficial. A certain risk attaches to the use of waters in high blood pressure (see Chapter V). The rule of safety may be stated in a few words: elimination must at least keep pace with absorption and it is better that elimination should lead the way.

Treatment of  
toxic condi-  
tions.

In many cases of abnormal arterial pressure there is widespread functional hypertonus. The high blood pressure is in fact spastic. In this condition there is often a toxic factor of some kind and a judicious use of waters may be advisable. In persons of a certain inherited constitution, towards middle life the blood pressure begins to mount, without obvious hyperpiesis or gouty or other toxic irritation of the vasomotor system. Rest, the exhibition of iodides and mercurials, and dieting may alike fail to arrest it. It would be highly injudicious to submit such a case to medicinal waters without a preliminary reduction of pressure. It is especially in this type of high blood pressure that *venesection* is, in the author's belief,<sup>1</sup> eminently beneficial. Spastic hypertension, with or without an initial venesection, is often amenable to subthermal baths

Spastic high  
blood pressure.

Venesection

<sup>1</sup> See *Lancet*, 1911, vol. ii, p. 1258.

and douches. The temperature and duration must be accurately adjusted to the individual reaction. Subthermal and sedative spas are always to be preferred for such cases—Schlangenbad, Wildbad, Aix-les-Bains, Buxton, etc.—avoiding any considerable elevation above sea-level. Prolonged baths and effervescing baths may sometimes be used with advantage. A systematic course of hyperthermal pediluvia acts upon the same general principles. It relieves spastic high blood pressure by bringing about general vasodilatation.

Persons affected with high arterial tension often derive benefit from diuretic waters (see Chapter XI). The calcareous waters of the Vosges Spas, Vittel, and Martigny, those of Bath and Strathpeffer, and the “indifferent” waters of Evians on the Lake of Geneva, are all powerful renal eliminants and helpful in these cases.

## II.—SUB-INFLAMMATORY CONDITIONS OF THE SUPERFICIAL VEINS

Periphlebitis and phlebectasis, usually of a gouty origin, are frequently met with at the spas, and often require careful handling. Any active thermal treatment, especially if combined with massage, is apt to precipitate focal phlebitis. In all sensitive and sub-inflammatory states of the veins, only the most sedative baths and applications are admissible, but eliminative treatment is usually indicated. Much resort is made for varicose veins to Bagnoles d’Orne, and mud baths are also considered useful for their pressure effects.

Gouty  
affections of  
veins.

## III.—CARDIAC AFFECTIONS

The large number of persons seeking treatment for “heart affection” at the spas may be conveniently divided into three groups.

1. There is, first, the large group of sufferers from *secondary cardiac disturbance*—palpitation, breathlessness, oppression, perhaps pain, with a heart embarrassed, it may be by dyspepsia, chronic inaction of the liver, constipation and backward pressure (or the reflex effects that amount to those of backward pressure) or neurasthenia, to which must usually be added the *fear* of heart disease.

Heart disturbance and its treatment.

In all such cases a confident prognosis can be given, and the appropriate treatment for the underlying dyspepsia, neurasthenia, etc., can be prescribed, including usually tonic baths, walking exercise and gentle hill-climbing, which is a reassuring treatment.

2. In the second group the heart disorder forms part of a *general vasomotor disturbance*. In one form or another this is not uncommon in the middle period of life in both men and women, and may assume an alarming form, as in Graves's disease. The nervous mechanism of an otherwise healthy heart is disturbed at a time of life when strain and shock coincide with natural epochal changes. The two factors of treatment should be (1) mental and physical repose, and (2) some form of cooling hydrotherapy (Chapter VII), such as salt or effervescing baths and local applications. It has been well said that cold is the digitalis of hydrotherapy. With these should be combined an open-air life and an unstimulating diet.

Nervous disturbance of heart.

3. The third group is that of the *intrinsic heart affections*.

It cannot be too clearly stated that no treatment by waters or baths of any kind should be employed in the presence of active or recent morbid changes in any part of the heart. It is contra-indicated, for example, in the case of recent rheumatic carditis, whether the part affected be the pericardium, the muscular wall or the valves. Such a condition demands, above all else, rest. On the other hand, when there is reason

Contra-indications.

to believe that the active process has entirely subsided the presence of valvular defects is no bar to the use of baths. But it should be remembered that persons suffering from any weakness of the heart are peculiarly liable to suffer from the debility that follows repeated thermal applications. Hence it is that in all forms of heart affection the temperature of the bath should seldom equal that of the blood, and never exceed it. In all such cases only subthermal bath temperatures are admissible, that is to say, having the skin temperature ( $93^{\circ}$ ) as a middle point and for extremes  $80^{\circ}$  and  $98^{\circ}$  F.

Liability to thermal debility.

Among definite disorders of the heart the first place must be given to rheumatic carditis. At most of the spas there are, however, many cases of toxic, gouty, influenzal, malarial, or other myocardial affection, and also cases of fatty or fibrous degeneration forming part of a widespread degenerative change.

The use of waters in heart cases.

Here again, especially in the beginnings of heart trouble, eliminative waters may play a part by controlling the rheumatic or toxic invasions and so striking at the root of the disorder. The advisability on general grounds, and as a preventive measure, of submitting all patients convalescent from acute or subacute rheumatism to an appropriate course of waters has been already referred to. Mild purgative and diuretic waters are usually helpful. Certain springs, for example Harrogate and Llangammarch, are believed to have a definitely tonic effect on the myocardium in virtue of the barium chloride which they contain.

With reference to bath treatments there is a considerable choice, and here the influence of *climate* ought to be taken into account (see pp. 124 and 143 *seq.*). For some heart cases a warm and sheltered spa, for others a more stimulating and bracing air with opportunity for systematic exercise, is desirable.

The effect of subthermal douches in cardiac dis-

orders following upon acute rheumatism has been carefully set forth by Dr. L. Blanc, founding himself upon prolonged experience at Aix-les-Bains.<sup>1</sup> He employed douches at very low pressure, the hot and cold supplies being mixed to the required temperature (90° to 95° F.) in an open *boîte de mélange*, from which the water poured in a large unimpeded stream over the patient, seated or reclining. This was accompanied by gentle massage of the body, and continued for five, eight, or ultimately ten to fifteen, minutes. *The absence of mechanical shock and of thermal stimulation* was regarded as essential. Following the douche the patient was placed in a cool wrapper and carried to his bed for at least one hour's rest. The use of "packs" and hot blankets (*maillot*) was regarded as injurious and even dangerous. In practice such baths increased the cardiac impulse and notably dilated the surface vessels, the pulse increasing in volume and resembling that of aortic regurgitation. There might be in the first week a recrudescence of rheumatic symptoms and some increase of cardiac excitement and pulsation, but this generally soon passed off. In the words of Vidal, "the temperate douche is sedative."

Sedative douches and their action in rheumatic cases.

A similar treatment by douches without either *pressure* or *heat* was introduced at Strathpeffer in 1886,<sup>2</sup> and given in a reclining and restful posture with gentle massage. Their tonic and sedative effect on the heart, even in conditions of great cardiac weakness and irritability, are unquestionable. (See Chapter VIII, p. 72, "The Subthermal Douche.")

Immersion baths at suitable temperature are equally applicable. The *salt*, and especially the effervescing bath, set up a more active and continuous peripheral stimulation, and should, therefore, be given at lower

Salt and effervescing baths.

<sup>1</sup> *Cardiac Affections of Rheumatic Origin.* (Churchill, 1887.)

<sup>2</sup> See *Strathpeffer Spa, its Climate and Waters*, p. 75. (3rd edn. 1896.)

temperatures than ordinary baths. The practitioner will in every case observe for himself the effect that is produced. The change in the character of the pulse and of the cardiac systole is often remarkable. A small and frequent pulse often becomes after a few minutes' immersion large and full, whilst the heart's action becomes stronger and slower. An account of these baths and of their employment in heart affections has been given in a previous section (see Chapter XII). Grave injury may be done by over-heating or fatiguing the patient in these cases. No hot bathing sheets, close dressing-rooms or the slightest agitation, hurry, or subsequent exertion are permissible. The influence of season and of climate, and the question of travelling, as affecting the use of baths, have been already alluded to.

The place of muscular exercise in heart affections.

Many cases, in which the heart weakness is not serious or advanced, benefit from various forms of *exercise*. Dr. William Stokes<sup>1</sup> first called attention to the value of muscular exercise in the treatment of heart disease:—

“The symptoms of debility of the heart,” he says, “are often removable by a regulated course of gymnastics or by pedestrian exercise, even in mountainous countries such as Switzerland, or in the Highlands of Scotland, or Ireland. We may often observe in such persons the occurrence of what is commonly known as ‘getting the second wind’—that is to say, during the first period of the day the patient suffers from dyspnœa and palpitation to an extreme degree; but by persevering, without over-exertion or after a short rest, he can finish his day's work and even ascend high mountains with facility.”

The resisted movements employed at Nauheim, Hom-

<sup>1</sup> *Diseases of the Heart and Aorta*, p. 357. (Dublin, 1854.)

burg, and elsewhere, are adapted from the well-known system of Swedish gymnastics, in which the muscular exertion is carefully graded by the hand of a skilled attendant. A more active form of exercise, without the same nicety of gradation, is provided by the appliances of mechanotherapy. At many continental spas various apparatus, like those of Zander, with weight resistance, are employed, as at Aachen, Wiesbaden, Baden-Baden, Wildbad, Karlsbad, Vichy, etc. Mechanical treatment of this kind may easily be overdone. Lastly, the graduated walking and climbing exercises, the so-called "terrain" cure, have a wide application in slight cases, especially at bright and bracing health resorts, of low or medium elevation, in fine air and on wooded hill-sides, as at Reichenhall, Baden-Baden, Meran, etc. Slow walking and climbing exercise, carefully graduated to the individual's condition, can be recommended for cases of feeble and "flabby" heart, in which the blood is apt to accumulate in the veins. Such exercise attracts the blood into the muscles and deepens the breathing. Muscular exercise is considered by some authorities to constitute by far the most powerful cardiac stimulant at our command. "Compared with it digitalis, strychnine and alcohol are as nothing."<sup>1</sup> It must be added that in many cases all forms of exercise are inadmissible, for which baths may yet be helpfully employed.

Zander  
exercises and  
terrain cures.

The author would here subjoin a series of **Rules of Practice and Practical Observations** from his own experience with reference to the treatment of patients by baths—

- (1) Before baths of any kind are employed an *examination of the cardiovascular system* should be made, and a general view arrived

<sup>1</sup> Dr. Harry Campbell: *Journal of Balneology and Climatology*, vol. ii, p. 169.

Rules for bath treatment.

at as to its structural and functional condition. The effect of the baths on the circulatory organs must be carefully watched throughout the treatment.

- (2) *Age and Sex.*—In children and in advanced life extreme temperatures should be almost always avoided. Baths at or near the point of thermal indifference are well borne in the old, and are often very beneficial. The same rule applies to women at the climacteric epoch. No mineral baths should be used during the menstrual period.
- (3) *The effect* of every bath, of whatever kind, is, in each particular case, either sedative or stimulant. The alternative will often depend on a very narrow range of temperature or duration, or even on the condition of the patient as affected by the time of day, the taking of rest, food, etc. It is, therefore, needful to discover and utilise the means by which the desired effect can be obtained, especially in cases of circulatory disorders.
- (4) *The duration* of thermal baths and the length of the course must be regulated with care. They must never be so prolonged as to cause marked or persistent debility.
- (5) As it is the tendency both of mineral waters and baths to increase congestion or inflammatory reaction in affected tissues, *they must never be employed in febrile or inflammatory states.* The *primæ viæ* must be opened and visceral congestions and other acute derangements removed where necessary to preliminary treatment.
- (6) A certain recrudescence of symptoms in the affected parts is to be looked for as the natural effect of spa treatment. Within certain limits



it is a favourable sign. The slow chronic action is replaced by a more acute phase of disturbance. When this presently subsides under the continuance of treatment a healthier action follows. In this sequence lies a principle governing the treatment of all chronic maladies. If the recrudescence of symptoms should be early or severe the treatment must be modified or intermitted, and baths given less often or somewhat cooler (less stimulating). The thermal reaction, marked by circulatory and nervous debility, that follows too prolonged or over-stimulating a course of baths is carefully to be avoided.

Rules for bath  
treatment.

- (7) The amount of *physical exercise* permitted during the course of baths must be regulated for each case. In all cases of debility every exertion after the bath must be avoided, even that of dressing and the use of stairs. The sedative effect of baths in circulatory affections is frequently neutralised by subsequent fatigue. The patient should be comfortably wrapped, and rest in a cool dressing-room. The hot pack (French *maillot*) must not be used where a sedative effect is desired.
- (8) The *after-treatment*, following immediately upon a course of baths, is a matter of consequence in many cases. In some a complete rest may be necessary, in all some degree of bracing is advisable. A week or two spent in some exhilarating climate among the hills or at the seaside, with pleasurable recreation, but without over-excitement or fatigue, should be prescribed in all cases, in which a course of treatment has been taken for serious organic or functional malady.
- (9) The *local employment* of balneary remedies has

an important place in spa treatment. In many localised diseases (*e. g.* many cases of degenerative arthritis) a purely local thermal application is often beneficial when general thermal treatment is unnecessary or contra-indicated. The same applies to some conditions of debility, and to many cases in advanced life, for which a local application of heat may prove quite as stimulating as a general application would be for robust persons.<sup>1</sup>

<sup>1</sup> See *Encyclopædia Medica*, vol. i, article, "Balneology," p. 444. (Edinburgh, 1899.)

## CHAPTER XVIII

DYSPEPSIA, CONSTIPATION, GLYCOSURIA, OBESITY, KIDNEY AFFECTIONS, ANÆMIA, CATARRH, TUBERCULOSIS, SYPHILIS, MALARIA, SKIN AFFECTIONS, OVARIAN AND UTERINE AFFECTIONS, CONVALESCENCE, OVERSTRAIN, INCIPIENT DISEASE, TRAUMATISM, MALADIES OF OLD AGE

DYSPEPSIA due to excessive or over-stimulating food and insufficient exercise may be corrected by a course of eliminative waters and baths, always combined with appropriate diet and regular exercise. The more or less purgative waters of Harrogate, Karlsbad, Marienbad, Homburg, and Brides-les-Bains, and the alkaline waters of Vichy and Vals, are often helpful. The latter spas are particularly indicated in hyperchlorhydria and in gouty and hepatic dyspepsia.

Dietetic  
dyspepsia.

In atonic, catarrhal, and nervous dyspepsias, on the other hand, milder waters are indicated. For neurasthenic individuals simple thermal spas may be recommended, at a moderate or sub-alpine elevation, or among quiet wooded valleys, such as Schlangenbad, Plombières, Buxton. Sometimes weak muriated waters (Llandrindod, Baden-Baden), or sulphuretted waters (Strathpeffer), with the fine air of these spas, are of service in gastric catarrhs: or an effervescing alkaline-muriated thermal water, such as that of Ems, which is a warm place, or that of Châtel-Guyon or Saint Nectaire, more bracing stations, in the Auvergne Mountains. In dyspepsia with anæmia an effervescing

Nervous and  
catarrhal  
dyspepsia.

chalybeate may be prescribed, especially if at a high elevation (Spa, Schwalbach, Royat, St. Moritz). Tonic baths, such as needle douches or alternating ("Scotch") douches, and regimen may properly be associated with waters in the depressed conditions of health that accompany all these forms of dyspepsia.

Hepatic  
dyspepsia :  
gall-stones.

In obese and congested persons, with enlarged liver, with or without gall-stones, a course of alkaline waters is often beneficial, as at Vichy and Vals. The sulphated alkaline waters of Karlsbad enjoy a good reputation in cholelithiasis. Karlsbad, Kissingen, Harrogate are much resorted to for catarrhal jaundice and "inactive liver" and hæmorrhoids. Chronic hepatic derangements, such as follow residence in the East, are much in evidence at the Bohemian spas (Karlsbad, etc.), and often benefit by the mild muriated springs of Leamington. The passage of gall-stones, as of urinary calculi, is not uncommon during a course of spa treatment.

Constipations,  
atonic and  
spastic, are  
relieved by  
surface treat-  
ments.

The treatment of constipation must be directed to its cause, whether waters, baths, or other remedies be in question. The indications for the atonic form of constipation are the same as for atonic dyspepsia, supplemented often by cold sitz baths, douche baths, massage, and exercises. There is, on the other hand, an equally common form of constipation in which there is chronic fullness of the splanchnic area and a spastic and irritable condition of the colon. This is often aggravated by ordinary tonic measures. It may, however, sometimes be relieved in a remarkable way by a more sedative form of bath. The sub-thermal baths of Plombières or the flowing "decongestive" baths of Châtel-Guyon allay irritation, and at the same time open up the peripheral circulation. Repeated hot and very hot sitz baths are also useful in this form of constipation. The irrigation of the

colon by means of medicinal waters, sometimes described as the "Plombières treatment," and widely used in what has been termed "muco-membranous colitis" is helpful where the colon is atonic and in a loaded condition. Many constipated subjects are benefited by copious injections (2 to 4 pints) of ordinary water, repeated every two or three days. The catarrhal irritation of the colon, with recurrent painful "colic," which is so often the result of chronic constipation in neurasthenic subjects, is usually a spastic condition, and is often relieved by such baths as those above mentioned. But in these and many other ailments having a nervous factor hydrological treatment should be rather directed to the nerve centres, through the skin. Hence in part the value of thermal waters and baths in sub-alpine stations, such as Gastein.

Many cases of glycosuria of a gouty type in stout or robust subjects are benefited by a course of waters, especially of the alkaline or muriated class—Vichy, Neuenahr, Contrexéville, and Llandrindod. For more delicate subjects the thermal waters and baths of Royat, Buxton, La Bourboule are by preference indicated. Some elderly diabetic subjects do well at Homburg, and gouty subjects (see Chapter XIV), whether thin or stout, can generally take sulphided waters with advantage. As the gouty condition subsides the glycosuria often diminishes or disappears. In the diabetes of young subjects all medicinal waters and baths are contra-indicated.

Glycosuria.

Obesity in subjects of a florid and plethoric habit, with habitual over-feeding and hyperactive digestion, is often amenable to a course of eliminative waters, combined with rigid dieting and exercise. Such is the treatment at Marienbad, Karlsbad, Kissingen, and Brides-les-Bains. Alkaline waters, like those of Vichy, are also helpful in some cases. Where the heart is

Obesity,  
treatment by  
waters, baths  
and exercise.

sound, a course of natural vapour baths, as at Plombières, promotes the eliminative action. Another type of obesity is seen in anæmic subjects, often with weak cardiac action. The salt waters of Brides are not contra-indicated for these cases, and they may be combined with a course of tonic effervescing baths. Cool and cold baths and douches may be employed in obesity, for their powerful effect in promoting circulation and tissue change. High and bracing resorts are also chosen for the same reason. At many stations systematic walking and climbing exercises are prescribed for obese persons, as at Marienbad, Baden-Baden, Reichenhall in the Bavarian Alps, Brides and Pralognan. Systematic exercise, especially at elevated and bracing places, is a valuable aid to the balneary treatment.

Kidney  
affections.

The development of nephritis can sometimes be postponed for many years by appropriate hydrological treatment of the gouty condition. The existence of albuminuria does not contra-indicate the moderate use of waters if the total quantity of urine passed is not already excessive. If casts are present, waters should be used, if at all, with great caution.

In gouty kidney, with a tendency to hydræmia and dropsy, medicinal waters appropriate to the gouty condition (Chapter XIV) are sometimes beneficial, if the *primæ viæ* are kept freely open. Waters containing considerable quantities of chloride of sodium are however contra-indicated in such cases, but diuretic (sulphided and calcium) waters may be cautiously taken.

Renal calculi :  
cystitis.

For renal calculi, whether of uric acid or oxalate of lime, the diuretic waters of the Vosges (Contrexéville, Martigny, Vittel) and Wildungen in Germany, are much resorted to (see p. 117), and such calculi are frequently passed during the treatment. For persons of a plethoric or constipated habit the purgative

sulphated waters of Karlsbad and Marienbad are preferable. The diuretic waters of the Vosges and of Evian are beneficial in the case of insufficient renal action with consecutive toxæmia and high arterial pressure; also in some cases of pyelitis and cystitis. Cystitis of a gouty and congestive type should, however, be referred to alkaline waters, such as Vichy and Vals.

The anæmia commonly associated with digestive disorder in young subjects is often amenable to spa treatment. If there is also constipation and portal congestion, a short course of sulphated or salt waters like those of Franzensbad, or Brides-les-Bains, or of sulphuretted, or salt-sulphuretted waters, like Strathpeffer, Harrogate, or Llandrindod, may be advantageously prescribed. In delicate subjects showing a tendency to gastric or other catarrhs the salt chalybeate waters are more appropriate, such as Cheltenham, Homburg, or Royat. For these and for many other slight symptomatic anæmias, effervescing carbonated chalybeate waters, such as those of Spa, Schwalbach, and St. Moritz, have been long employed, both internally and as baths: also certain ferruginous and arsenical waters at high elevations, like La Bourboule and Roncegnon. As a rule, only slight cases with fair power of reaction should be sent to elevated stations. The treatment of possible toxæmic causes, such as tuberculosis, malaria, and chronic pus formation should not be overlooked. Lastly, tonic measures and regimen, including cold douches, friction, and brief hyperthermal baths, are often as helpful as waters in anæmia and chlorosis. (See "Chalybeate and Arsenical Waters.")

Anæmia.

For young subjects in the pre-tuberculous and "tuberculisable" stage, the object of treatment is to restore the normal resistance of the tissues to the invasion of the bacillus. In particular the respiratory

Tuberculosis,  
threatened or  
actual.

mucous membranes may be fortified and recurrent catarrhs prevented. In addition to hygienic and dietetic methods, and the recourse to marine climates, hydrotherapy is of much value.

The tonic value of cold, especially in the early stages of tuberculosis, has been recently emphasised by Winternitz.<sup>1</sup> Basing himself on the cardinal importance of predisposition in the development of tuberculosis, the veteran professor advocates cooling procedures, by spongings, compresses and douches, in order to strengthen the organism, augment the power of resistance in the tissues, improve digestion and circulation, deepen the breathing and prevent fever and night sweats.

A tonic spa treatment, with mild muriated chalybeate or arsenical waters may be given in early cases or in "scrofulous" subjects. The same treatment can be employed where the bones, joints or lymphatic glands are already affected with tuberculous disease, provided that the latter is definitely local and non-febrile in character. Certain spas have enjoyed a considerable reputation in dealing with "scrofulous" affections. Brine baths and other external applications are employed at Bex, Salsomaggiore, Kreuznach, Salies-les-Béarn, and at the "Limans" on the Black Sea coast, as well as salt sprays and pulverisations for the respiratory passages. The catarrhal conditions so commonly met with in chronic afebrile phthisis may sometimes be relieved by the "sedative" inhalations and fine sub-alpine climate of Mont Dore (3440 feet). In young subjects catarrhs of the nasopharynx may be treated by arsenical muriated waters and sprays at La Bourboule. Older subjects in whom the mucous membrane of the larynx is similarly affected (*e. g.* "clergyman's sore-throat"), often resort to Cauterets or Luchon, in the Pyrenees, or such

<sup>1</sup> W. Winternitz in *Tuberculosis*, No. 10, Oct. 1911.



muriated waters as Ems. At Mont Dore the treatment is assisted by "derivative" footbaths at hyperthermal temperatures. For bronchial catarrhs in gouty subjects the only appropriate treatment is that of the underlying condition. (See "Gout.")

With reference to pulmonary tuberculosis Braun<sup>1</sup> long ago bore witness to the "incomparable efficacy" of baths of an indifferent heat in relieving nervous irritability and febrile disturbance.

The mercurial treatment of syphilis may in many cases be suitably combined with a course of sulphur waters and baths (see "Sulphur Waters"), especially where it is desired to obtain a rapid and intensive action. Where there is considerable constitutional disturbance and anæmia, a bracing spa, such as Luchon or Uriage may be preferred. The baths and mercurial inunctions at Aix-la-Chapelle (Aachen) and Wiesbaden can be taken at any period of the year. Syphilis.

Cases of malarial cachexia and anæmia, from long residence in tropical countries, are often benefited by waters and baths, varied according to individual indications. In delicate and anæmic subjects a course of subthermal baths at a considerable elevation, such as Plombières or Wildbad, may be preferred. For cases with hepatic and splenic enlargements the Bohemian spas, and especially Karlsbad, have a high reputation. In malarial anæmia bracing climates and chalybeate or arsenical waters may be helpful (Schwalbach, La Bourboule). Malaria.

Among common functional disorders, the chronically inactive, torpid and often chilly skin, with poor peripheral circulation, requires an active thermal treatment. Brief hyperthermal sulphur or peat baths, Skin affections  
eczema, etc.

<sup>1</sup> *Loc. cit.*, p. 554.

from 105° F. upwards, and the alternating douche, are very helpful. Hot air and especially vapour baths remove epidermic and glandular accumulations. For the ill-nourished and senile, dry or atrophic skin, soft, peaty, alkaline, sulphur and silicated baths may be employed, as at Strathpeffer, Cauterets, Bagnères de Bigorre, Plombières, Bains-les-Bains. Sulphuretted waters are peculiarly appropriate to many skin affections. The most intractable cases of diffuse generalised chronic eczema have yielded to a long course of sulphur waters and baths at Strathpeffer, and never recurred. In many forms of irritable gouty eczema, so common at the climacteric, alkaline or sulphur baths at an indifferent heat may be used with benefit (Strathpeffer, Royat, Schinznach). For localised and dry eczemas higher temperatures are employed. Psoriasis and ichthyosis and dry chronic eczema and pruritus may be relieved by hot sulphur baths, or by prolonged subthermal baths, as at Leukerbad. Acne and furunculosis and "scrofulous sores" are also amenable to sulphur waters, but may exhibit temporary exacerbations under their use. (See "Sulphur Baths.")

Diseases of  
women.

Conditions of vaginismus and dysmenorrhœa in early married life, the symptoms of a general irritation and neurasthenia, are sometimes notably benefited by recourse to sedative baths and climates, such as Nérès, Schlangenbad, Buxton (see "Subthermal Baths"). The soothing effect of the baths and the enforced and complete rest, alike of the nerve centres and of the affected organs, are the operative factors.

Another essentially congestive and sometimes gouty condition is met with in rather older subjects towards middle life. Cases of menorrhagia with chronic congestion of the uterus, sometimes with old pelvic exudations and sometimes with commencing fibromyoma, have been for many years treated by muriated

waters and baths, as at Kreuznach, and often with benefit. Similar baths are given at Woodhall Spa. For others, the sulphated alkaline waters and peat baths of Franzensbad give better results.

Spa treatment is often sought for the common sub-inflammatory and catarrhal conditions of the pelvic organs, chronic leucorrhœa, and endometritis. Of these sterility is a usual and obvious result. Muriated waters may prove beneficial for such complaints, and such patients may be recommended to La Bourboule, Saint Nectaire, Kissingen, Saint Sauveur, and Ems. The two last-named spas have acquired some reputation for the successful treatment of sterility. A more active resolvent thermal treatment is sometimes helpful, as at Dax and Franzensbad.

Sterility.

Protracted convalescence, both in young subjects and in later life, may often be assisted by a tonic course of waters, especially at bracing spas. The recurrence of acute rheumatism or influenza is often prevented by a mild eliminative and stimulant treatment (Strathpeffer, Llandrindod, Homburg, Châtel-Guyon). Chalybeate waters and baths are indicated in anæmic conditions (Schwalbach, St. Moritz).

Convalescence.

Many persons in middle life under habitual overstrain best maintain average health by an annual resort to the spas of the type just mentioned. Many others, showing signs of incipient nervous, circulatory, or renal disease or various toxæmias, may often by means of appropriate hydrological methods effectually postpone more serious developments.

Overstrain of middle life.

In all such cases any treatment by waters and baths, should, if possible, be given in the pure and invigorating air of northern or sub-alpine stations.

At some of the French and Italian spas, inflammatory thickenings, contractions and adhesions resulting

Results of traumatism.

from wounds and injuries, are submitted to a course of thermal treatment. Increased tissue change, which probably becomes more active in partially or recently organised tissues than in healthy parts, and the heightened power of absorption from stimulation of the arterial and lymphatic circulations, no doubt explain the good results obtained. Old effusions and adhesions can be treated in the same manner.

Old age,  
premature  
failure of  
function.

Many persons of advancing or advanced age suffer from chronic failures of function, comparatively slight, it may be, but sufficiently well marked to depress the active powers and destroy the sense of well-being in life. Added to these numerous cases of mere disorder, there are, of course, in this period of life the various degenerative or commencing organic maladies which belong to age: which are often, however, very gradual in their onset, and which may be by appropriate treatment long held at bay.

How is this good object to be accomplished? How can not only life itself be prolonged to its normal limit, but the powers and pleasure of life—a reasonable degree of health and vigour—be maintained and preserved? The problem belongs to a somewhat advanced period of civilisation. It is a daily recurring question in the medical practice of our time.

The increasing distrust and disuse of powerful drugs in advanced life, and the general adoption of artificial teeth, are both obviously beneficial from this point of view. The return to mild and simple remedies for the ailments of declining years, greater care in hygiene and regimen, the power conferred by the dentists of continuing to take a stimulating and supporting diet, and lastly, the growing habit of locomotion, the result of improving travelling facilities, are all factors of modern life favourable to length of days and preservation of health.

All of them, happily, do much to *prevent* the disorders of advancing age and to *postpone* inevitable decay. But what if the disordered process has been already set up, or the premature degeneration has commenced? On what agencies can we then rely for treatment? What therapeutic methods afford us the best hope of restoring healthy action to disordered functions or tissues?

The answer to these questions depends on our view of the chief characteristics of senile change. Is it not marked by an absence of inflammatory reaction? Is not the process, to use an old expression, an asthenic one? Above all, is there not a proneness to degenerative change, to obliteration of vascular supply, to diminished oxidation in the tissues, and to a slow and languid condition of circulation, of digestion and of elimination? Does not this promote faults of metabolism, as well as retention and deposit of waste products, especially in areas of defective blood supply?

It is obvious that a treatment applicable to acute congestive or inflammatory disorders would be inappropriate to conditions such as these. They demand, on the contrary, a gentle, a prolonged, and in a certain degree a stimulating, treatment. It must be *gentle*, for very "active" treatment in the old commonly causes more disorder than it cures: *prolonged*, because the morbid conditions to be met are of a slow and progressive character: and *stimulating*, because these senile changes imply states of depression.

Such a treatment belongs *par excellence* to the health resort, to the climatic station, and especially to the well-appointed spa. In the discriminating use of waters and baths, with appropriate dietetic and hygienic measures, are included all its needful requirements. What may, for brevity's sake, be termed *spa treatment* may be gentle, prolonged, and stimulating in its action. At the same time, it brings to bear very

Stigmata of senile ailments.

The kind of treatment required in old age.

powerful influences upon the body: and it has as necessary accessories absence from home surroundings, change both of scene and climate, and a comparatively open-air life.

The question  
of travelling.

For some elderly persons long journeys are impossible or inadvisable. On the other hand, mere distance is of little consequence if the journey can be taken in comfort. In that case even night travelling is not usually objectionable. Indeed, with the present railway facilities night travelling is preferable to breaking a long journey, on the principle that for the elderly invalid *one* setting out is preferable to *two*. Many old people travel very well, if care is taken to provide their usual meals. The incessant change of air stimulates them, and they are often refreshed by long journeys. Sea passages are to be deprecated from their obvious risks of cold and exposure. The same applies to all railway journeys involving long delays, change of carriages, or unsatisfactory arrangement for meals.

Type of  
climate that  
is most  
beneficial.

For a considerable proportion of elderly invalids and delicate persons only temperate climates are well adapted. Therefore in the summer sojourn at the health resort, whether for waters and baths or only for "change of air," such persons should not be subjected to any extreme climatic influences. Excess of heat, and any abrupt or extreme change of temperature are by them badly borne. As a rule they must avoid exposed and windy places and high elevations, as well as close and ill-ventilated valleys. Dust and dryness of the atmosphere are obnoxious to them, and more to be avoided than moisture.

For this class of patients the spas and climatic health resorts of the British Islands, as well as a certain number of rather sedative continental stations, are especially appropriate. The winter resort should, of course, afford a fair proportion of warmth and sunshine,

although the lower range of temperature in winter is favourable, not only to healthy, but to many invalid persons. The sequence of the seasons should not be shunned overmuch. It may, indeed, be questioned whether it is wise to exchange our own country for a warmer one *for the entire winter*, unless perhaps for some respiratory affections.

Let it be assumed that the patient has arrived at some suitable climatic station equipped with an adequate establishment of baths and medicinal waters. The first of all requisites is one day, or it may be many days, of complete *rest*, for the natural adjustment to change of climate and surroundings. If waters are then prescribed, no large or strong doses are admissible; no disturbance of digestion is to be risked. No sudden changes must be made in diet or in the principal meal hours, although it will usually be found that less alcoholic stimulant is required than was the case at home. A moderate and cautious *change of diet* is usually beneficial, as well as a gradual lengthening of the intervals between meals. No exertion must be permitted when fasting, and therefore care is necessary in adopting the usual early hours for "taking the waters." A first dose taken hot in the bedroom often enables the patient to rise and take a second in the open air. It is sometimes very cheering to an elderly invalid to find himself able after a while to join the throng at the springs before breakfast. The fresh morning air and the mental exhilaration are a good beginning for his day, and often worth the trouble of a subsequent rest.

The case may be of a kind to require treatment by baths. Baths of various kinds are indeed remarkably well borne in advanced life, and in many conditions of debility: and when properly adapted to the case and skilfully administered are productive of much benefit. It needs not to insist that, of course, great care is

Rules for  
treatment of  
elderly patients.

Cautious use  
of baths.

always indispensable. An accurate prescription must be accurately followed. There must be no haste or bustle or excitement. It is obviously needful that the spa practitioner should himself regulate treatment of this kind in its every particular, and only resign its actual administration to well-trained and competent attendants. The latter must not quit the patient until he has left the bath, and is comfortably resting in a cool dressing-room. It is often advisable to give the patient, wrapped in a blanket, a similar brief rest *before* entering the bath.

The kinds of bath that are most helpful.

Certain practical rules for the use of baths in elderly and debilitated subjects will be borne in mind by the experienced practitioner. He will remember that neither *hot* nor *cold* baths are ever applicable to the old; that no sudden alterations of temperature are admissible, nor any mechanical shocks. Transitions of temperature must be gradual and not exceed about 20° F.; and mechanical stimulation, whether with the *douche* or the hand, must be with water at low pressures, and gentle and continuous rather than abrupt. Manipulation baths, such as the various forms of *massage-douche*, are very often used with advantage. The same applies to the immersion bath at a temperature slightly below that of the blood. It may be doubted whether *prolonged immersion baths* are sufficiently used in this country. It is sometimes helpful to the patient, even in advanced years, to place him, for one or more hours every day, in an atmosphere of water. In this case the temperature should be indifferent, say 90° to 93° F. Thermal baths (temperature above 95°) should, on the other hand, always be brief, and more and more brief, with increasing temperature, as well as with advancing years.

The object of these baths.

Speaking generally, the object of bath treatment in later life may be stated to be to regulate and equalise the circulation, to act upon the nervous centres both



as sedative and stimulant, and to stimulate also the glandular and eliminative functions, including those of the skin.

Experience has shown that wasting, decline of oxidation, failure of the vegetative functions, may, in an early stage of the downward career, respond in a remarkable manner to the massive stimulation of appropriate bath treatment. Here, also, the favourable results obtained must be attributed to the effect produced at the periphery on the circulation and nervous system.

## CHAPTER XIX

### THE PROVINCE OF THE SPA PHYSICIAN <sup>1</sup>

The priest-physician and the supernatural."

WHEN the invalid in early classical times made his way in search of health to medicinal springs, he often found erected in their proximity a temple to Asclepias or Æsculapius, and connected with the temple some minister of the God of Healing, half physician and half priest, qualified thereunto by wisdom and purity of life, whose office it was to keep guard over these mysterious and secret gifts of Nature and to dispense them for the good of suffering mankind. The necessity for a priestly function arose from a widespread belief that the efficacy of waters, and indeed of most other modes of cure, depended on a special supernatural intervention, that healing was in fact a direct act of the Divine Power; and even in our own day the "pilgrimages" to "holy wells" under priestly guardianship attest the survival of the same belief in the obscure recesses of the human mind.

Whilst, however, in connection with medicinal waters and with medicine in general, the priest now barely survives—has, indeed, withered with the doctrine of disease that called him into existence—the physician, the man of practical wisdom, is "more and more." Under the auspices and direction of the modern representative of Æsculapius, Baths and Waters are more resorted to at the present time than at any period in the world's history. The mists of the supernatural

<sup>1</sup> The substance of this chapter formed the Presidential Address delivered before the British Balneological and Climatological Society, October 31, 1898.

have lifted and cleared away, not perhaps more from this department of medical practice than from others. The clear light of investigation is gladly welcomed in every part of it. Nothing is now secret or mysterious or miraculous in one sense; nothing is supernatural. We know with Hippocrates, and better than Hippocrates, that in disease no event takes place excepting in conformity with Nature; that the order of phenomena in medicine as elsewhere must be unbroken. This is a great conviction, which the centuries have matured, and it represents a great step in the history of the human mind.

There is a true sense in which every physician may be said to mediate between Nature and man. It is his part to make peace in the conflicts of disease. Still more is this true of the spa physician. He has first to detect and to define, and then to harmonise, the habitual unrests, the physical and mental discords, under which his patients suffer. By means of the effectual control that he exercises, both over the individual and his environment, he is often enabled to accomplish this result. He is called upon to mitigate the excesses and defects of civilised life, and he strives to do this by bringing the invalid into surroundings that are simple, healthful, and natural, by restoring the order of the functions, in short by re-establishing the obedience of Nature.

The obedience of Nature.

The spa practitioner is sometimes spoken of as a specialist, and in one respect the description is an accurate one. He is a specialist in respect to the means of treatment that he employs, whether hydrotherapeutic, or belonging to the medicinal spring, or to the climatic character, or other circumstance attaching to a particular locality. Undoubtedly he does handle means of treatment that are not available to the bulk of his professional brethren. But in another point of view the spa physician is, or should

The spa physician as specialist.

be, very far from being a specialist. He cannot, in any case that comes under his care, confine his attention to a particular organ or tissue. His clinical horizon must be a wide one, for his practice will traverse a large part of the field of incipient and chronic disease.

Absence of  
special teach-  
ing.

Considering how extensive and yet well-defined is the scope of spa practice, and for how many years able practitioners at the different spas have devoted themselves to their practical study and application, it is remarkable how few and slight are the traditions that guide the steps of their successors to-day. Local prescription and traditional usage no doubt abound, and are sometimes helpful in the localities to which they relate; but in his general standards and aims and methods the spa physician of the present time enjoys a freedom that is scarcely to be envied or desired. Unlike practitioners in every other specialty he receives no special training in his professional curriculum. This branch of medicine is at present in the unenviable position of being practised without being systematically taught. The spa physician is bound by no traditions; held to no system; fettered by no theory. Only the general principles of medicine are his guides.

His true pro-  
vince in medi-  
cine.

Now, however, that spa physicians are emerging from this too largely individual and isolated existence, and are beginning to acquire a corporate character and association, it seems fitting to endeavour to survey and define their position in the medical body.

It cannot be doubted that a full comprehension and recognition of the scope of Medical Hydrology and Climatology, and of the necessity for systematic instruction in their principles and practice, will come in due time. But it is in the first place necessary that he who assumes responsibility for their practice should, as far as may be, acquaint himself with their elements,

should recognise their proper place and importance in general therapeutics, and should be aware of his own special requirements and obligations, forming thereby for himself at least some provisional ideal of the aims and scope of the health resort practitioner.

The present observations, founded on a personal experience of more than twenty years' practice at a British health resort, are intended to suggest rather than to describe. Their purpose will be served if they contribute some faint outlines to the ideal which it is the duty of the hydrologist to keep in mind, and enable him in any degree better to comprehend the nature of the province which it is his to enter and to possess.

In considering the province of the spa physician two topics naturally present themselves. There is, in the first place, the greater topic of *general hydrological treatment*, including both its incidental and its essential elements. There is, secondly, the smaller topic—the *spa practitioner* himself; and with regard to him it is needful to inquire what are his proper qualifications and equipment; what, if any, are his special besetments and dangers; and what are the objects and endeavours that should animate him, whether as an individual or in his corporate capacity.

Many and varied are the influences that are operative in spa treatment.

Elements of  
spa treatment.

The *Course of Waters* or Baths is the main objective of the invalid at the spa, but other important factors cannot be excluded. The *climate* and natural characters of the health resort have their own effect in each case—and climatic conditions may, as has been shown in a previous chapter, powerfully qualify the effect of baths. Again, *change of environment* is often a most potent influence, with a corresponding alteration in the daily habit—of hours, diet, repose, exercise, and occupation. A strong *psychical influence* attaches to a “course of treatment” undertaken with the purpose

Waters.

and expectation of establishing a new routine more favourable to health.

It is obvious that such a break in the customary and often faulty routine of ordinary life furnishes the best opportunity for checking chronic disorders—and, indeed, affords an indispensable leverage in dealing with many morbid conditions, otherwise intractable. To these positive advantages are added a negative factor: *absence* of anxiety and fatigue and other unfavourable and unhealthy influences.

A new routine  
with new hope-  
fulness.

Spa treatment is, therefore, a complex, including many healthful agencies brought to a focus, for a definite and sufficient length of time. Any of the factors enumerated above may be sometimes operative and essential, and Waters but accessory. Again, Waters may be essential and the others accessory. In the ideal spa treatment all these allied forces are as far as possible utilised. Moreover, it is conducted under *continuous medical oversight*. The patient's daily life is subordinated in every particular to its requirements. There is introduced into it a certain *precision* and *routine* which enables the invalid in many cases to overcome morbid habits of body and mind and to acquire habits of health. Lastly, there is a happy circumstance attaching to treatment of this kind without which the work of the spa practitioner would be in vain; it enlists in a remarkable manner the *confidence* of the patient. Only those who are familiar with this branch of medical practice are aware how widespread is the confidence reposed by the health-seeking public in medicinal waters and baths. Many invalids who never consult a medical man except under the pressure of acute illness, gladly resort to the spa and spa physician. It follows that such a confidence confers a very high privilege on the practitioner at the health resorts, and at the same time imposes upon him a great obligation.

By an intimate study of the chemical and medicinal properties that belong both to mineral waters in general and those that are particular to his own resort, the spa physician must familiarise himself with their various effects and uses. With regard to the local waters he is bound to acquaint himself more and more not only with their influence on the functions of absorption, excretion, and elimination; but also with any gradual and alterative action that they may exert upon the tissues. He has to study the best method of their application both internally and in some cases locally, to the skin and the respiratory tract.

Another and a common element in spa treatment is Hydrotherapy. Thermal baths of all kinds, whether immersion baths or douches, applications to the periphery of heat, in any form and by any vehicle, such as sand or watery vapour or dry hot air, fall under this head. The action of thermal agencies upon the human body has been set forth in previous chapters. It has been shown that in the treatment of disease the effect of thermal applications at different levels of thermality is profound and unquestionable. In spa practice *plus*-thermal applications have generally been the rule. When *minus* applications are combined with other forms of peripheral stimulation, as in *minus*-thermal carbonated salt baths and in many other baths, a new series of effects complicates that of temperature. It is clearly incumbent on the hydrologist, who places a great and increasing reliance on thermal agencies and on surface treatments, to investigate as far as possible by personal and daily observation their *modus operandi* and actual influence in different conditions of health and disease.

Thermal agencies

and other surface treatments.

It may further be suggested that whilst waters primarily affect the digestive apparatus and excretions, and whilst climate is generally tonic or sedative, thermal applications, acting entirely through the skin,

when skilfully handled, appear to correct or allay abnormalities in the circulation, modify the production and loss of bodily heat, and exercise also a strong influence on the nervous system and the general nutrition. It is, indeed, difficult to exaggerate the value of thermal and surface treatments in many forms of chronic disease. These alone, or almost alone, have given to Aix-les-Bains and to Bath their well-deserved reputations. By external agencies it is often possible at all the spas to complete and to confirm the effects of medicinal waters.

Climate, diet  
and mechanical  
treatment.

After Waters and Baths, *climate* and *diet* are the elements of next importance in spa treatment. It is unnecessary to enlarge on their very real influence. It is within the experience of every practitioner at the health resorts that climate and diet sometimes prove a preponderating factor in the means of cure. With regard to diet no formal system is sufficient for the spa physician. He will find that by the avoidance of routine and traditional restrictions, and by the careful study of individual requirements, the best results are to be obtained. The auxiliary value of climate can best be appreciated from the fact that the patient at the spa commonly spends a great part of his life in the open air.

It may be freely admitted that where several separate elements are thus blended in one course of treatment, it is difficult and may be impossible to disentangle their particular effects. But let it also be remembered that the forms and phases of chronic disease are themselves sufficiently numerous and complicated. A corresponding variety and choice in the provision and equipment and methods of the various spas are therefore not only legitimate, but necessary. The principle of *change* and *modification* of the individual environment, both within the body and external to it, and the principle of reversion to



simpler and healthful habits of life underlie and govern them all.

There are yet other remedial agents that may often appropriately form a part of spa treatment, for without their assistance the spa physician would be unable in many cases to deal satisfactorily with chronic and localised disorders. These are the various forms of *mechanical* and *electrical stimulation*. Undoubtedly both active and passive movements and massage, whether combined or not combined with baths, as well as electrical currents, are, if judiciously used, of great value in many of these disorders.

What, it may be asked, is the actual and proper scope of a treatment compounded of elements such as these? What are the morbid conditions to which hydrological remedies as a class are applicable?

Scope of hydro-  
logical treat-  
ment.

Within certain important and well-defined limits, all the medicinal waters are more or less adapted to the same classes of cases. Spa treatment deals in general with chronic conditions and with slight ailments, conditions which are often the despair of the general practitioner, or for which medical advice is but seldom sought in ordinary practice. It is addressed to the removal of intractable and fluctuating constitutional states: it concerns itself with the earliest manifestations of disorder, and with the prevention of serious disease. How large a range of disorder there is to which no valid diagnosis of disease can be attached! Shifting constitutional disturbances, connected sometimes with the evolution of hereditary characters or epochal changes, physical states due to psychical causes, these have no known morbid anatomy, very little fixed localisation in the tissues, and may perhaps best be characterised by the words "a deranged balance of functions." But these are conditions of real suffering, which are not always very easily dealt with in ordinary practice or by means of drugs, and

for which a properly regulated spa treatment is often appropriate.

Common phases  
of disorder.

The phases of such disorders are innumerable and have been elsewhere referred to. The following examples may be here cited in order to illustrate some of those that are more commonly met with in spa practice.

Digestive.

(a) There is first of all the very common and sometimes serious condition in which the chemistry of the digestion is disordered, with an accumulation of toxic or waste products. This condition, often excited by dietetic errors, by a sedentary life, by critical changes in the organism, is frequently founded on some hereditary diathesis, and is of itself a fruitful cause of many painful consequential disorders.

Catarrhal.

(b) Another class of cases presents mainly chronic visceral congestions and catarrhs of mucous membranes, with or without retention of waste as above. This condition is almost always associated with defective action of the skin.

Circulatory.

(c) In the third place disorders of the circulatory mechanism. *Arterial* excess or deficiency in large areas, due to morbid vasomotor conditions, and also irregular distribution of the *venous* blood, are perhaps as important as functional disorders of the heart itself. The judicious use of thermal applications, both in this class of cases and in the one just mentioned, is perhaps the best treatment that can be employed (see Chapter XVII).

Nervous.

(d) There is another large group of cases characterised mainly by nervous disturbances. Individuals constantly present themselves in whom the nervous centres are breaking down or giving way in the common strain of life, or in the stress of particular circumstances, or it may be in consequence of unhealthy habits or occupations. Spa treatment relieves the dangerous tension, provides for a time a healthy environment,

improves faulty nutrition, and is in itself directly sedative (see Chapter XVI).

The conditions here sketched are frequently blended in the same patient, but the claim of the hydrologist is that in this field of functional disorder and incipient disease, spa treatment is an effectual remedy, and should be the recognised prescription.

For a large number of persons the maintenance of health during the active years of life is a matter of increasing difficulty. After a time the annual holiday is no longer restorative. But a few weeks spent year by year at a properly selected spa makes the ordinary life possible. The pressure of business, of society, of professional life, of public affairs, even of "pleasure," becomes an intolerable burden and necessitates a periodical *retreat*, both physical and mental. It is not a new thing. It was a familiar experience during the Roman civilisation. Not only did jaded senators go up year by year to the thermal baths, but the legionaries, exhausted by their campaigns, found rest and recuperation in the same manner.

Necessity of physical and mental "retreat."

In the case of many ailing persons three or four weeks of continuous eliminative treatment year by year will enable them with tolerable ease to bear the burden of life. And as *periodical elimination* is the need and the safeguard of many persons, so *periodical repose* of the nervous centres is equally desiderated for others. In neither of these cases, met with usually in the most active and valuable lives, can the condition be regarded as one of actual disease, although full of evil potentiality.

Periodical elimination and repose.

Often allied with the disturbances of function already referred to, there are certain painful conditions due to chronic congestion or a low inflammatory state (*fibrositis*) of the fibrous tissues, and commonly ascribed to cold and damp. Many painful periosteal swellings, myalgias, neuralgias, and many cases of

Fibrositis.

neuritis are of this nature; and all of these conditions are strikingly benefited by waters and thermal treatment (see Chapter XV).

Affections of  
joints.

With reference to chronic affections of the joints, the prescription that connects their treatment with medicinal waters is not more time-honoured than it is well founded. Here, even more than elsewhere, a fruitful field is spread before the hydrologist. An attentive study of individual cases of joint affections will enable him to discriminate between the many different conditions which are at present loosely grouped under the same diagnostic term. He will notice that the same word is made to stand for many very different morbid states. He will also notice that the various conditions of the articulations with which he has to deal gradually group themselves around certain definite ætiological factors, by means of which in due course a true classification may be obtained.

It is not too much to say that there is no treatment that affords so fair a prospect of relief in sub-inflammatory and degenerative conditions of the joints, whether in the young, the middle-aged or the old, and at each period of life the spa practitioner will recognise in these changes a special distinguishing character which will give the key to the proper application of the resources of hydrology (see Chapter XV).

### The Equipment of the Spa Physician

It will be sufficiently obvious that one of the first requirements in the equipment of the spa physician must be a diligent study of the evolution of chronic maladies. He must be acquainted with their predisposing and exciting causes, and, if the expression can be allowed in describing a morbid condition, their *normal* course. The knowledge also of certain well-marked tendencies to particular kinds of disorder, and

Study of  
chronic  
maladies.

of the various ways in which these tendencies are revealed is equally important, especially in regard to preventive treatment; and it cannot be too clearly stated that preventive treatment occupies a large and increasing field in hydrological practice. The recognition of the danger of disease and of the probable lines of its approach will often suggest the most effectual means for its avoidance. Many members of the same family group, in more than one generation, will frequently come under his care. He will, therefore, pay particular regard to the medical history of families and to inherited differences of temperament and nervous organisation. Epoch changes are constantly presenting themselves, especially those that belong to middle age and to advanced life. The study of the disorders and the diseases peculiar to these epochs must, therefore, engage his attention.

Family and epoch diseases.

The practitioner who administers spa treatment in its various branches, waters, thermal applications and the rest, will of course lose no opportunity of increasing his knowledge of the effect which they produce, whether alone or in combination, both in health and disease. More particularly he must have an intimate knowledge of his own health resort, must know its drawbacks as well as its advantages, and be able to minimise those in their practical operation and to make the most of these. He must study the indications and contra-indications in regard to treatment at the spa. Experience will gradually reveal to him the signs which indicate that Waters and Baths should be discontinued, and those again which point to the advisability of an "after-cure" for rest or bracing.

Most of the dangers or accidents connected with spa practice arise from *treating too much (nimia diligentia)*, and among these there are three ill-effects in particular which may be commended to the notice of the spa practitioner. There is first of all the peculiar

Some dangers of spa practice.

cardiac weakness ("thermal debility") to which reference has been made in previous chapters, and which has been ascribed, no doubt correctly, to the "cumulative effect of the higher thermal treatment."<sup>1</sup> In the second place he has to beware of exciting or intensifying overmuch the inflammatory reactions of chronic local affections, particularly in or near the joints, in gout and in degenerative arthritis.<sup>2</sup> There are also, thirdly, some conditions in which ordinary treatment by waters is absolutely dangerous, for example, high blood tension and abdominal plethora. The rash use of waters in conditions of tension may precipitate cerebral hæmorrhage. Such accidents are not uncommon, and a timely venesection has often averted still more serious consequences.

The spa physician's temptations.

No survey, however cursory, of the province of the spa physician should omit to notice the fact that he is exposed, like other men, to snares and temptations. It may, indeed, sometimes be well to confess their existence. Thus it would be almost impossible that he should never be tempted to employ hydrological methods a little indiscriminately to all comers. Cases of all kinds pass before him. In some the ailment is, strictly speaking, immaterial, mental and not physical; in others it is material enough. It is his first duty to select for serious spa treatment those only to whom it is clearly applicable. It is no part of his duty to prescribe waters or baths where in his opinion they are uncalled for, or might be at that moment inappropriate or injurious. Again, he is sometimes sorely tempted to hurry in his work, to rely on rapid judgments, founded too much on indeterminate impressions, and

<sup>1</sup> S. Hyde: *Journal of Balneology and Climatology*, vol. ii, p. 133.

<sup>2</sup> "The bath . . . stirs up in most people inveterate infirmities and pains which have long been dormant. Such people returning from it say rightly, 'I went to the bath for pains.' Inflammations occur in some cases, fevers in others."—ANDREA BACCIUS: *De Thermis*, p. 172 transl. (Venice, 1571.)

not quite sufficiently based on a ground of exact examination. Not that the intuitive perceptions of the physician are to be set aside. Then again, he is often induced or invited to attempt tasks that are impossible in the short time at his disposal; for example, to overcome disorders of many years' duration in as many days. He may incautiously promise too much; possibly he may promise too little. Medical men are not always endowed with the serene assurance that was displayed on one occasion by a spa practitioner. "My dear lady," said he, "you have come just in time, but by the great mercy of Providence I will cure you."

Certain spas are much resorted to by patients affected with biliary concretions, with urinary or renal calculi, with chronic phlebitis or varicosity of the veins, or with other affections that are sometimes regarded as surgical. These patients are recommended to particular waters or baths because in the course of years they have been found beneficial in such cases. Sometimes a particular resort has acquired a certain fame for a particular class of affections, because the hydrological measures there provided have of themselves proved to be curative.

Surgical treatment at the spas.

Of late years it has happened that with the development of modern surgery, operative treatment has been everywhere increasingly used for all these maladies. At the spas referred to there are consequently able surgeons with much knowledge and experience in these lines of practice.

It may be well to point out that, speaking generally, hydrological treatment and surgical treatment, although both may be prescribed for the same cases, are essentially different procedures and antagonistic the one to another. No doubt cases of all kinds present themselves at the various spas, and many which have not been medically recommended. Sometimes more care

might with advantage be taken in the selection of patients for spa treatment, especially in view of possible surgical intervention. In the great majority of cases it is surely better for persons requiring surgical treatment to remain under the care of their ordinary medical advisers and at home. It is not surprising that at some of the spas in a population of many hundreds of invalids emergencies not infrequently occur. But such a fact does not invalidate the rule that excepting in cases of grave and urgent necessity operative measures have no place in spa treatment. And, of course, in such an event the spa physician will feel himself bound to acquaint the patient's ordinary adviser. Only thus can there subsist between them as colleagues that *entente* which is necessary above all in the patient's true interest. It follows that among his many duties and obligations it is sometimes incumbent upon a keen and able practitioner at the health resort to put upon himself a severe self-restraint.

Loyal co-operation with colleagues.

The foregoing considerations do not, unfortunately, cover the whole of the snares that beset the practitioner at the spas. Some may be tempted to forsake the daylight of science and to hug to themselves some remnant of that veil of secrecy and mystery, which it is the pride of modern medicine to have dispelled.

The task of the physician is at times a thankless and exacting one. It is often nothing less than to help a chronic invalid, against his will or without his assistance. Goaded by unnecessary obstacles, by the disappointments that attend even upon his best efforts, or by the unexpected jealousies of his friends, he may be in danger like other men of losing hold of his higher purposes, his true aims. He may find himself growing indifferent. Let him remember that it is the Record which counts, and that there is no oblivion.



Among the privileges of the spa physician it must not be omitted to mention the opportunity afforded in hydrological practice of loyal and friendly co-operation with many other medical men. These opportunities are not always so common or so much availed of as might be desired. It is to be regretted that the patients who are medically recommended to the spa practitioner, do not form a larger proportion of those whom he is called upon to advise.

It remains to be added that excellence in individual work should not exhaust the aims and duties of the hydrologist. It is not only incumbent upon him to follow the highest standard in practice, but also, as occasion offers, to do whatever may be in his power to cultivate the art and build up the science of hydrological medicine.

The spa physician will always recognise, and must sometimes be keenly conscious, that behind all physical conditions, all sensible signs and states of disease, there is a psychological element in his cases and in his treatment. It would not be correct to say that he *must*, for the true physician would find it impossible to do otherwise than give this psychological element its due weight in his mind. Not only so, but he will be called upon to discover in his own psychological experiences points of contact with his patient, and thus very often he will be led by the truest sympathy to league himself with the invalid in a common effort to regain the paths of health. There are many in whom a dormant volition must be roused, depression or apathy or despair put aside, and a healthy desire rekindled. These are psychical revolutions, in which the physician is privileged to bear a part. It is above all the duty of the spa practitioner to have regard not only to what is called a "disease" but to the individual. He comes into close and intimate relationship with a whole disordered personality.

The psychological element in spa practice.

And again, he who has to deal with slow and chronic and inveterate disorders has perhaps more need than others to be a man of hope. When hope fails, health fails and life fails. But on the contrary, to invert a common proverb: Where there is hope there is life. Few and rare indeed are the conditions from which this most potent of all medicines should be withheld by the spa practitioner.

## CHAPTER XX

### THE QUESTION OF NOMENCLATURE

AMONG many changes in the practice of medicine during the last century none has been more remarkable than the widespread movement throughout Europe in favour of *physical methods of treatment*. A new and almost startling confidence in natural agencies for the cure of disease has been revealed in many places and in many shapes, sometimes, no doubt, in ways that may be a little unbalanced and irrational. If there were nothing more solid than such an exhibition of faith it would still be worthy of respectful study from those who are charged with medical responsibilities. The case is far otherwise. The growth of this movement, and its recognition in the public and medical mind, actually corresponds with and depends upon certain great and striking additions to knowledge. Among the gains of science during this time may be reckoned not only a more accurate comprehension of the processes of disease, but a much fuller knowledge of the manifold energies in Nature.

Recognition of physical methods of treatment.

The methods of physical therapy seek to bring these natural powers into contact with the organism, in order to stimulate or to modify the failing or perverted energy of its tissues. The principles of treatment by contact, and the function of the skin as the organ of surface treatments, lie at the root of such methods and have been dealt with in the preceding pages. Let it suffice to say here that many new *therapies*, to use the French

Many forms of physical treatment.

expression, have been founded upon this principle.<sup>1</sup> It has been well said by Professor Vierordt<sup>2</sup> that the recent introduction of physical methods of treatment marks an important turning-point in the history of medicine. "Physical therapy," said von Leyden, "should be utilised not in the clinic alone. It must become the common property of general practitioners."

The medical  
use of waters.

To this wide and constantly widening group the treatment by waters and by baths properly belongs. Moreover, it may justly be said to occupy the foremost place, since in the action of water are involved so many forms of energy, and since water is as respects the human body the principal vehicle of force. It cannot be denied that some underlying truth of physiotherapy has given value and vitality to the many water cures in past and present times in all countries, wrapped up as these cures have sometimes been in the elaborate ritual of their cult.

What, then, is to be comprehended in this first part of physio-therapy?

The "fresh-  
ness" of  
waters.

The medical use of springs and of baths comprehends a bewildering variety both in the potable water and in the methods of its application. Hitherto, this too obvious diversity has rather obscured the truth that all such treatments have certain essential characteristics in common. The action of pure, sweet and fresh water is the first of these common factors. The quality of *freshness* is of the first importance in the administration of waters, and springs differ widely in respect to this

<sup>1</sup> For an example of the work that is now being done in these subjects see the *Proceedings of the Third International Congress of Physiotherapy*, held in Paris in 1910. They make two bulky volumes of more than 1400 pages, having sections devoted to treatment by movements, to hydrotherapy, crenotherapy or medicinal waters, cryotherapy, thermotherapy, ærotherapy, to medical climatology and marine treatment, to medical electricity, radiotherapy and to diet.

<sup>2</sup> Vierordt: *Therapie der Gegenwart*, xlv, p. 481. (Berl. u. Wien, 1903.)

quality. It is common knowledge that the flowing, or in the old parlance the "living" fresh water of the fountain has a different property to that of the same water when still, bottled or contained in reservoirs. Consequently most natural waters produce their fullest effect when employed either for drinking or externally at the source.

The second common factor in these methods of treatment is not less important, namely *heat*. For warm-blooded animals living in a cooler medium, it has been shown that heat is measured relatively to the temperature of the body. *Plus* or *minus* applications of heat are naturally inseparable from waters, whether internally or externally used. Baths act in the main as vehicles of energy, of which heat is the chief form. Water is in respect to the human body the commonest and most convenient medium of energy, but it is convenient to include in the category of bath treatment other media, such as dry sand and air, by which heat can be abstracted or conveyed.

The heat of waters.

It is evident that waters, of whatever kind and however employed, internally or externally, exhibit certain general qualities and actions which it should be the first aim of any science of waters to define and describe; and which every spa physician must acknowledge lie at the foundation of his practice.

There is in the next place a group of factors that depend upon the particular qualities of medicinal waters. Each spring has its own proper *ingredients*, and these must have their pharmacological effects, beneficial or otherwise. Under this designation must be placed the gases, salts, acids, metallic elements and ferments and other organic matters, all of which belong to medicinal springs and the study of which must therefore be germane to the science of waters. It is also necessary to take account of the particular *physical properties* of waters. Their temperature, electrical

The ingredients of waters.

The physical properties of waters.

condition, tonicity and radio-activity fall under this heading. Important researches during recent years have thrown much light upon the physico-chemical properties of medicinal waters, particularly of the thermal springs, and still much remains to be learned.

One science  
with two  
branches.

Therefore it is plain that the medical doctrine of water embraces two great branches. The first concerns itself with the use of this element in medicine solely as a vehicle of energy, whilst the other branch has to do with the various ingredients and physical properties of medicinal springs, and of the emanations and deposits in connection with springs, and with their chemical and physical action upon the body, whether taken internally or applied either locally or generally to its surface.

What name should properly attach to this elemental science, apparently so simple in its nature but which yet embraces an art or treatment so wide in its range? Although the science itself is of modern growth, the medical use of waters is as old as Hippocrates. Their efficacy and that of baths has been proved and recognised at every period in the history of medicine. Not only so, they have survived every vicissitude of medical doctrine, and show no sign of perishing by disuse.

The art and  
science of  
waters.

A distinction should always be drawn between a treatment or art of any sort and the science or orderly knowledge that may or may not substantiate it. The art must be practised though it rest only on the experience and wisdom of the physician. If it runs counter to no ascertained facts it must be admitted and allowed to await its scientific justifications hereafter. But the sick man cannot wait.

At the present moment there exists in all civilised countries an extensive and varied medical practice of waters, resting not upon one but upon many correlated orders of fact. It has been truly said that no single science, unless it be mathematics, can by its very

nature stand alone or be sufficient to itself. The unity of truth forbids such independence. Is this not eminently the case with the medical sciences? That which deals with the medical uses of water, although apparently so simple, furnishes a good illustration of the intimate relationship between natural orders of knowledge, for it is based on geology, chemistry, electricity and pharmacology; and upon the physiological and pathological laws governing the reaction of the living body to many kinds of stimuli—hydraulic, thermal, chemical, electric and mechanical. The present work is concerned with the doctrine relating to the medical employment of these many and various agencies to be found in waters of whatever kind. It is because it embraces so many agencies that the use of water and of waters in medicine must be regarded as the first and most important branch of physical therapeutics.

A science with wide relations.

What single comprehensive name can be applied to such a science? It is surely unnecessary to argue the convenience, nay the necessity, for such a general term. To meet the exigencies of the case such a name must satisfy certain necessary requirements. It should be inclusive of all the medical uses of water; it should be distinctive, and it should also, as far as possible, conform to or be capable of international use. It has seemed to the author that the time may be ripe for reconsidering in this country the nomenclature of this branch of medical science. The subject-matter has indeed undergone so rapid a development that the terminology of the last century has become inaccurate and even misleading. The various connotations given to familiar words cause an unnecessary confusion, and the fundamental unity of the whole subject may be overlooked for want of a simple and inclusive name.

Importance of a sound nomenclature.

The various current usages with reference to nomenclature may be best set forth by a brief historical

History of the word "balneology."

Balneology.

examination. The word "balneology" appears to be a new one and was but seldom used before the middle of the nineteenth century. In the Oxford Dictionary "balneology" is defined as the "scientific medical study of bathing and medicinal springs." One of the earliest examples of its occurrence is found in 1840, when Kraemer of Leipzig published a review of the "balneological" literature of the preceding year. Löschner brought out his *Beiträge zur Balneologie* at Prague in 1845, whilst in 1849 Bückner used the same word in the clinic at Utrecht, and G. L. Ditterich published at Munich his work on *Clinical Balneology*. After this date the literature of systematic "Balneology" or "Heilquellenlehre" (health-spring-lore), as it is sometimes called in Germany, grew rapidly. From 1850 to 1870 appeared the works of Merkel and Flechsig at Leipzig; Rinne at St. Petersburg; Men, Braun, Jacob and Helfft at Berlin; Seegen, Dietl and H. Kisch at Vienna; Schaer at Bremen. About the last-named date the words "balneology" and "balneological" found their way into this country, and until the present time have been generally employed in England and in Northern and Central Europe. It is particularly to be remarked that in spite of their wider dictionary meaning the connotation of these words is strictly limited by all authors to the properties and uses of *medicinal* springs. The various actions of simple water and heat are excluded. Although these form essential and fundamental factors of all treatment by means of waters and baths they have been set apart as a separate study under the name of *Hydrotherapeutics*. In the Latin countries, France, Italy and Spain, the term "balneology" has not found acceptance, although the expression "balneotherapy" is sometimes used, not as the name for the science but rather as a description of a treatment.

Limitation of  
the term.

It is true that derivation is a poor guide to the mean-



ing and use of words, but the purist might urge that "balneology" (from *balneum*, a bath) should rightly have to do only with the external use of water. Custom has on the one hand *restricted* its application to the use of medicinal waters, and on the other *widened* it to their employment internally as well as in the form of baths.

The conception of "bath treatment" and of "bath doctors," with which the word "balneology" is historically associated, takes its origin from the Middle Ages, when the use and abuse of baths throughout Europe were, like wisdom and folly, strangely mingled together. The "bathkeepers" according to Baas,<sup>1</sup> appear to have arisen in the twelfth century. They were organised in guilds and taught their skill to apprentices in a course of instruction lasting from two to four years. Their golden age extended from the twelfth to the fifteenth centuries. One, Hans Foltz, a learned barber and bathkeeper, who flourished in Nuremberg in the last quarter of the fifteenth century, is considered to be the first German writer on "balneology." The bath-houses, after a long and often disreputable history, seem to have disappeared in the sixteenth century.

Objections to the term.

Many instances could be quoted in which words have for various reasons acquired a misleading or sinister implication, and their original value has been impaired or destroyed. Perhaps on account of some association of ideas they undergo a subtle change, and a name—as in politics—becomes a term of reproach. Language has its decay as well as its growth. Such words as *knave*, *villain* and *smell*, began life well, but have sadly come down in the world. Others like *fame* and *minister* have undergone a surprising upward evolution. Innumerable others are staled and stereotyped by repetition. "Balneology" is a decayed word. Another serious objection to its claim to be a proper name for the whole science of waters is that it

The decay of words.

<sup>1</sup> *History of Medicine*, Eng. Trans., 1889.

is too narrow, and that modern usage has confined its connotation to the medicinal spring.

Names for  
sweet water  
treatments.

The treatment by means of pure or sweet water has, during the last century, received various names. The term *hydriasis* was used by Roner of Leipzig in 1832. The adjective *hydriatic*, and the more correct *hydriatric*, have since that date been occasionally employed, more particularly to designate cold water applications.

Hydropathy."

The author is unable to trace the source of the words *hydropathy* and *hydropathic*. They have been and are used to describe the special methods which originated in Silesia in the third decade of the nineteenth century, and the systems of treatment that arose out of them. In 1836 appeared Herzog's *Handbook of Hydropathy*, and in 1838 we find the word spreading into Italy, a country which has always been among the first to adopt physical methods of treatment. In that year Bertini at Turin published his work *Della medicina idropatica*. For the most part, although occasionally used in medical literature, these rather barbarous terms have been restricted to the particular system of water treatment inaugurated by Priessnitz, which was referred to in an earlier chapter.

History of the  
word "hydro-  
therapy."

The earliest use of the word *hydrotherapy*, within the author's knowledge, occurs in 1834, when Eck wrote on "Hydrotherapy in Croup." From 1840 to 1850 a very large number of acknowledged medical writers, such as Engel, Lubanski, Baldou, H. Scoutetten, Schedel, Fleury and Julien in France, Sauvan in Warsaw, Munde in Leipzig, Krause in Dresden, Kneeland in America and T. Smethurst in London, adopted the same nomenclature; and we find the words *hydrotherapy* or *hydrotherapeutics* generally used from this time onwards with reference to the medical use of sweet water. In 1861 appeared the historic work of Ernst Brand on the *Hydrotherapy*

of *Typhus*, and in 1863 the systematic treatise of Dujardin-Beaumetz. The great Vienna school of hydrotherapy is represented by the famous work of Winternitz, first published in 1877, *The Physiological and Clinical Basis of Hydrotherapy*. In this book, which was subsequently translated into French, Spanish, Italian and English, the foundations of the science of water were well and truly laid.

Thenceforward we find an ample and growing literature in the French and German languages dealing with the medicinal employment of water, under the name of *hydrotherapy*. We have, for example, in the *Proceedings of the Society of Medical Hydrology of Paris*, reports upon the French "hydrotherapeutic clinics," and in Italy papers on "il cura idroterapica" in their national Congress of Hydrology and Climatology. The Dutch, Germans, Russians and Scandinavians have used the word in the same sense; whilst in America the modern science, under the same name Hydrotherapy, found expression in the work of Baruch in 1890. In the long series of works referred to there has been no question of applying this term to medicinal waters.

According to the Oxford Dictionary, *hydrotherapeutics* is defined as "that part of medical science which treats of the therapeutical application of water : the practice of this : water cure." Definition

There has been quite recently, particularly in America, a disposition on the part of some writers to enlarge the connotation of this word. It is even proposed to include under *hydrotherapy* the whole science of waters and of baths. It is not difficult to trace the origin of this proposal. For more than a generation the accurate study and practice of hydrotherapy had proved the efficacy of simple thermal applications in many disorders. As the part played by these great primary and general properties of all

Modern  
scepticism  
regarding  
medicinal  
springs.

waters became evident, so the secondary and particular qualities of the springs naturally waned in estimation. At the same time the great reliance that was formerly placed upon the cutaneous absorption of the ingredients of mineral baths was shown in many cases to be unfounded, by the discovery that comparatively little absorption of saline matter takes place through the uninjured skin. And the fact that widely different medicinal springs have been supposed to exercise the same effect, and are constantly resorted to for the same ailments, was held to show not only the importance of those qualities which waters have in common, but the insignificance of those in which they differ.

The proposed change of nomenclature is therefore not so much an extension of the range of hydrotherapy as a denial of the active qualities of the medicinal spring. It is advanced doubtless in the interests of scientific uniformity and precision, but in the author's opinion it is founded upon imperfect generalisations, and begs the question it professes to solve.

The name of  
an art is not  
the name of a  
science.

Moreover, according to the customary use of language the word *hydrotherapy* cannot well be the name of a complete science. It signifies quite correctly an art or treatment. For more than half a century the word has been consistently applied in the medical literature of several languages to *the use of sweet water*. Would it not therefore violate an established and convenient usage, and introduce confusion, if it were now sought to employ it so as to include the particular and distinctive properties of the medicinal spring? In a recent letter, Dr. Frankenhäuser, Lecturer in "Balneology" at the University of Berlin, writes: "In Germany, hydrotherapy and balneology are sharply divided departments of medicine. By hydrotherapy we understand the application of hot and cold water. With this is connected thermotherapy, steam, hot air, and incandescent

light baths. By balneotherapy we understand the therapy of mineral waters."

If, then, "balneology" and "hydrotherapy" are terms too narrow and misleading, what other name can be properly applied to the whole science of water and of waters as employed in medicine? An old and well-tried competitor is already in the field. The expression *medical hydrology* is occasionally met with in the seventeenth and eighteenth centuries. What appears to be one of the earliest instances occurs in the work of W. Simpson, an English writer in 1670, *Hydrological Essayes, or a Vindication of Hydrologia Chymica, being a further Discovery of the Scarborough Spaw, and the right use thereof*. M. Davies in his *Athenæ Britannicæ* (1716), in the dissertation on "Physick," vol. vi, part iii, p. 56, refers to the *Astrological and Hydrological Branches of Physick*. Zedler's *Universal Lexicon* (1735) describes "Hydrologia" at length and recognises the medical, chemical, physical, etc., systems of Hydrology. There is also in 1772 a work by M. Monnet, entitled *Nouvelle hydrologie*, etc., dealing with sweet waters, sea-water and natural salts.

History of the name "Medical Hydrology."

In the renaissance of the science which occurred in the nineteenth century the Italians bore an early and a distinguished part. The work of Pietro Lichtenthal, *Idrologia medica*, was published at Milan in 1838; the *Hydrologie* of Wulzinger at Passau in 1839. In 1851 Durand-Fardel adopted the same name in his communication to the *Union médicale* of Paris, and 1854 witnessed the foundation of the first "Society of Medical Hydrology," also at Paris. In the years from 1871 to 1877 the *Jahrbuch für Balneologie, Hydrologie und Klimatologie* was commenced in Vienna, the *Journal of Hydrological and Climatological Medicine* at Florence, and the Spanish *Society of Medical Hydrology* was founded at Madrid. In 1880

the first *Revue d'hydrologie* appeared in Paris. A little later, in 1886, the first "International Congress of Hydrology and Climatology" was formed at Biarritz, and has continued its meetings in various countries since that date. Two years afterwards an Italian congress with the same designation met in Rome. The *Archives générales d'hydrologie* was published in Paris in 1891, and the *Hidrologia medica* at Valencia in 1896. We may also note that since the latter years of the nineteenth century the various international congresses of medicine have often included a section of Hydrology.

It is therefore evident that for many years the name has been widely employed on the Continent of Europe. A literature of medical hydrology, which embraces in its scope the whole subject of hydrotherapy and of medicinal springs, has grown up, particularly among the Latin races, and periodical meeting of congresses under this name in different countries have done much to promote and co-ordinate its study.

The question  
of etymology.

It may be asked whether this use of the name Hydrology is correct in etymology. Like other words it has undergone a growth in meaning during the last hundred years. The great English dictionaries from Johnson to Murray define it as the science which treats of the "nature and properties of *water*." In this matter the Italians are again first in the field. In Tommaseo and Bellini's dictionary (1869) "hydrology" is "the part of science dealing with the properties and uses of water," and medical and mineral hydrology are specifically recognised. In Littré's great dictionary of the French language (1875) hydrology is "that part of natural history which treats of waters and their different species," and in the dictionary of the Spanish Academy (1878) it has the same significance. Ten years later (1888) Hatzfeld's Dictionary defines the word as treating of waters, "and especially of mineral

waters." In the same year the New Sydenham Society's *Lexicon of Medical Terms* includes under the word "hydrology" not only the nature, quality, distribution and laws of water, but also its *uses*. Lastly, in Foster's *Encyclopædic Medical Dictionary*, published in New York in 1891, it is defined as "that department or division of medical science which treats of the use of waters, especially mineral waters, for therapeutic purposes."

It would seem, therefore, that philology offers no bar to the use of this word in a medical sense. The author would venture to submit that the expression "Medical Hydrology" satisfies the three essential conditions with which this discussion set out. That it is distinctive cannot be denied; that it is sufficiently comprehensive is also evident; and it is also, as far as may be, in conformity with international usage. The name may accordingly be defined as follows: "Medical hydrology is the science of waters, vapours, and mineral or organic deposits in connection with waters, as used in medicine, both by internal administration and in the form of baths and applications." Definition.

## CHAPTER XXI

### THE GEOGRAPHICAL DISTRIBUTION OF MEDICINAL WATERS AND BATHS

*(For further particulars see Index)*

#### GREAT BRITAIN

##### 1. THERMAL AND SUBTHERMAL WATERS—

Bath (Aquæ Sulis, or Solis, of the Romans);  
Buxton; Matlock Bath; Bakewell; Clifton;  
Mallow.

##### 2. SULPHUR WATERS—

Harrogate; Strathpeffer Spa; Llandrindod;  
Llanwrtyd; Builth; Moffat; Lisdoonvarna.

Among other Sulphur Waters in Great Britain  
may be mentioned—

Askern Spa; Gilsland Spa; Shap Wells; Croft  
Spa; Dinsdale-on-Tees.

Also in Ireland—

Lucan (Co. Kildare); Swanlinbar (Co. Cavan);  
Ballynahinch (Co. Down).

##### 3. MURIATED WATERS—

Droitwich; Nantwich (Cheshire); Woodhall Spa;  
Cheltenham; Leamington; Bridge of Allan;  
Llangammarch; Ashby-de-la-Zouche.

##### 4. CHALYBEATE WATERS—

Tunbridge Wells. Also Cheltenham, Harrogate,  
Strathpeffer, Buxton.

Many chalybeate wells in Great Britain, formerly



much resorted to in their several localities, have now fallen into disuse. Among those that are at present employed is that of FLITWICK (Bedfordshire), which is bottled and sold. In this water the iron occurs in the unusual form of ferric sulphate. The chalybeate at SANDROCK near Blackgang Chine, that of MOFFAT in Scotland, and at TREFRIW in Wales, besides others, contain the proto-sulphate of iron; and there are carbonated chalybeate waters in most parts of the country.

### FRANCE

#### 1. INDIFFERENT THERMAL AND SUBTHERMAL WATERS—

Plombières; St. Amand; Nérès; Mont Dore; Dax; Bagnères de Bigorre; Aix-les-Bains. The neighbouring water of Challes, a very strong sulphur water, is employed for internal use; and that of Marlioz, in close proximity to Aix, for inhalation, etc.

#### 2. MURIATED WATERS.

The following are thermal—

Châtel-Guyon; Bourbon l'Archambault; Bourbon Lancy; Bourbonne-les-Bains; La-Motteles-Bains; Balaruc. Salins possesses a cold muriated water with traces of bromides and iodides.

#### 3. ALKALINE WATERS—

Vichy; Vals; Royat; Saint Nectaire. La Bourboule, 2780, has a thermal muriated alkaline water containing arseniate of sodium; Evian-les-Bains.

#### 4. SULPHATED MURIATED WATERS—

Brides-les-Bains and Salins-Moutier; Saint Gervais.

## 5. CALCAREOUS WATERS—

Contrexéville ; Pougés-les-Eaux ; Cransac ; Martigny-les-Bains and Vittel.

## 6. CHALYBEATE WATERS—

Lamalou ; Rennes-les-Bains.

## 7. SULPHUR WATERS—

The following are thermal, and situated in the Pyrenees. They all contain sulphur in the form of sodium sulphide or sulphydrate in proportions varying from 1 to 7 parts in 100,000. Bagnères de Luchon ; Cauterets ; Eaux Bonnes ; Eaux Chaudes ; Barèges ; St. Sauveur ; Ax-les-Thermes ; Amélie-les-Bains ; Uriage ; Vernet-les-Bains.

At Pietrapola and Guagno (Corsica) are thermal sulphur springs containing about two parts of sulphide, and Prezza in the Larne Island has gaseous chalybeate water.

## GERMANY

## 1. INDIFFERENT THERMAL AND SUBTHERMAL WATERS—

Wildbad ; Schlangenbad ; Baden-weiler ; Landeck and Warmbrunn.

## 2. MURIATED WATERS—

Nauheim (subthermal) ; Kreuznach (cold) ; Homburg (cold) ; Wiesbaden (thermal) ; Kissingen (cold) ; Baden-Baden (thermal) ; Oeynhausien and Soden (subthermal).

## 3. ALKALINE WATERS—

Neuenahr (subthermal) ; Salzbrunn (cold) ; Ems (thermal) ; Elster (cold).

## 4. CALCAREOUS WATERS—

Wildungen ; Lippspringe.

5. CHALYBEATE WATERS—

Schwalbach; Kudowa; Driburg; Rippoldsau;  
Pyrmont.

6. SULPHUR WATERS—

Aachen (thermal); Weilbach (cold); Nenndorf;  
Meinberg and Eilsen (cold).

HOLLAND AND BELGIUM

1. INDIFFERENT THERMAL WATER—

Chaudfontaine.

2. CHALYBEATE WATERS—

Spa; Haarlem.

SWITZERLAND

1. INDIFFERENT THERMAL AND SUBTHERMAL  
WATERS—

Ragatz-Pfäfers; Loèche-les-Bains.

2. MURIATED WATERS—

Rheinfelden; Schweizerhalle; Bex.

3. ALKALINE WATERS—

Passugg; Tarasp-Schuls.

4. CHALYBEATE WATERS—

St. Moritz; Acquarossa; San Bernardino.

5. SULPHUR WATERS—

Baden (thermal); Schinznach (subthermal);  
Lavey and Yverdon (thermal); Lenk (cold);  
Gurnigel.

6. CALCAREOUS WATER—

Weissenburg.

## AUSTRIA

## 1. INDIFFERENT THERMAL WATERS—

Gastein ; Teplitz ; Johannsbad.

## 2. MURIATED WATERS—

Ischl ; Herculesbad.

## 3. ALKALINE WATERS—

Bilin ; Gleichenburg ; Karlsbad (thermal) ;  
Marienbad ; Franzensbad.

## 4. SULPHATED WATERS—

Hungary is rich in these "bitter waters." Franz-Joseph, Hunyadi-Janos, Apenta, and Æsculap with sulphates of magnesium and sodium. Pullna and Seidlitz, in Bohemia, are weaker waters of the same class, the latter containing no sodium salts.

## 5. CHALYBEATE AND ARSENICAL WATERS—

Franzensbad and Marienbad ; Ratzes and Mitterbad in the Austrian Tyrol, have sulphate of iron springs, and Levico and Roncegno in the same region yield strong ferruginous waters containing arsenious acid, which are used at the source and for exportation.

## ITALY

## 1. INDIFFERENT THERMAL WATERS—

The thermal sources of Italy are very numerous and were many of them used by the Romans. Bormio ; Battaglia ; Monsummano.

## 2. MURIATED WATERS—

Abano ; Salsomaggiore ; Montecatini.

## 3. CHALYBEATE AND ARSENICAL WATERS—

The hot spring at Pisciarelli (near Pozzuoli)

contains sulphate of iron, and Ceresole Reale (Piedmont), 5290, has carbonated iron waters with arseniate of sodium.

4. MURIATED ALKALINE WATERS—

At Pozzuoli (Puteoli), on the Bay of Naples, there are thermal, alkaline, and weakly muriated waters that have been used for baths since Roman times. The famous *solfatara*, an ancient crater, was formerly used for vapour baths. In the crevices of the hills are numerous *fumeroles* giving forth sulphuretted hydrogen. Vapour baths, *stufe*, are given at 95° and 113° F. The neighbouring thermal spring at Bagnoli is somewhat similar, and furnishes vapour for the *Bagni di Nerone*. Casamicciola (Ischia) has also a thermal spring of this class. The waters of CASTELLAMARI DI STABIA (Bay of Naples) are cold, and include alkaline, muriated, and ferruginous sources.

5. SULPHUR WATERS—

Acqui. Other hot sulphur springs are Vinadio (Piedmont), Poretta (Bologna), 1100, and Viterbo, Acque Albule and Civita Vecchia in the province of Rome; also Acireale and Sciacca in Sicily.

6. CALCAREOUS WATERS—

Lucca; Chianciano.

GREECE

Greece is well supplied with thermal and other mineral waters. Though much resorted to in ancient times, they are now almost entirely neglected. Among the more important sulphurous thermal springs may be named Hellopia in Epirus, Adepsos (I. of Eubœa), those of the island of Lesbos, and at Thermopylæ. Lepanto, and Katharsion (in Lesbos) are saline sulphur waters. The islands of the Ægean Sea furnish many

powerful waters, for example, the thermal waters of Ikaria and Kythmos. There are bitter waters at Epidaurus.

### SPAIN AND PORTUGAL

Fitero (province of Navarra) and Caldas-de-Gerez (Portugal), a feebly sulphurous thermal water at 115° F., are practically indifferent thermal waters. There are several hot muriated waters in Spain, the most important being that of Caldas-de-Montbuy (Barcelona). Vidago (N. Portugal) has a strongly alkaline water. Rubinat on the French frontier yields the bitter sulphated waters called "Rubinat" and "Condal." Among sulphur springs that of Panticosa in the Pyrenees, 5600, is a thermal water resembling some of those on the French side of the mountains, and containing two parts of sulphide of sodium in 100,000. At such an altitude, almost the highest of European spas, bath treatment is greatly modified by climate. Carratraca (near Malaga), Montemayor y Bejar and Ledesma, 2600 (both near Salamanca), and Caldas da Rainha (Portugal), are among many other sulphur springs. Urberoago de Alzola (near Plasenzia) has warm calcareous and chalybeate springs.

### NORWAY, SWEDEN, AND ICELAND

Sandefjord and Laurvik (near Christiania) possess both sulphurous and chalybeate springs, and employ baths and frictions with sulphurous mud. Mud baths are much used at Modum, where there is also an effervescing chalybeate water (St. Olafs). Among the numerous chalybeate waters of Sweden may be mentioned Medewi, Porla Brunn, Daneverd (near Upsala), and Gustafsberg (near Uddevalla). At the two last mud baths are commonly used, also at Wahlberga (near

the Lake of Wenver), and at Loka (on Lake Lersjö). In Iceland, Barestrand Syssell has indifferent waters at 218° F., but Randamel, with ferruginous waters, is more frequented.

## RUSSIA

Among the better-known Russian spas are Köt-schenowa (near Moscow), an effervescing chalybeate water; Stolypin (on the Kuschum), a saline sulphur water; in Poland, Ciechocinck, with strongly muriated springs, and Busk (near Cracow), with muriated sulphur waters and peat baths; on the Baltic, Oesel (in Livonia), with sea and mineral mud baths, and Kemmern (near Riga), with cold sulphur waters and peat and sea baths. There is in the Caucasus at Pjäti-gorsk and its neighbourhood an important group of thermal waters, some sulphurous and others ferruginous or alkaline. One of these, Schelnesa-Wodsk, 1800, is an alkaline ferruginous spa and much frequented. Among other Caucasian springs, Borgum has strong sulphurous alkaline waters. Bituminous and brine mud baths are given at Astrakhan on the Caspian Sea, and sea mud baths are much made use of at Odessa and on the Black Sea coast.

## TURKEY, BULGARIA ETC.

There are some very complete thermal baths in Turkey. Brussia (Asia Minor), with many thermal springs, is said to have one of the finest balneary establishments in the world. Among many others, there are thermal muriated and ferruginous waters at AHILO (near Constantinople), and thermal sulphur waters at SMYRNA, at CALLIRHOE (Palestine), and at SALONICHI (Macedonia), where mud baths are also used. Other thermal waters are found at FEREDS-CHIK (Roumelia); LIDJA (Anatolia), and GADARA

(Palestine), where sulphurous and mud baths at high temperatures are used by the Arabs.

Bulgaria is said to possess no less than 200 hot springs, some of which have been in use since Roman times. As in other Slavonic countries very hot and sweating baths have been employed from remote times, and are still much used.

Many thermal and hyperthermal sulphurous and calcareous waters are found in the vicinity of SOFIA, the swimming baths in the city being served by one of their springs. At BANKI are subthermal waters said to resemble in their action those of NÉRIS and SCHLANGENBAD, served in magnificent marble baths. Among other thermal waters in the same district are KNIAJÉVO and PANITCHERÉVO, both resorted to for hyperchlorhydria and catarrh of the stomach as well as for uratic gravel and for sterility: GORNIA BANIA and DOENA BANIA (thermal sulphurous).

HISSAR (near Phillipopolis) has many thermal sources and baths employed by the Romans and well known throughout the East. They are visited by large numbers of people from Asia Minor and the surrounding countries. The waters of MERITCHLÉRI in Stara-Zagora are sometimes likened to those of Carlsbad. SAPARÉVO possesses the hottest of the Bulgarian waters (88° C.), containing sulphur with organic matter. It is praised for its stimulating action in "scrofula," inveterate and hereditary syphilis, chronic skin affections and metallic poisoning. VARSHEZ in the North Western Mountains is one of the most famous of the Balkan spas. Its subthermal waters are recommended for skin affections, for rheumatism and the results of wounds and injuries.

## AFRICA

HELOUAN-LES-BAINS on the desert near Cairo, 200, a remarkably dry winter climate. Muriated and



muriated-sulphur springs at 90° F. Inhalations. Douche and other baths.

Algiers has many valuable thermal spas. The water of BAINS-DE-LA-REINE (near Oran) is muriated, at 130° F., as also that of HAMMÂM-MELOUAN. HAMMÂM-R'IRHA has hot calcareous and chalybeate waters, and HAMMÂM-MESKOUTIN a hyperthermal water at 203° F. MARA (Abyssinia) has bitter waters, and OKME (Nubia) warm sulphur springs.

## INDIA

As in all volcanic countries, so in India, mineral springs abound, but very few of them have at present been subjected to scientific investigation and analysis. Those in particular that occur at high altitudes might probably prove valuable to Europeans.

**THERMAL SPRINGS.** Of this class there is a large number in India, especially in the TENASSERIM provinces. In the HAZARIBACH district (Bengal) the country for more than 100 miles in all directions is teeming with thermal springs, at an altitude of about 1500 feet. At MUNNIKARN (Jalandhar Doab) there is a boiling fountain (207° F.) at an elevation of 5587 feet, as well as waters containing iodine and bromine. There are also many in the HIMALAYAS and in SINDH.

**SULPHUROUS THERMAL WATERS** are also numerous in India. Among the better known are: JAWALA MUKHI ("Flames mouth"), in the Kangra district of the Punjab. There are here many sources, some of a remarkable character, containing iodine as well as sulphur. They are used especially for goitre, from which the local inhabitants are said to be exempt. Combustible gas issues in jets, which are kept constantly burning as a manifestation of the Hindu goddess Devi. There is also a sacred sulphurous spring at DANERA. At SONA (near Delhi), there are sulphur

waters with a considerable establishment; also in the HAZARIBAGH district and at high elevations in the Jalandhar Doab (BESHISHT, 6681); also at DARJILING, at CANNEA (Ceylon), at MALACCA, and elsewhere. Muriated springs are universal through the SALT RANGE (Punjaub), and occur in Western SINDH. Chalybeate waters are found in parts of the Himalayas and in the Neilgherries, and at NAGCONDA in the Simla hills.

### AMERICA AND CANADA

**ALKALINE WATERS.** Among Californian springs, the OJO CALIENTE is a thermal (100° F.) and weakly muriated alkaline water. The SARATOGA "VICHY" (New York State) is a somewhat similar source, but cold.

**MURIATED WATERS.** There are many brines and muriated springs in CALIFORNIA, UTAH, MISSOURI etc., both artesian and otherwise. At SARATOGA, the HAWTHORN and some other sources are of this kind; also BLUE LICK SPRINGS (Kentucky), and SAINT CATHARINE'S WELL and the CALEDONIA SPRINGS in Ontario, among other Canadian springs.

**SULPHATED or BITTER WATERS** are comparatively scarce in America. That of CRAB ORCHARD (Kentucky) is one of the best known.

**SULPHURETTED WATERS** are numerous in the States of New York and Virginia. Sulphurous inhalations are used at RICHFIELD (New York). The SALT SULPHUR SPRING (West Virginia), the PAROQUET SPRING (Kentucky), the SHARON and WHITE SULPHUR SPRINGS (in the State of New York) and the SANDWICH SPRING (in Ontario) are among the best known in the North American continent.

**HOT and ACID SPRINGS.** Free sulphuric acid is usually found associated with sulphates. The OAK ORCHARD SPRING (New York) is a striking example. This water is said to contain 40 per cent. of free sul-

phuric acid. Free hydrochloric acid usually occurs with chlorides. Some of the New Zealand geysers are of this kind, and the Californian geysers (Lemonade Spring) and some in the Yellowstone National Park. TEXAS has some strong springs, and TUSCARORA in Canada.

Another kind of hot acid springs, like most geysers, contains free silicic acid. The YELLOWSTONE NATIONAL PARK, at an elevation of 7000 feet, possesses an unrivalled treasure of hot and medicinal springs, in great variety but for the most part at present not utilised. They comprise calcareous, carbonated and silicious, and one or more arsenical waters. There are also hot springs in Virginia, North Carolina and Arkansas.

### NEW ZEALAND

One of the most interesting groups of medicinal waters in the world occurs in the province of Auckland in the North Island. The hot springs of ROTORUA arise in astonishing profusion on the southern shore of the lake of the same name. In this district the famous "pink white terraces" were destroyed by volcanic eruption in 1886. Some of the springs are of the nature of geysers and columns of silicious water are periodically shot into the air.

In addition to the springs there are numerous blow-holes, either of steam (*fumeroles*) or of sulphurous gas (*solfataras*). OHINEMUTU (962 feet), the former native township of Rotorua, has very many thermal sulphuretted silicious waters, of which some are strongly alkaline while others contain free sulphuric acid. Waters of this last type do not exist in Europe, although met with in the Yellowstone Park, U.S.A., and in Japan. The acid waters are only used externally and have a marked rubefacient and derivative action on the skin. The PISCINÆ are said to form the finest

bath in the southern hemisphere. Sulphur-mud and vapour baths are also commonly used. "Rachel's Bath" has a soft saline water at 194° F.

At TAMPO, 1500 feet, there is an important group of hot springs: (1) the Crow's Nest Spring (170° F.), which is muriated, (2) the Rushini (190° F.), containing free acid, (3) thermal sulphurous, (4) alkaline silicious water.

In the South Island, HANMER (1220 feet), situated upon a bracing plateau, has thermal muriated springs, 100°–118° F., containing carburetted and sulphuretted hydrogen.

TE AROHA (also in Auckland) has sulphurous, muriated alkaline and effervescing carbonated springs, some of them among the strongest of known alkaline waters.<sup>1</sup>

## JAPAN

**SULPHUROUS THERMAL WATERS.** There are many hot sulphur springs—especially in SATSUMA. KUSATSU, 3500, is the most celebrated of the Japanese spas. The waters are hyperthermal, and contain much sulphur, and also (it is said) arsenic and copper. The temperature of the "Fever Bath" is 150° F., that of the "Eagle Bath" somewhat cooler. A remarkable feature is the amount of free sulphuric acid in some of the baths. They are much used, and at very high temperatures, for syphilis, leprosy, and severe forms of rheumatism. ASHINOYA (near Lake Hakone) possesses many hot sulphur springs and solfataras. It is frequented by the Japanese for skin affections and syphilis. YUMOTO, 5061, and NIKKO (in the same district) have similar waters. UNZEN, near Nagasaki, is also a sulphur spring. At KAWANAKA, a

<sup>1</sup> See *The Health Resorts and Mineral Waters of New Zealand*, by A. S. Wohlmann, M.D., New Zealand Government Dept., Wellington. 1907.

little subthermal spa near IKAO, bathers remain many hours or days in the water.

Among chalybeate waters are those of IKAO, 2700, "a cool and pleasant" resort near Nagasaki; and ARIMA (near Kobe), with hot iron springs and baths. The best-known of the SALT SPRINGS are ATAMI and ISOBE. At BEPPA (Kiushiu) people take hot baths on the sea-shore when the tide is out, digging the sand deep enough for the body.

The Tansan Water from Takarada (Kobe) is now much used in the East.

## CHAPTER XXII

### AN INDEX OF SPAS

ABANO (near Padua), 100 feet, hyperthermal weak salt springs, 100° to 183° F., radio-active, an organic mud (*fango*), applied locally for chronic joint affections.

ACQUI (Piedmont), 480 feet, one of the chief Italian spas, hyperthermal salt sulphur springs, 102° to 158° F., thermal baths and hot *fango*, applied in chronic joint and neuralgic affections.

AIX-LA-CHAPELLE (Germany), 530 feet, thermal salt sulphur springs, employed internally and by inhalation in catarrhal conditions, in chronic joint affections and (with mercurial inunctions) in syphilis; open throughout the year.

AIX-LES-BAINS (Savoy), 860 feet, thermal waters faintly sulphuretted, 109° to 112° F., mainly used externally for the douche-massage, and for general and local vapour baths in chronic arthritis and gouty and rheumatic affections of the joints and fibrous tissues, neuritis and neuralgia. The characteristic treatment of Aix is the massage douche in its various applications. The strong sulphur water of Challes, 0·5 per mille of sodium sulphide with iodide and bromide, is much employed in *pulverisation* for the respiratory mucous membranes and is also used internally at Aix. Sulphur inhalations are also given for catarrh at Marlioz.

ALEXANDERSBAD (Bavaria), 1915 feet, a gaseous chalybeate water used also for baths, peat baths, and hydrotherapy.

ALLEVARD (France), 1400 feet, strong sulphuretted

waters used especially for chronic catarrhs (by pulverisation) and for rheumatism.

AMÉLIE-LES-BAINS (Eastern Pyrenees), 920 feet, hyperthermal alkaline sulphur waters, 0.01 per mille, indicated in chronic arthritis, rheumatism and catarrhal and skin affections; may be visited in winter.

ARGELES-GAZOST (near Lourdes), 1520 feet, cold sulphided waters resembling those of Eaux Bonnes; a pleasant spa in spring and autumn for nervous and catarrhal affections.

BADEN (near Vienna), 700 feet, subthermal sulphided calcareous waters and mud baths, used for rheumatism, arthritis and skin affections. Open throughout the year.

BADEN (Switzerland), 1230 feet, hyperthermal sulphur waters, given in subthermal baths for chronic rheumatism, sciatica, etc.

BADEN-BADEN (Germany), 650 feet, many hyperthermal muriated springs, 124° to 150° F., radio-active, weakly mineralised by chloride of sodium and traces of arsenic, used for drinking and flowing baths, douches, and natural vapour baths, the usual indications for thermal baths, especially for delicate subjects, convalescence and chronic catarrhs; open all the year, warm in summer, in the vicinity of forests; terrain cure.

BADEN-WEILER (Black Forest), 1400 feet, subthermal waters at 79° F., terrain cure.

BAGNÈRES DE BIGORRE (Pyrenees), 1805 feet, thermal calcareous waters, 77° to 123° F., diuretic and tonic, used, with baths sometimes prolonged for two or more hours, for their sedative action in irritable and painful nervous conditions, neuralgia and, dysmenorrhœa; chalybeate and sulphur waters are employed in anæmia and catarrhal affections.

BAGNOLES DE L'ORNE (Normandy), 530 feet, subthermal waters in fine wooded hill country, subthermal

baths prolonged to 30 to 60 minutes, believed to exercise a tonic action on the surface arterioles and veins, used in convalescence from phlebitis (especially gouty), and in circulatory disorders at the menopause.

BAINS-LES-BAINS (Vosges), 980 feet, a sedative thermal spa among woods, with silicated radio-active waters. The subthermal baths are markedly sedative to the nerve centres, and, with the diuretic waters, are employed in vascular hypertension and sclerosis.

BARÈGES (Pyrenees), 4200 feet, thermal sulphur waters, 0.04 per mille, unctuous with organic matter (*baregine*, which consists of an alga, *Leptomitus sulphurarius*). Both the waters and the sulphur and douche baths are valued for their highly stimulant action in scrofulous affections of bones and joints, chronic rheumatism, the results of wounds and injuries, and in some cases of infantile paralysis.

BATH (Somerset), 100 to 600 feet, R. 32, MT. 50.5, *Aquæ Sulis* of the Romans, thermal waters with sulphate of calcium, radio-active, principally used for baths and the massage douche, inhalations and local vapour baths; a sedative spa for chronic gout, rheumatism and fibrositis, and in circulatory and nervous erethism (Chapter XIII).

BATTAGLIA (Italy), 1900 feet, hyperthermal waters containing a little salt, used for baths and natural vapour baths and inhalations, also *fango*, in gouty and rheumatic affections, and arthritis and chronic catarrh. The treatment is available all the year.

BEX (Switzerland), 1400 feet, brine baths, beautifully situated in the Rhone Valley; a tonic spa.

BILIN (Bohemia), 650 feet, a cold gaseous alkaline water used for catarrh of the stomach and respiratory organs.

BORMIO (Italy), 4500 feet, an alpine spa with thermal waters, 91° to 105° F., immersion baths, douches and mud baths, used for arthritic and chronic skin affections.



BOURBON-LANCY (France), 1780 feet, weak hyperthermal salt springs, radio-active, with thermal and vapour baths, especially used in rheumatism and nervous erethism.

BOURBON-L'ARCHAMBAULD (near Moulins), 870 feet, thermal muriated waters, local vapour baths and hyperthermal douches and pediluvia, employed in nervous affections, rheumatism, arthritis and scrofula.

BOURBONNE-LES-BAINS (France), 900 feet, hyperthermal salt waters, high pressure douches and subthermal and thermal baths; a stimulating spa for scrofulous and rheumatic affections and the results of traumatism.

BRIDES-SALINS (Savoy), BRIDES-LES-BAINS, 1860 feet, a warm, weak, salt sulphated water, tonic and laxative, used especially for constipation and congestion and enlargement of the liver and obesity (see *Salins-Moutiers* and *Pralognan*).

BRIDGE OF ALLAN (Scotland), a salt water with chloride of calcium, used for dyspepsia and hepatic engorgement (Chapter XIII).

BUDAPEST (Hungary), thermal sulphur waters and mud baths, for rheumatic and digestive disorders.

BUXTON (Derbyshire), 1000 feet, R. 48·2 MT. 46·2°, subthermal water, rich in nitrogen, radio-active, also chalybeates; reclining, douche, peat baths, indicated for chronic rheumatism, gout, nervous affections, and anæmia (Chapter XIII).

CASTELLAMMARE (Bay of Naples), salt alkaline and iron waters and sea baths.

CAUTERETS (Pyrenees), 3200 feet, thermal alkaline sulphur waters, 0·01 to 0·02 per mille, unctuous with silicates and organic matter, radio-active, used internally and for baths, douches, inhalations, gargling, etc., in chronic pharyngeal and respiratory catarrhs, sluggish tuberculous lesions, atonic dyspepsia, eczema and nervous dysmenorrhœa.

CERESOLE-REALE (Italy), 5290 feet, a bracing alpine spa with iron and arsenical waters.

CHALLES, see Aix-les-Bains.

CHÂTEL-GUYON (Auvergne), 1300 feet, warm gaseous alkaline waters with a little salt, chloride of magnesium and iron, used internally and for effervescing flowing baths, for atonic nervous and gouty dyspepsia, catarrh of the colon and constipation; a sedative and tonic spa in beautiful country.

CHELTENHAM (150 feet), R. 29·8, MT. 47·1°, cold sulphated salt and chalybeate waters, resorted to for chronic gout and hepatic disorders, especially by persons from hot countries.

CHIANCIANO (Sienna), 1800 feet, thermal calcareous and diuretic waters.

CONTREXÉVILLE (Vosges), 1150 feet, cold calcareous waters, used chiefly internally, very diuretic and slightly laxative, recommended for insufficient renal action, urinary gravel, oxaluria and chronic cystitis, gouty hypertension and atonic dyspepsia.

CRANSAC (near the volcano le Montet), 980 feet, calcareous waters and natural sulphurous vapour baths.

CUDOWA (Silesia), 1310 feet, cold gaseous alkaline chalybeate waters and effervescent baths, indicated in convalescence, anæmia, and cardiac debility.

DAX (near Bayonne), 130 feet, hyperthermal waters, 88° to 147° F., used for baths, douches and vapour baths, local and general, soft silicious mud baths, unctuous with organic matter ("thermal algæ"), often given at high temperatures for their stimulant, revulsive and resolvent effects in chronic rheumatism and arthritis, in peri-articular thickenings and contractions and in pelvic exudations; a thermal spa, open both summer and winter.

DRIBURG (Westphalia), 730 feet, gaseous chalybeate waters, effervescing, moor and gas baths, employed chiefly for anæmia, debility, and catarrhal affections.

DROITWICH (Worcester), 200 feet, R. 26·5, MT. 50·5°, a nearly saturated brine, used externally in chronic rheumatism and gouty affections; sciatica, and muscular rheumatism, also in some "scrofulous" conditions and for anæmia and retarded convalescence. The baths are open all the year (see Chapter XIII).

EAUX-BONNES (Pyrenees), 2460 feet, a thermal sulphided water, 0·02 per mille, radio-active, used mainly internally, in catarrh of the respiratory passages, anæmia, and scrofula; a stimulant spa, with marked intensive action.

EAUX-CHAUDES (Pyrenees), 2050 feet, weak sub-thermal sulphided waters, radio-active, used chiefly for baths and irrigations, for their sedative effect in pelvic and many nervous disorders and subacute rheumatism.

ELSTER (Saxony), 1550 feet, cold gaseous alkaline sulphated and chalybeate waters, effervescing iron and peat baths, indications as for Franzensbad; a bracing spa.

EILSEN (Germany), 230 feet, strong sulphuretted and calcareous waters, sulphur mud baths and sprays, used for gouty and skin affections.

EMS (Prussia), 260 feet, thermal salt alkaline effervescing springs, much used internally and as baths, sprays and inhalations for chronic catarrhs, gouty bronchitis and dyspepsia, also with occasional advantage for leucorrhœa and sterility.

ENGHIEN (near Paris), cold sulphuretted and calcium waters.

EVAUX-LES-BAINS (France), 1500 feet, a thermal water resembling that of Nérès, with similar indications, and locally for chronic rheumatism.

EVIAN-LES-BAINS (on the Lake of Geneva), 1240 feet, a feebly alkaline cold water, diuretic; employed with advantage in deficiency of renal action, catarrh of the bladder, and in early cases of arterio-sclerosis.

FRANZENSBAD (Bohemia), 1500 feet, cold effervescent alkaline, sulphated and chalybeate waters, used in anæmia and chlorosis, hepatic dyspepsia and gout, effervescing moor and gas baths, employed in cardiovascular and functional nervous disorders, leucorrhœa and affections of the pelvic organs.

GASTEIN (Austria), 3430 feet, thermal waters, radio-active, principally used for baths, both thermal and hyperthermal, in painful rheumatic and nervous affections (tabes dorsalis), and for the resolution of exudations, as in pelvic peritonitis; a mountain station, also resorted to for "after-cures."

HAMMÂM-MESKOUTIN (near Constantine, Algeria), 900 feet, a winter and spring resort in mountainous country, hyperthermal calcareous waters, stimulant and intensive, used externally for chronic rheumatism and sometimes for anæmia and diseases of women.

HAMMÂM-R'IRHA (Algiers), 1800 feet, hyperthermal waters with a fine winter climate, in the neighbourhood of pine woods near the sea; a highly stimulating thermal spa for atonic arthritic and nervous affections, neuralgia and slight paralysis, contra-indicated in congestive conditions.

HARROGATE (Yorkshire), 400 to 600 feet, R. 28·5 MT. 46·5°, cold salt sulphur and chalybeate waters, used for their alterative and laxative effect in many congestive and gouty conditions; sulphur, peat, douche, vapour and other baths, much employed in chronic joint affections and "fibrositis" (Chapter XIII).

HELOUAN (near Cairo), a climatic winter resort with subthermal salt sulphur waters; the baths are used mainly in chronic rheumatism and arthritis.

HERCULESBAD (Hungary), 570 feet, thermal muriated and sulphuretted springs, 70° to 133° F.

HOMBURG (Germany), 600 feet, effervescing salt waters, with chloride of calcium, also salt chalybeate waters, inhalations, salt and effervescing baths; a spa

and pleasure resort, for gouty disorders and dyspepsia of a congestive type, catarrhal affections, and anæmic and cardiac debility.

ISCHIA, thermal salt alkaline springs (Gurgitello), natural vapour baths, 108 to 133° F., and sand baths at Castiglione; available in winter.

ISCHL (Austria), 1550 feet, a strong brine for baths and salt springs for drinking, mud baths, and "terrain" cure.

JOHANNISBAD (Bohemia), 2070 feet, subthermal waters and a chalybeate spring; a bracing station for after-cures and convalescence.

KARLSBAD (Bohemia), 1230 feet, hyperthermal alkaline sulphated waters with free gas, radio-active; much used for liver affections, dyspepsia, constipation and overfeeding, especially in stout subjects, and in those who have resided in the tropics.

KISSINGEN (Bavaria), 650 feet, effervescent salt waters with chloride of calcium and some carbonate of iron, plain and effervescing salt baths, douches, gas, and mud baths, inhalations; the waters are used for catarrhal conditions, dyspepsia and constipation, atonic gout, glycosuria, obesity, also in scrofula and anæmia, and the effervescing baths in circulatory disorders.

KREUZNACH (Germany), 340 feet, salt waters with chloride of calcium and traces of barium, radio-active; a typical salt spa (chloride of sodium 1 per cent., chloride of calcium 0.1 per cent.), with very mild climate, for drinking, baths and inhalations from the *gradir hausen*, where the water is exposed to evaporation on walls of thorn, largely used for scrofulous and catarrhal affections, especially of the throat and bronchi, and in endometritis and old pelvic cellulitis.

LA BOURBOULE (Auvergne), 2780 feet, hyperthermal muriated alkaline, arsenical radio-active waters, in a mountain climate, indicated for anæmia, scrofulous

and chronic skin affections, prolonged sedative baths and douches, inhalations for chronic mucous catarrhs.

LAMALOU (Cevennes), 620 feet, subthermal alkaline chalybeate waters and "piscine" baths, employed for chronic rheumatism, neuritis and nervous affections (tabes dorsalis).

LANDECK (Prussian Silesia), 1530 feet, indifferent subthermal waters, subthermal and moor baths, for rheumatism, neurasthenia and pelvic disorders.

LAURVIK (Norway), cold sulphurous and chalybeate waters and mud baths, employed especially in rheumatic affections, sciatica and pelvic effusions.

LAVEY (Rhone Valley), 1350 feet, weak thermal sulphur waters, brine and hot sand baths, for atonic scrofulous and rheumatic affections.

LEAMINGTON, 200 feet, R. 30 MT. 48°, cold sulphated salt water with sulphate of lime, diuretic and laxative, baths and douches, resorted to for hepatic disorders, dyspepsia, and constipation (see Chapter XIII).

LENK (Switzerland), 3630 feet, strong sulphuretted waters with sulphate of lime; indications as for Strathpeffer.

LEVICO (Tyrol), 1700 feet, cold sulphate of iron and arsenical waters, used in anæmia and malarial cachexia.

LIPPIK (Slavonia), 500 feet, thermal muriated alkaline waters and baths, for rheumatic and scrofulous disorders.

LISDOONVARNA (Ireland), 430 feet, a bracing spa with weak sulphuretted and chalybeate springs, helpful in rheumatic and digestive disorders (Chapter XIII).

LLANDRINDOD (Wales), 700 feet, R. 35, salt, sulphur and chalybeate waters, slightly laxative, employed as at Harrogate; a tonic spa, helpful in neurasthenia and debility (Chapter XIII).

LLANGAMMARCH (Brecknockshire), 600 feet, muriated

water with chlorides of calcium and barium, a tonic and sedative spa for scrofulous affections, neurasthenia, etc. (Chapter XIII).

LLANWRTYD (Wales), 800 feet, a strong sulphuretted water with indications similar to those of Strathpeffer (Chapter XIII).

LOÈCHE-LES-BAINS (Switzerland), 4600 feet, thermal waters containing sulphate of calcium, subthermal baths and douches, prolonged immersion baths at indifferent temperatures, in chronic and intractable eczema and psoriasis, sometimes as a sedative in gouty arterial hypertension and nervous erethism; the alpine climate powerfully modifies the effect of treatment.

LUCAN (near Dublin), a weak sulphuretted water (Chapter XIII).

LUCCA (Italy), 390 feet, is an ancient and famous bath; hyperthermal calcareous springs 98° to 129° F., thermal vapour and mud baths, intensive treatment for chronic joint affections.

LUCHON (France), 2050 feet, thermal and hyperthermal sulphur waters (0·05 to 0·07 per mille) used for drinking, baths and inhalations; indications similar to those of Cauterets, but with the warmth of the climate a more intensive treatment; mercurial inunctions as at Aix-la-Chapelle; terrain cure.

LUXEUIL-LES-BAINS (near Plombières), 1300 feet, thermal waters, radio-active, used for subthermal baths and hyperthermal rectal and vaginal douches; indications those of Plombières, also chronic endometritis, inflammatory conditions of the uterine appendages, and old pelvic peritonitis, with amenorrhœa or sterility.

MALVERN, see Chapter XIII.

MARIENBAD (Bohemia), 2090 feet, cold alkaline sulphated springs with free carbonic acid gas, thermal effervescing and moor baths; indications as Karlsbad,

also cardio-vascular disorders in gouty and nervous subjects, and chronic uterine affections.

MARTIGNY (Vosges), 1200 feet, cold calcareous diuretic waters; indications as for Contrexéville; a quiet, restful spa.

MATLOCK BATH (Derbyshire), tepid immersion baths, *fango* and effervescing baths; a sedative station for chronic rheumatic affections, sciatica, and some cases of cardiac and functional nervous disorder.

MERGENTHEIM (Württemberg), 690 feet, a strong gaseous muriated spring, useful in obesity, constipation, and chronic gastro-intestinal catarrh.

MOFFAT (Scotland), 370 feet, weak salt, sulphur, and chalybeate waters; recommended with the climate in rheumatic affections and convalescence.

MONDORF (Luxembourg), 650 feet, a subthermal muriated and bromided water.

MONSUMMANO (Italy), subthermal waters in large natural caverns, used as vapour baths in lumbago sciatica, also a tepidarium and douche baths.

MONT DORE (Auvergne), 3400 feet, a mountain spa; hyperthermal weak alkaline waters with a trace of arsenic, 104° to 116° F.; hyperthermal half-baths and foot-baths, local treatment by inhalations and sprays in respiratory catarrhs and asthma, especially in gouty subjects.

MONTECATINI (near Pistoia, Italy), 920 feet, "one of the first balneary stations in Italy," a weak subthermal salt water, much used internally for delicate catarrhal and dyspeptic subjects. The natural vapour baths of Monsummano are near at hand.

NENNDORFF (Prussia), 230 feet, a strong sulphuretted water, sulphurous mud baths.

NÉRIS (France), 1150 feet, thermal soft, faintly alkaline waters, 102–120° F., radio-active, subthermal and prolonged baths, with sedative effect in nervous excitation, gastralgia, enteralgia, hysteria and dis-



orders of the pelvic organs, also natural vapour baths ; the climate enhances the sedative action.

NEUENAHN (Germany), 260 feet, thermal gaseous alkaline waters, often used for gouty glycosuria and dyspepsia ; inhalations for chronic catarrhs ; a warm and sheltered spa.

NAUHEIM (Germany), 400 feet, subthermal effervescing muriated waters, 82° to 95·5° F., with 1 to 3 per cent. of salt and rich in carbonic acid gas, taken internally for catarrhal conditions, dyspepsia and scrofula ; baths at subthermal temperatures, either plain salt effervescing, or strengthened by *mutterlauge* ; inhalations for pharyngeal and bronchial catarrhs ; the baths are used in chronic rheumatic affections, especially as a tonic treatment in weakness of the heart and circulation, in the latter case often combined with graduated " resisted exercises " ; a warm spa.

OEYNHAUSEN (Westphalia), 230 feet, strong subthermal effervescing salt waters, principally used for effervescing baths in circulatory and nervous disorders (*tabes dorsalis*).

PANTICOSA (Spain), 5600 feet, subthermal and sulphur waters, inhalations of nitrogen gas, chronic tuberculosis and catarrhal affections.

PLOMBIÈRES (Vosges), 1300 feet, thermal and hyperthermal waters 77° to 155° F., some unctuous from the presence of silicates ; radio-active ; piscines and thermal baths, underwater douches, Roman vaporarium, lavage of the large intestine ; the waters used internally for their subsedative action in nervous dyspepsia and as a diuretic ; the thermal baths, aided by the mountain climate, are markedly sedative and employed in painful " arthritic " and nervous disorders, painful spastic conditions of the large bowel, " typhlitis " and chronic colitis, especially when associated with a tendency to diarrhœa, also in cases of appendicitis before or after operation ; the indications also include

nervous gastralgia, sciatica, tabetic pains and crises, insomnia, irritable neurasthenia, and spasmodic dysmenorrhœa.

PORETTA (Bologna) 1100 feet, has hot sulphur springs.

PÖSTYEN (Hungary), 490 feet, hyperthermal sulphur waters, baths and local applications of sulphurous mud, an intensive treatment, used for indolent joint affections, neuralgias, and syphilis.

POUGES (France), 650 feet, cold gaseous alkaline calcareous waters, resorted to in many conditions of debility, atonic gout and dyspepsia, anæmia, glycosuria, and senility; terrain cure; a warm spa.

POZZUOLI and BAGNOLI (near Naples), thermal salt alkaline waters, fumaroles of sulphuretted vapour and natural vapour baths.

PRALOGNAN, 4670 feet, near Brides-les-Bains, is a valuable Alpine climatic station.

PYRMONT (Germany), 420 feet, cold gaseous chalybeate and salt springs, effervescing and "moor" baths; indicated in anæmia and scrofulous affections.

RAGATZ-PFÄFFERS (Switzerland), 1700 feet, sub-thermal indifferent waters, radio-active, prolonged baths; a bracing and sedative spa for painful rheumatic affections and arthritis, irritable nervous conditions, and some chronic skin affections.

RECOARO (near Vicenza, Lombardy), 1400 feet, gaseous chalybeate calcareous springs, both tonic and aperient; a climatic resort.

REICHENHALL (Bavaria), 1570 feet, a strong brine (22 per cent.) used for inhalations and gaseous and other baths, for catarrh of respiratory organs, etc.; terrain cure.

RHEINERZ (Silesia), cold gaseous chalybeate waters, effervescing and peat baths; terrain cure; indicated in anæmia, debility, and convalescence.

RHEINFELDEN (Switzerland), 866 feet, a nearly

saturated brine like that of Droitwich, especially useful in scrofula and chronic rheumatism.

RIPPOLDSAU (Black Forest), 1856 feet, cold gaseous chalybeate waters and iron baths.

RONCEGNO (Tyrol), 1750 feet, cold sulphate of iron and arsenical water.

ROYAT (Auvergne), 1480 feet, subthermal salt alkaline gaseous waters with a little iron, used internally, and for effervescing baths and inhalations; valuable for atonic gouty affections, dyspepsia, eczema, bronchial catarrh and anæmia; the baths are also employed for their tonic effect in cardio-vascular disorders.

SAINT-AMAND (near Lille), 100 feet, subthermal waters, 70° to 79° F., diuretic; the silicious sulphuretted mud baths are unctuous with organic matter; duration of bath from one to three hours; also hyperthermal local applications; employed in chronic rheumatism and arthritis, sciatica, the results of traumatism and pelvic peritonitis and in old-standing phlebitis and periphlebitis.

SAINT GERVAIS (near Chamounix), 2075 feet, a sedative mountain spa with warm, weak, sulphated salt waters; used with advantage internally and for baths, in arthritis and nervous affections, chronic eczema and prurigo.

SAINT-HONORÉ (France), 900 feet, subthermal waters containing sulphur and arsenic, used internally and for baths, and locally for the throat and bronchial mucous membrane in young scrofulous subjects and for chronic catarrhs and torpid tuberculosis in adults.

ST. MORITZ (Switzerland), 5800 feet, cold gaseous chalybeate springs, with effervescent baths; a bracing spa, appropriate in chlorosis, anæmia, debility and atonic conditions.

SAINT NECTAIRE (Auvergne), 2500 feet, thermal gaseous salt alkaline springs with a little iron; a tonic

spa for rheumatic, gouty anæmia and dyspeptic subjects, with some reputation in functional albuminuria.

SAINT-SAUVEUR (Pyrenees), 2500 feet, subthermal unctuous sulphur waters, 0.02 per mille, mainly used for baths in utero-ovarian disorders, dysmenorrhœa and sterility, especially in weakly and nervous subjects, also in irritable neurasthenia and nervous dyspepsia; a sedative, sheltered mountain spa.

SALIES DE BÉARN (France), 100 feet, a strong brine bath, recommended in scrofulous and torpid uterine affections and fibromyomata.

SALINS (France), 1200 feet, cold muriated waters, with traces of bromides and iodides, used for baths in scrofula and convalescence.

SALINS-MOUTIERS (near Brides-les-Bains) has a warm radio-active brine with much gas, employed in "flowing baths" in lymphatic and circulatory disorders; terrain cure.

SALSOMAGGIORE (Italy), 520 feet, a cold brine (13 per cent.), much used for baths and inhalations in scrofulous, gouty, and rheumatic affections.

SALZBRUNN (Prussian Silesia), 1320 feet, cold gaseous alkaline waters, bicarbonate of sodium, 2 per mille; used for gouty and chronic catarrhal affections, digestive and respiratory; terrain cure and hydrotherapy.

SANDEFJORD (Norway), gaseous salt sulphur and sulphate of iron springs, hot salt and mud baths; indications as for Laurvik.

SCHINZNACH (Switzerland), 1140 feet, strong subthermal sulphuretted waters with baths, douches and sprays, employed especially in skin affections and catarrhs, also in rheumatism, scrofula, and syphilis.

SCHLANGENBAD (Germany), 900 feet, a soft subthermal water 82° to 90° F., rich in gases; a restful and sedative spa, valuable for retarded convalescence,

nervous erethism and overstrain and neurasthenia, and some chronic skin affections.

SCHWALBACH (Germany), 950 feet, cold gaseous chalybeate water; peat and effervescing iron baths; indications as for Spa.

SPA (Belgium), 1000 feet, cold gaseous chalybeate effervescing iron and moor baths; indications, anæmic and atonic conditions, especially in women, with leucorrhœa, menorrhagia, or sterility, in convalescence and circulatory disorders.

SODEN (Taunus, Germany), 450 feet, warm salt waters, some gaseous, used internally and by inhalation, and gargling for catarrhal affections, scrofula and convalescence; circulatory disorders are treated by gaseous baths.

STRATHPEFFER (Scotland), 150 to 300 feet, R. 31, MT. 45.5°, strong sulphuretted and chalybeate waters, sulphur, peat, douche and artificial effervescing baths; resorted to for chronic gout and rheumatism and skin affections (gouty eczema); both the climate and baths are helpful in neurasthenia, insomnia, and in the debility of age; a tonic and sedative spa.

TARASP-SCHULS (Switzerland), 3890 feet, cold muriated effervescing strongly alkaline waters, used in dyspepsia, glycosuria, and constipation of plethoric subjects; salt and effervescing baths in cardio-vascular disorders; also a chalybeate and arsenical spring for anæmia; a bracing spa.

TEPLITZ (Bohemia), 730 feet, thermal waters with thermal and peat baths, used in rheumatic, gouty and functional nervous disorders.

TUNBRIDGE WELLS, 430 feet, cold chalybeate waters, helpful in many cases of anæmia and convalescence.

URIAGE (France), 1350 feet, a subthermal salt sulphur spring, isotonic, laxative, diuretic, prolonged baths, and local irrigations and inhalations; recommended for scrofulous and delicate children, impetigo,

eczema and psoriasis, and used as an adjuvant treatment in syphilis.

VALS (France), 790 feet, many cold alkaline waters with a little iron and much free carbonic acid gas, slightly laxative, diuretic, and cholagogue; more stimulating than Vichy, used for atonic dyspepsia and gouty affections.

VERNET-LES-BAINS (France), 2060 feet, soft unctuous thermal sulphur waters, 0.04 per mille; indications those of Cauterets, also as an adjuvant treatment in syphilis; open throughout the year.

VICHY (France), 736 feet, many cold and thermal strongly alkaline waters, bicarbonate of sodium more than 4 per mille, also traces of iron, arsenic, and fluorine, and free carbonic acid gas; nearly isotonic; employed for drinking and for many kinds of baths; given especially for hepatic dyspepsia, gall-stones and jaundice, gouty glycosuria, hyperacidity and obesity; contra-indicated in thin and weakly subjects.

VINADIO (Piedmont), 4360 feet, thermal salt sulphur waters and a series of vapour baths (*stufe*) in ascending order of temperature, hyperthermal mud baths (*fango*).

VITTEL (Vosges), 1100 feet, a cold calcareous and diuretic water; indications those of Contrexéville; a modern spa and pleasure resort.

WEILBACH (Germany), 440 feet, cold sulphuretted and weak alkaline waters, with reputation in liver affections.

WIESBADEN (Germany), 380 feet, thermal salt waters, 100° to 156° F., with contained gases, radioactive; thermal and hyperthermal baths, douches and inhalations; a valuable spa, warm in summer but open throughout the year, situated in the vicinity of forests; helpful in atonic gout and "intestinal catarrh," uterine disorders, and catarrhs of the respiratory passages; also for the inunction treatment of syphilis and systematic exercises in nervous diseases.

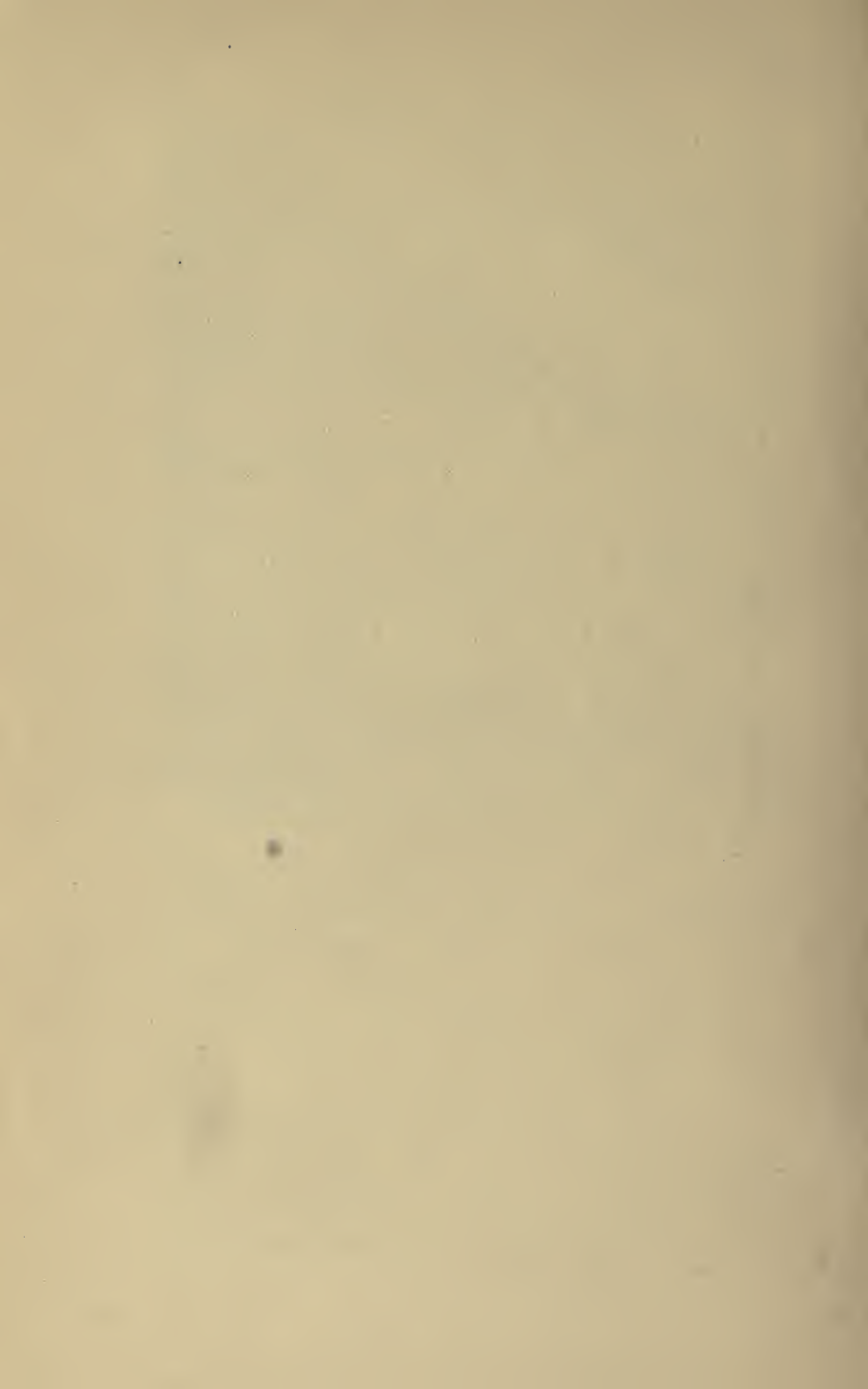
WILDBAD (Black Forest), 1410 feet, subthermal and thermal waters, 91° to 104° F., rich in nitrogen gas; subthermal flowing baths, douches and vapour baths; indicated for rheumatism and gout, and especially for conditions of nervous erethism and weakness, convalescence and premature senility.

WILDUNGEN (Germany), 980 feet, alkaline calcareous gaseous water, also a chalybeate, powerfully diuretic; used in urinary lithiasis and genito-urinary catarrh; stimulating subthermal baths.

WITTEKIND (Saxony), 200 feet, a cold muriated water, 3·5 per cent. chloride of sodium, moor and salt baths.

WOODHALL SPA (Lincolnshire), R. 22·7, salt waters with chloride of calcium and a small quantity of bromide; the baths, like those of Kreuznach, are used in scrofula, leucorrhœa, and for their decongestive effect in uterine fibroids, also in rheumatic affections and arthritis; the comparatively bracing east coast climate is a factor in the treatment (see Chapter XIII).

YVERDON (Switzerland), 1430 feet, warm sulphur water, used for drinking, baths and inhalations; also *fango* and sun baths; indications those of Cauterets.





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