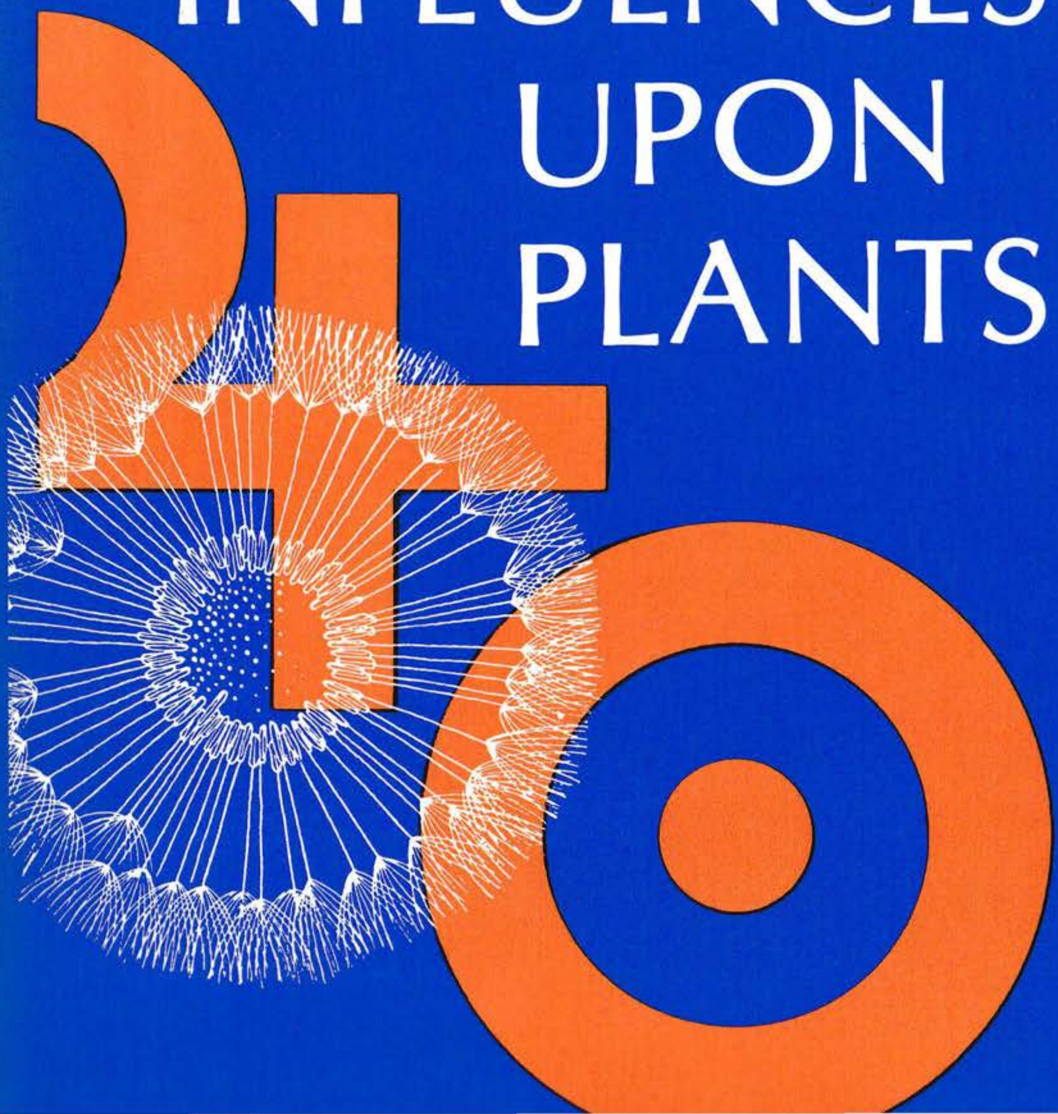
ERNST MICHAEL KRANICH

PLANETARY INFLUENCES UPON PLANTS



ERNST MICHAEL KRANICH

PLANETARY INFLUENCES UPON PLANTS

A COSMOLOGICAL BOTANY

Bio-Dynamic Literature
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Contents

"The comprehension of nature's rhythms . . . will become true natural science."

Rudolf Steiner

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FORMULATING THE QUESTION

At the beginning of our century a significant change occurred in the investigation of life. The great achievements of the nineteenth century had taken place in the investigation of form; anatomy and comparative morphology had their golden age, of which little is noticeable at universities nowadays. But more recently the interest of biology has shifted from the external form of the organs to life processes and behavior. Today, as opposed to the description and the comparative observation of form, attempts are being made to penetrate life by researching its development and its uniform physiological processes and laws.

Similarly to morphology decades ago, physiology today has reached its boundaries. The abundance of facts uncovered by physiology relates to those things which conform to physical laws by influencing the life and formative processes through substances and forces (light, heat, etc.). To quote the physiologist E. Bünning, "physiological research . . . is knowingly one sided." Life is not just that complicated collaboration of substances and forces which the physiologist uncovers with his methods of research. One of the limitations results from the coexistence of morphology and physiology. In plants and animals, the form and life of the organs are one unity. However, this unity has been artifically separated into two disciplines through the various methods of observation and investigation. The gap is not bridged by combining the results of both disciplines, e.g. in a "physiological morphology," as instructive and stimulating as such an undertaking might be. Physiology fails with the problem of form, much as anatomy and morphology in the nineteenth century did with questions concerning the life processes.

Since the end of the 1920's, physiology has experienced an important expansion through rhythm research. At the instigation of research conducted by Bünning and Kleinhoonte concerning rhythmical leaf movements, more and more researchers turned to the mysterious field of rhythmically occurring life processes. It was found that in plants not only the movement of the leaves and petals, but also growth, cell division, propagation and numerous metabolic processes, are determined by rhythms of varying duration — even when external influences by the sun or moon have been eliminated. The physiologist Pfeffer established the hypothesis that these rhythms are endogenic, assuming that the cause lies within the plant. The search for the "physiological clock" has brought to light many facts. It was found that indeed all life processes are permeated by rhythm and many of them follow a characteristic internal rhythm. The physiological clock, however, remains undetectable. Bünning elaborates on this in his extraordinarily learned review.[1]

In the field of rhythm research, physiology reaches another boundary. Rhythm is a basic manifestation of life. Respiration, assimilation, cell division, etc. are significant individual processes, and all are uniformly permeated by the periodic fluctuations of rhythm. This phenomenon was discovered and described. But rhythm itself, its innate nature, remained an unsolved mystery.

A few years ago, the American physiologist F. A. Brown pointed out the unsatisfactory situation of rhythm research. In his essay, *"Why Is So Little Known About The Biological Clock?"*,[2] a change in viewpoint develops. Brown ascertains that there is no pertinent reason to look for the cause of rhythm in the plants themselves. An entire generation of researchers had looked in the wrong direction with their hypothesis of the endogenic cause. Brown and other researchers point to a force field in which plants, animals and human beings live: the rhythmically fluctuating electromagnetic field of the earth. One cannot, however, stop here, since this field is not isolated but is influenced in its fluctuations by the cosmic environment, and to that extent it is incorporated into a larger cosmic framework.

Research into rhythmical phenomena thus initiates a wider, more inclusive, way of understanding life. The extent to which these rhythms are related to life has been demonstrated by investigations in which the suppression of certain rhythms led not only to a disturbance of life processes but also to a hindering of form expression. Observation of rhythms reveals the unity of life encompassing both the development of form and the functions of life. Here, however, it is essential, after the first constraint (endogenic cause), not to get caught in a second one (electromagnatic earth field) but to include the field of cosmic rhythms.

1. A more complete description of this complex is to be found in E. Bünning, *Die physiologische Uhr,* 2nd ed. (Berlin, Göttingen, Heidleberg: 1963).

2. *Chronobiology*, ed. L.E. Scheving, F. Halbert, J.E. Pauly (Stuttgart, Tokyo: 1974), p. 689 ff.

As early as the 1940's, J. Schultz discovered a correlation between the seed and fruit formation of trees and Jupiter's twelve-year cycle.[3] For red beech, the years of high seed yields coincided with specific constellations of Jupiter against the zodiac. The seeding experiments by M. Thun point to diverse relationships between the course of the moon through the zodiac and the formation of certain plant organs (root, shoot, flowers, fruit, seed).[4]

In addition to the empirical research, there are several more theoretically oriented works. During the 1920's and 1930's, A. Usteri attempted to establish a relationship between the families of flowering plants, and their individual genera, and the sphere of the planets.[5] The results of these investigations were not conclusive. A consideration of the astronomical facts was missing — and, with that, any secure basis. Later on, J. Schultz, as an astronomer, worked more precisely in a limited area, that of the connection of leaf positions (the Braun-Schimperschen Hauptreihe) with the rhythm of the moon, the sun, and the planets.[6] He convincingly pointed out the correlation of several leaf positions with the rhythmic movement of the planets. This interpretation, however, meets with some difficulties. For one thing, the leaf positions are dealt with too little in their relationship to the entire plant kingdom, and astronomy predominates over botany (See footnotes 23 and 30)

It is necessary, on the one hand, to look at the entire plant in its formation, and on the other, at the sphere of the planets in its rhythms and its structure, in order to link them. This is the task we have put before ourselves in this book. It is an attempt to formulate an understanding of plants out of their connection with nature, of which the planets are a part.

Our research is built upon previous work done by others. First, the book *Rhythmen der Sterne (Rhythms of the Stars)* by J. Schultz has to be mentioned.[7] The understanding of the planetary world, as put forth

3. J. Schultz, "Samenjahre bie Wäldbaumen und Planetenperioden," *Sternkalender 1948* (Dornach: 1947), p. 46 ff.; and "Kosmische Perioden bei den Samenjahren der Waldbäume," in *Sternkalender 1951* (Dornach: 1950), p. 89 ff. J. Schultz's investigations were continued by G. Wolber and S. Vetter, "Samenjahre der Rotbuche und Planetenstellungen im Tierkreis," in *Sternkalender 1973* (Dornach: 1972), p. 94 ff.

4. M. Thun and H. Heinze, *Anbauversuche uber Zusammenhange zwischen Mondstellungen im Tierkreis und Kulturpflanzen,* vol. 1 and 2 (Darmstadt: 1973).

5. A. Usteri, *Versuch einer geisteswissenschaftlichen Einführung in die Botanik* (Zurich: 1923), p. 41 ff.; and *Geisteswissenschaftliche Planzenbetrachtungen* (Basel: 1936).

6. J. Schultz, "Die Blattstellungen im Pflanzenreich als Ausdruck kosmischer Gesetzmässigkeiten, in *Goethe in unserer Zeit,* ed. G. Wachsmuth (Basel: 1949).

7. J. Schultz, *Rhythmen der Sterne* (Dornach: 1963).

in that book, is the basis for the present book. I am obliged to my late Dutch collegue, F. Julius, for the significant stimulus provided by several years of exchanging information. His book *Metamorphose (The Metamorphosis of Plants),* which is one of the important achievements in the conceptual formulation of the "type" and its various modes of formation, contains a short chapter about "Plant Growth as a Reflection of Cosmic Phenomena."[8] Here, botanical and astronomical observations are almost equivalent. This leads to evaluations which, for the most part, correspond with what is said in this book *(v.* p.*73)* concerning the growth patterns.

The scientific-theoretical basis for this book I owe, most of all, to Rudolf Steiner's writings on the theory of knowledge. From Steiner's investigation of the human process of gaining knowledge, it follows that the task of knowledge must be to make an object comprehensible by using thought to place it again into a context from which the time-space limitations of our perception have isolated it.[9] This leads to a question concerning the world of reality of which the plant kingdom is a part. Rudolf Steiner, mostly in brief explanations, stated that plants must be seen in connection with the sun and the planets of our solar system in order for one to be able to elucidate the laws governing the plant kingdom. When Steiner refers to the specific relationships between the spiral leaf arrangement and the revolution of the planets, this must be taken more as an indication of a new direction for research than as a detailed single statement.[10] The issue at hand is to again direct our attention to the entirety of nature and to overcome the arbitrary limitation of our consciousness to a perception only of the phenomena directly before us. Rudolf Steiner's brief description, in 1924, of the connection between the plant form and the solar system was particularly helpful. Without it, many insights would have been even harder to come by.[11]

This book is an attempt to contribute a significant advancement to the views held by natural science. For several years, interdisciplinary research has been called for because it appears that reality can only be approached by synthesizing the detailed results of special research. The necessary principles for such a method, however, must be found. For natural science the inclusion of rhythms is one aspect, and Rudolf Steiner advocated this step as the decisive beginning of future natural science.[12]

8. Fr. H. Julius, *Metamorphose* (Stuttgart: 1969).

9. R. Steiner, *Philosophie der Freiheit,* GA 4 (Dornach: 1973), p. 80 ff.

10. R. Steiner, *Die Geistigen Wesenheiten in den Himmelskörpern und Naturreichen.* GA 136 (Dornach: 1974), p. 169; and *Menschenwerden, Weltenseele, Weltengeist,* part 1, GA 205 (Dornach: 1967), p.58.

11. In the *Pastoral-medizinischen Kurs,* GA 318 (Dornach: 1973), pp. 108-110, R. Steiner wrote: "Let us say that we see a plant growing out of the ground, the shoot developing upward and the roots downward. Therefore two tendencies are present within the plant: the upward-urging and the downward-urging. If physical science were ready to take its investigative methods, which sometimes are used for less essential research, and apply them to the upward growth of the shoot and the downward growth of the roots, then we would find the connections with the universe. Those connections, in turn, in that they relate to man, make this totality of man and world, microcosm and macrocosm, comprehensible. We would see that everything connected with the upward-growing shoot has a certain relationship with the unfolding of the sun's forces during the day, during the year, and even beyond the year. Everything connected with the development of the roots' forces relates to the moon's development, to the moon's forces. If we observe the plant in the proper manner, we must already include the relationship between the sun and the moon during the formation of the plant. We must look out through the universe and at its forces to the simplest, most primitive image of the plant. Those who are able to visualize accurately will never see the root in any other way than driving down into the ground and at the same time becoming round. The image of the root rounding itself by entering the ground is the image we have to see of the root: the rounded image in the ground.

    The shoot, the upward development, must be seen differently. When we combine feeling and sensation with observation, we necessarily get this feeling: the shoot extends upward in a radiant way, and wants to establish a direction of growth. This is the original image of the plant Being. We must see the presence of the sun's forces on earth in the pressing upward. In the rounding-out of the root, we see the presence of the moon's forces on earth.

    Now we continue to observe. We comment: the sun is present everywhere that the plant radiantly extends upward. Now it expands again above; it increases in width and has a periphery. We find in that which emerges from the upwardly radiating development—initially effective directly in the blossom above, where the forces of Venus interact with the sun's forces, and the blossoms develop farther below and are transformed into leaves—Mercury's forces active in form-expression from without. When we want to understand the structure of the plant in conjunction with the radiating sun direction, we must understand that the forces of the sun are aided by Venus' forces and Mercury's forces. This is one aspect.

    On the other hand, we must be aware that these forces alone would not be capable of forming the plant. The essence of the plant would develop towards contraction. In order for it to unfold, as we see, for example, in the extreme case of tree growth, the forces of Venus and Mercury are everywhere opposed by those from Mars, Saturn, and Jupiter. Both polarities, the effects from the sun and the moon, are joined by the remainder of the planetary influences." (Printed by permission of the Rudolf Steiner Nachlassverwaltung, Dornach.)

12. R. Steiner, *Die Polarität von Dauer und Entwicklung im Menschenleben,* GA 184 (Dornach: 1968), p. 295.

THE METHOD

In botany, as in other areas of science that deal in one way or another with the phenomena of life, there is a discrepancy between the abundance of facts, which become known through several generations of researchers, and the mental accomplishment of understanding the interrelationships among these facts. Often attention is focused on detail or on models of interpretation in such a way that these connections are disregarded. For everyone who is still searching for the secrets of nature, however, the simplest and even the most obvious questions are still unanswered. The shoots, the leaves and the blossoms of the various plants, for example, each display specific forms. For many plant genera, these forms have been described in morphological and anatomical detail. It is also known how they follow the simplest hereditary laws. The influence of certain substances — the phytohormones, for example — on the acceleration or the suppression of their development and growth are also known. But how does the specific form of the growing tip in a rose or maple tree correspond to the form of the leaves, the inflorescences, flowers and fruits? There is no answer to such a question. Such a question is not seriously raised — unless it is brought up for the purpose of treating it as a problem of hereditary laws. Here the plant form is traced back to an earlier plant form that is equally mysterious. It is apparent that the problem is not being solved, but merely shifted and enlarged. Everywhere in nature it may be observed how plant forms appear in certain relationships. We are, however, initially incapable of penetrating those connections.

And yet we have at our disposal a special sense for forms. Inexplicably, we violate our common sense if we try to imagine a rosebush with liliaceous blossoms or a daffodil on thistle shoots. The uneasiness we sense with such combinations is not only the result of being accustomed to certain forms. Our feeling stirs our subconscious into a judgment of whether or not the forms have an inner connection. This is in no way different from the observation of a painting, in which we feel the presence of artistic harmony before we consciously become aware of it. This understanding is an important basis for the deeper understanding of nature, though not quite suitable for the clarity required for scientific formulations describing the laws governing plant forms. This realization has been of great importance to research done in years past. Only by means of this sense of form is it possible to recognize the similarities between plants. The entire system of plant taxonomy is based on the application of this peculiar capability. Without it, it could not ascertained which plants, for example, are similar to the rose or the buttercup. This sense of form is the most important mental tool of the morphologist and the systematician.

The geneticist also uses this sense of form as a basic tool. He may speak of genetics only when he painstakingly investigates how in the sequence of generations certain characteristics of form, for example, remain constant. His interpretations are based on the results conveyed to him through his sense of form. This, in the end, is true for the entire theory of the origin of species. It examines the impressions of early organisms left behind in the earth's layers and determines the degree of their similarities. The successive findings of similar forms in the rock strata are then interpreted as hereditary relationships.

For the formation of scientific theories it is important to recognize clearly this fundamental significance of form perception. There is a tendency nowadays to interpret plant forms through genetics, ecology and paleontology. This, however, is possible in a limited way only. All of these interpretations are hindered by an inherent weakness, which is the present, quite common, inability to understand form. Aside from one's inability to comprehend mentally the interrelationship of forms, one comes to the conclusion that, in the end, it is more or less arbitrary into which form the individual plant organs develop. The plant then is thought of as a mere sum total of simultaneously appearing characteristics, and the form is interpreted by genetics and the theory of the origin of species as such a combination of characteristics. If, however, an understanding had developed emphasizing the common formative force principles underlying all the details (from which would follow the particular formation of specific shoots, leaves and flowers), all the above interpretations would collapse. Genetics, physiology, and the theory of the origin of species would have to orient themselves towards a view that recognizes the plant as a supersensible entity permeating its individual organs. As long as the question concerning the interrelationship of forms is not emphasized and addressed more definitely, many fundamental statements will have to be considered as preliminary only.

The understanding of the plant form is of central importance to all botanical terminology. In recent years, a number of works have pointed to the interrelationship of forms, using as an example individual plants and closely related plant groups.[13] Two questions, however, must be addressed in order to make progress in the whole issue of form. The first question concerns itself with the spiritual requirements necessary for an understanding of forms, while the second question centers around the "type" that Goethe discovered as a uniting, principle governing all relationships of form.

The question concerning the conditions for the understanding of plant forms is connected with yet another. First one has to become conscious of the implications of the fact that morphology has now become the science of form study. Morphology arrives at its results by turning away from the interrelatedness of nature. As a first step, the morphologist takes the plants out of their originating environment. For his description, it is all the same whether it is a plant of spring or summer, whether it is a species from mountain or plain. Morphology begins, consequently, by ignoring the interwoveness of the plant with nature. This narrow perception of the isolated plant forms, ignoring the living plant developing in nature, leads to abstraction. It is in this manner that the detailed descriptions of the individual organs and organ systems have been arrived at. A morphology of the vegetative system, flower formations, the root, etc. has been developed. This has necessarily led to a doubling of abstraction. In order to return to nature, attention must be directed to the interrelatedness of nature, from which the details have been isolated.

Therefore, holistic understanding, an acknowledgment of the interrelatedness of nature—as opposed to distorted perceptions—must be developed. Comparative morphology in the usual sense is not meant here. It may well have provided us with many important insights; it is concerned, however, almost exclusively with the area of isolated organ systems.

Nevertheless, some important methodological principles may be gathered from it for the more far-reaching task at hand. In order to grasp the connection between the differently formed organs, of, for example, the flowers of the buttercup and the flowers of the columbine, one should look at the individuality of their forms only. The relationship of the forms to each other must be envisioned; i.e., one must depart from a fixation on one or the other form and follow the transition between them.

13. J. Bockemühl, "Das Ganze im Teil," in *Elemente der Naturwissenschaft,* number 6, 1967; and "Von der Dynamik und den Gestaltmotiven verwandter Pflanze," in *Elemente der Naturwissenschaft,* number 10, 1969. Th. Goebel, "Die Ebereschen und der Speierling," in *Die Drei,* number 2, 1969. B. Gut, "Vorarbeiten zu einer Physiognomie der Gewächse," in *Elemente der Naturwissenschaft,* number 16, 1972: W. Schad, "Zur Biologie der Gestalt der mitteleuropäischen buchenverwandten Bäume (Fagales)," in *Elemente der Naturwissenschaft, number 7, 1967.*

A mental transition needs to be made from a perception of an abstract image to one of living mobility. This changing perception, during the usual experience of similarities—i.e., during the activation of form sense—occurs without any conscious effort. It is brought to full consciousness from a subconscious state when one transforms with imagination the one perception into the other. Through this effort—and here is the decisive point—the laws underlying that transformation may be grasped.

Provided with this active perception, morphology relates quite dissimilar organs: for example, leaves and thorns, sepals and stamens, leaflets and tendrils. Not only the completed parts are observed but also their development from another form. Through this living imagination, through the sense of form elevated to the conscious mind, one advances from the created object to the process of becoming. In this area of becoming, the character and conformity of plant development are revealed.

Imaginative perception may be extended to all created forms, in fact, to the entire plant. However, one must disengage oneself somewhat from the usual terminology, which is filled with superficial analogies (palmate, pinnate, etc.) without any valuable insights. Such terminology may well serve as clear description but has no connection to the processes of growth and formation in the plant. Let us here depart from general statements to an example which points out how we may penetrate into the inner connection of the plant form by means of imaginative perception.

As a free-standing tree, the Norway maple *(Acer platanoides)* develops a rather regular crown in all directions. The individual branches,

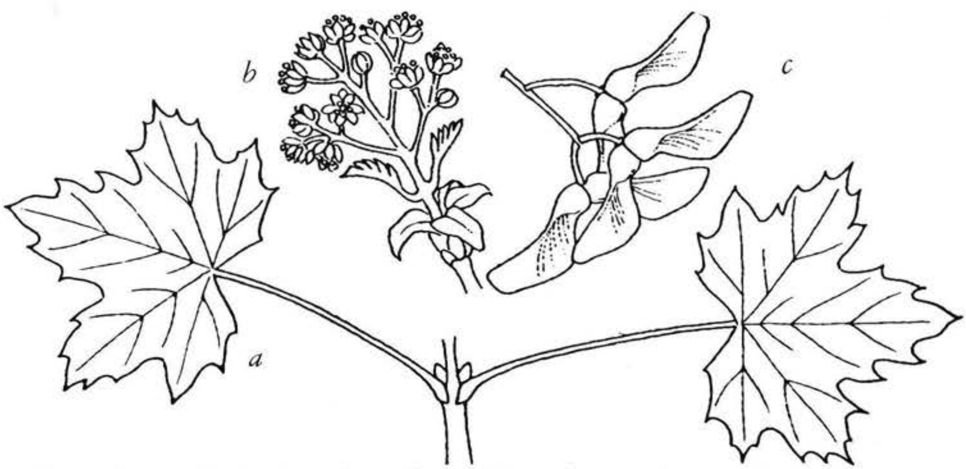

Fig. 1 Norway Maple *(Acer platanoides)*. (a) Piece of a young branch with two opposite leaves; (b) blooming inflorescence; (c) ripe fruits.

in constrast to those of various other trees, grow in all directions in a comparatively straight manner. Particularly in the periphery, many of these branches fork. This means that the branches developing rather harmoniously towards the outside take up an ever-increasing interaction with the periphery as the crown expands. With its continued growth, the crown adjusts itself more and more to the given space: The leaves have noticeably long petioles. With their aid, the leaves extend relatively far into the area of the branch tips. With their palmately lobed form, they fill out the space in all directions. A round leaf blade, in contrast, would be self-contained. It becomes obvious that the length of the petiole (carrying the leaf to the periphery) and the leaf shape (connecting with the surrounding space) belong together. The formation of the leaf in total corresponds to the development of the entire form of the tree. The yellowish-green flowers develop into loose umbellate panicles (similar to those of the elder); they are turned towards the surroundings in their entirety. After pollination, the fruits develop with their two peculiar wings stretched out. This reaching into space even intensifies: the fruits, as so-called samaras, separate into two halves, and each whirls to the ground independently. The wings whirl around the thicker middle part, in which the seed is contained, and through this whirling motion point in all directions.

Whichever formation we look at, the same law of formation is always present: the harmonious entering into a relationship with the surrounding space and the uniform positioning in it. One must, however, see the forms in such a way that one does not just register them but can, in fact, recreate them during observation with an active, perceptive imagination. In this way, the gestures of formation and a uniform law of structure underlying the growth of the entire tree become clear. While initially the observer merely perceives that the tree has a uniform form, he now understands what this unity or totality of the tree is based on. What in morphology is reduced to individual organs is united again in this observation. One acquires what B. Gut in his thoroughly enlightening article "Zur Theorie de Gestalterkenntnis" (the theory of understanding form) called the "selbstbesonnene struktuierte Gestalt-Erkenntnis" (self-conceived structured knowledge of form).[14] Large parts of our work elucidate the laws of formation working in the higher plants by means of this kind of knowledge of form.

Beyond this, a larger law of conformity exists in the individual plant species and genera, at which the second investigation is aimed: the general "type" of flowering plants. The flowering plants all develop as

14. B. Gut, "Zur Theorie der Gestalterkenntnis," in *Elemente der Naturwissenschaft,* number 9, 1968.

Goethe described in his *Metamorphosis of Plants,* in a strict sequence of successively developing organs. Just what this type might represent has produced a number of diverse views. Goethe himself saw it as the archetypal plant working in a formative manner in all plants. The archetypal plant for Goethe was a spiritual fact governing all plant growth, a fact which could be experienced directly by those who have "eyes" to see.

For most idealistic morphologists referring to Goethe, the archetypal plant, according to the botanists W. Troll's formulation, is the "general building scheme" of the higher plant. This arrangement is described, as in logic, as an over-all concept, as a structure, to which "all seed plants . . . are subordinate."[15] This building scheme appears as a model of thought derived from concrete perception by means of generalization and abstraction. Such an interpretation fails to recognize Goethe's view in which the archetypal plant is not a model of thought existing aside from sense-perception but, rather, a reality present in the plants.[16]

Those researchers who perceive the type as a vague terminological structure in contrast to real plants dispute its essential reality. With a "new morphology" they seek the "historically realistic process" of plant development on a level that allows them to experience the perceived plants as reality. The type, for them, is an extremely suspicious fiction. They would like to see the form sequences of the types, as proposed by the idealistic morphologists, replaced by lineages. However, they overlook the fact that their summary of the various forms initially exists in their thoughts only. They overlook the fact that they too proceed in an "idealistic" manner by immediately interpreting the outcome of thought on a "historically real" basis. Without hesitation they speak of types, like ferns, gymnosperms and angiosperms.[17] In the practice of cognition, it is unavoidable that in perception one simultaneously comprehends broader interrelationships of forms.

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15. W. Troll, *Allgemeine Botanik,* 3rd ed. (Stuttgart: 1959), p. 20.

16. The understanding of the plant form described in the preceding pages leads to a view in which the opposites prevalent in consciousness today between material objects and abstract terminology or models become meaningless. The ideal form relationship is to be found in the things of sense perception. In reality, the organic form and the ideal law of formation manifest in the plant are one. In a like manner, we are able to comprehend the archetypal plant in the individual plant's particular form expression—a method of observation uncovered by Goethe—as in the area of geometry a rectangle and trapezoid are particular forms of a square. Goethe did not merely undertake a different interpretation but a different method of observation. Through such a view, the error of seeing the world as material existence void of any spirit, and a dependence on the abstract concepts in man's head, can be overcome. Compare to this R. Steiner's book *Goethes Weltanschauung,* GA 6 (Dornach: 1963) in the chapter "Goethes Stellung innerhalb der abendländischen Gedankenentwicklung."

Nevertheless, criticism by the "new morphology" of the idealistic old one is in certain aspects justified. In the manner in which the latter speaks about the type or the archetypal plant, it indeed does not deal with a very real structure. How shall the real plants be deduced from it? For Goethe such a question was meaningless. His morphology did not deal with the dualism of external perception and idealistic deduction. With spiritual imagination, he comprehended the type at the same time that he perceived the plants in the outer world.

In this case as well, however, an important question remains unanswered. Where does the "archetypal image" originate, if in the plant kingdom it appears only in specific expression? Or, to put it differently: where is this archetypal image to be found as such? Since all plants are governed by it on earth, though its pure being is nowhere revealed, one has to expand one's view beyond the earthly realms.

Let us direct our attention away from genetics, which seeks causative reality in the minutest realm, in the genetic code at the molecular level. This orientation loses much of its significance when one sees that the unity of the individual plant is to be sought not in the molecular structures but in the law of formation, i.e., not in the material, but in the spiritual, sphere.

The plant itself always points beyond the boundaries of its form. With its processes of life and growth, it is a part of its environment even more that is the animal. It is rooted in the soil and absorbs moisture from it. With each leaf, it maintains a constant interchange of substances with the atmosphere. From the cosmic environment of the earth, it receives the forces necessary for life, growth, and formation. In the following discussion, starting with the first larger chapter, the cosmic environment is included in the observation of plants in order that we may search for the archetypal image there.

Because this is still a somewhat unusual undertaking, it seems appropriate to make a few basic remarks about this method of observation. When trying to explain a phenomenon, one must take into account its environment. There one looks for the relationship between a phenomenon and the events which have produced it—just as, for example, a

17. W. Zimmermann, the most marked representative of the "Neue Morphologie" (new morphology), admits that he stands "on the shoulders" of the "Alte Morphologie" (old morphology) founded by Goethe (in *Geschichte der Pflanzen*, 2nd ed. (Stuttgart: 1969). Deriving our modern flowering plant forms from the primeval plants and the supposed primal beginnings of life, he points to the central problem: the proof for such a connection may be produced only "indirectly." Only fantasy and thought may be the bridge between the various forms. The manner in which Zimmermann describes ten stages of plant life and connects them through his elementary processes exemplifies vividly the typological point of view.

shadow is produced by the interaction between light and a non-transparent body. In chemistry, we can understand matter in the same way when we follow how one substance results from certain other substances. A phenomenon is always to be comprehended from the joining of certain other phenomena. As long as one does not know those phenomena and the mode of their juncture, the phenomenon in question remains a mystery.

The plant's manifestation is based essentially on the development of forms, in movements of growth. Different spheres of the world interact: foremost are the substances that are used to create the forms and formative laws through which the type is affected. In the following chapters, little attention will be paid to the role of the material substances. The type, as it manifests itself through the movement of growth, is viewed in connection with the phenomena of our planetary system. There is movement there, too, only it does not result in physical form.

But how is it possible to establish a connection between the development of plants and the movement of the planets? We will not describe a connection according to the rules of external causation, i.e. in the sense of the formulation of physical concepts. There is yet another form in which relationships and connections express themselves. We will call this the *correspondence of images*. In physics, e.g. in optics, this is of great importance. We can see clear images of the movement of the sun and that of the planets, of their relationships to each other and their prevalent conformities. In doing so, one brings order into one's imagination and into the thoughts that correspond to processes in the planetary spheres. And in the exact same manner, it is possible to work towards a view of the formation of the type through changing, re-creating, perceptive imagination.

If both the plant and planetary worlds are pursued with the necessary thoroughness, an important discovery can be made: the images perceived in one area correspond to those of the other area in gesture, dynamics and conformities. Only in the duration of processes of movement are there at times differences.

Such a method of observation, centered on corresponding images in the plant kingdom, is not unusual. On the contrary, we always apply this principle when we recognize two plants as of the same species, genus or family. This approach became the basic effort in seeking to bring order to the multitude of plant forms. With the archetypal plant, this search at first encounters a barrier because there is no comparable counterpart on the earthly level, such as with roses, for instance. The reason for this is that, unlike the rose, the archetypal plant exists outside of sense perception yet works in the rose as the most common law of formation and reveals itself in the same way, whether in rose, buttercup, or sunflower. When applying this mode of observation to the archetypal plant to recognize a plant species, the corresponding image is to be found in the movement and rhythms of the planetary system.

The ensuing investigation will have to prove this statement. We will follow the above-mentioned method so that the relationship between plant development and planetary sphere will be self-evident in viewing them side by side. Our object is not to establish a new theory, rather to *enlighten the perception* by learning to observe nature with more than an undeveloped imagination. Just by allowing imagination and thinking to penetrate the facts of the planetary sphere, one develops imagination and thinking. Finally, the expanded human capacity of thought will quite naturally experience the plant world as a reflection of the cosmos.

THE ARCHETYPAL PLANT AND ITS COSMIC ARCHETYPAL IMAGE

1. The Center Shoot: Earthly Image of the Sun

The growth of flowering plants clearly points to those areas in which we have to look for the facts upon which their formation is based. When the shoot develops, when one leaf after the other appears around it and finally the flowers unfold, it becomes clear that the entire development is governed by the near and far surroundings. The novice sometimes envisions this growth process as an expansion and differentiation proceeding from the bottom of the plant to the top. This is correct only in part. A flow of fluids rises from the root below through the shoot into the leaves. Here, by way of complicated processes, the totally transparent and restless carbon dioxide is, in its gaseous condition, materialized from the surrounding atmosphere. The light from the sun enters these processes as formative force. All substances used by the plant to create form are, in the end, the result of this formation of substance dependent upon the surroundings. Growth and formation of the higher plants consequently are processes that are in direct connection with the earth's sphere and with the sun as the central heavenly body of our planetary system. The plant in its development is actually interwoven with those spheres.

The form of the flowering plant clearly expresses connections with the cosmic environment. Two regions in the flowering plant must first be differentiated: those organs that develop above ground in the atmosphere and in light and warmth streaming in from the cosmos, and those that tie the plant to the soil and water of the earth. The aboveground plant is shaped in its entire formation by the main or center shoot because all the other organs, such as the leaves and secondary shoots and also the flowers with their sepals, petals and stamens, originate from it. The key to the aboveground plant form lies in this central organ and its relationship to the other organs. At this point, it is expedient to start by looking at the herbaceous plants. The plant form with its individual structures appears as the most comprehensible in the herbaceous plants since, within one year, most of these plants develop completely from seed to shoot, to flower, fruit and seed. Shrub and tree formations become comprehensible only when considered as alterations of herbaceous plants.

In its formation, the center shoot of the herbaceous plant shows, like no other organ of the plant, the connection with the sun. Especially during spring and early summer, one may follow how, on many species growing in open locations, the growing tip turns directly towards the sun and simulates the sun's movement from morning until night (phototropism). At the base, the shoot is held to the ground by the root, while at its tip it develops through its positioning towards the sun. In its elongated form it visibly expresses its relationship to the sun. The formative forces orginating from the sun are received by the tip. In the lower, woody parts of the center shoot, the manifestations of past effects of the sun are present.[18]

Forces orginating from the earth also continuously affect the formation of the shoot: the shoot adjusts to the gravitational pull of the earth. While the plant in the primary root is subject to gravity (positive geotropism), the effect of gravity directed toward the center of the earth penetrates the upward-striving growth, directed to the sun, as negative geotropism. One has to visualize how the forces related to gravity blend with the upward-striving development, dominated by the sun, and assert an influence in the opposite direction (upward). They act as forces of form-expression wherever structures develop in the shoot that add rigidity to the plant. When one follows the growing center shoot, which is directed toward the sun and its movement, the development of the shoot is experienced out of its relationship to the sun. The already hardened vertical shoot expresses, in addition, the influences orginating from the earth.

For a more precise understanding of the formation of the shoot, it is important to note that the shoots will, to a certain degree, grow even when sunlight is completely blocked off. They must, however, be supplied with organic substances and moisture, as is the case with germinating plants and potato shoots. In darkness the internodes of dicotyledons become excessively long. The leaves on the other hand do not grow

18. This view corresponds to R. Steiner's description in note 11, where "everything connected with the upward shoot development . . . relates to the unfolding of the sun's forces during the year, the day, and even beyond the year" (the last may refer to the biennials and perennials; compare with the chapter on the various growth patterns). G. Adams and O. Whicher in their book *Die Pflanze in Raum und Gegenraum*, 2nd ed. (Stuttgart: 1979)—from a different perspective, namely projective geometry—bring the vegetative point of the shoot into close connection with the sun.

larger than scales. The shoots remain pale; they appear to be without vitality and, in regard to their internal anatomy, are less well differentiated. This is growth without form-expression.

In this etiolation, a life-process that is present in the plant at all times clearly manifests itself. Plants usually grow faster during the night than during the day. When plants and their life processes are no longer under the sun's direct influence, vertical growth becomes more intensive. The date-palm tree, for example, grows only in the darkness of the night.[19]

Light always has a more or less restraining effect on growth. Due to the slowed-down processes of growth, the tissues necessary for the translocation of sap are differentiated in the shoot. Here one is directed to the forces of form-expression and structure that, as part of the light, become tangible; these are generally referred to as the morphogenetic effects of light.

Thus two processes are active in the development of the shoot: in the daytime the form-giving process caused by the sunlight; during the night the process of intensified vertical growth. Thus, the shoot is the result of the successive action of processes taking place during the day and night. Observing the green shoot from this point of view, one sees in its form of expression the effect of the sun. The activity of nightly growth, on the other hand, has moved this form ever closer to the sphere of light.

The effect of the sun on the center shoot becomes quite clear when one follows the development of the herbaceous plants from early spring to midsummer. During this time, the plants grow and develop in sunlight that is long and intense. The early spring species among the herbaceous plants have quite short shoots. In the crocus the shoot does not even reach the surface of the ground. Some shoots remain in the bud-like condition of the bulb (snowdrop, bluebell), and others, like the winter aconite, form a short shoot originating from a tuber. In the coltsfoot and the wood anemone, the center shoot grows underground as a rhizome; only short-stemmed flowers emerge from it into the sphere of light. The leaves of the cowslip and dandelion remain in rosettes on the ground. In the lady's smock, on the other hand, the center shoot develops further and elevates the leaves beyond the ground-based rosette,

19. We may also approach the development of the shoot from the point of view of stretching growth. Then the shoot appears as the formation through which the plant penetrates from the ground into the sun's light-sphere and enters into close connection with it. From this point of view, the shoot is the reflection of the moon. (See the essay "Der Weg zur Natur durch Künstlerisches Betrachten" in the periodical *Erziehungskunst* 7/8 (1975).

thus achieving its characteristic form. In the areas of the northern hemisphere the shoot does not reach its full development until May, examples being such genera as the buttercup, the herb bennet, the geranium or the lily spiderwort. In midsummer another intensification of the sun's effect is finally noticeable, especially in the *Umbelliferae,* the grasses, the rosebay and numerous other plants.

In almost all plant families the development of the center shoot may be observed in the successive appearance of the various species toward midsummer. It is particularly impressive to follow the progression among the *Ranunculaceae*. The individual species and genera bloom between February, the beginning of the vegetative period, and July, its culmination, in the following sequence: winter aconite—pasqueflower and wood anemone—buttercup (many species after May)—larkspur—monkshood. Among the *Liliaceae* the sequence is as follows: bluebell and yellow gagea—star of Bethlehem—lily of the valley and Solomon's seal—wild garlic—day lily and tiger lily—yellow day lily and white hellebore during the culmination of the year—shortly thereafter the Turk's cap—and with the fading of the sun's power during fall (until November) the meadow saffron, in which the shoot remains totally suppressed during the descent of the sun. The shoot develops together with the leaves no sooner than the following spring along with the renewed ascent of the sun.

Thus the unfolding of vegetation during the course of the year demonstrates that the sun affects plant formation ever more intensely during its ascent and dominance during the long days of summer. There could hardly be a more impressive demonstration of the fact that the center shoot is the image of the sun's movement and effects upon plant growth during the course of the year.

The connection between the movement of the sun and the development of the center shoot becomes apparent only when the sun is seen in relation to earth. For life on earth, happenings in the universe are to be taken into consideration only to the extent that they are mirrored on earth, i.e., how they appear when seen from earth. Therefore one must proceed strictly from the phenomena. For this reason the heliocentric view of the world, for our purposes, is not applicable. It is not a phenomenon; it is instead constructed from phenomena, with the support of certain assumptions. Seen from earth, nothing points to the sun as the center of the planetary system and to elliptic orbits of planets. For the earthly plant kingdom, the universe as seen from earth is of importance, not the thought-concept man has of it. Insofar as there are connections between the plant kingdom and the motions in the planetary system, they can be decoded through a geocentric approach alone and not by using the heliocentric system.

We will base our further considerations of the connection between the center shoot and the sun, making it the sound basis and the key for further understanding. The other plant organs emerge from the center shoot in various ways and therefore have varied relationships to it. We will examine these relationships more closely. First, however, it is necessary to deal with the cosmic environment of the sun. Just as the center shoot is the central organ of the herbaceous plants, so the sun is the dominant, and thus central, star of a vast region of the world, our planetary system.[20]

2. Rhythmical Order in the Planetary System

The planetary system is not a more or less arbitrary accumulation of celestial bodies around the sun, but rather it functions as an organism in which a variety of interrelationships exists. The Titius-Bodeian sequence already points to the unitary character of our planetary system.[21] The interrelationships become apparent particularly when a comparison is made between the rhythms of orbital rotations and the prevailing intensities of movement.

The moon must also be taken into consideration since it is, next to the sun, the most important celestial influence on the earth. Its nature first manifests itself by reflecting the sun's light to earth during its phases. The rhythm of this process, i.e. the 29.53-day period from one new moon to the next (synodical revolution of the moon), has planetary significance. These 29½ days are a little less than the twelfth

20. Our observation follows closely the image of plant growth that Goethe developed in his essay "Über die Spiraltendenz der Vegetation" (*Goethes naturwissenschaftliche Schriften,* ed. R. Steiner, vol. 1 (Dornach: 1975). Goethe sees in the higher plants the interaction of two laws: "The two main tendencies . . . or, if you want, the two living systems that make plant life complete, are the vertical system and the spiral system." About the vertical system Goethe said: It is "that through which the plant separates from the root and elevates itself in a straight line towards the sky". We meet it most genuinely in the center shoot of the herbaceous plants, and we see the reflection of the sun in relationship to the forces emanating from the ground (negative geotropism). The chapter about the center shoot then is a description of the vertical tendency, "which is coiled around the other". The leaves growing in spirals, but also the blossoms with their various organs, belong here. (*v. p. 218 , 231, 159*).

When we now turn our attention to these organs and their relationship to the plants, we merely continue along the line of Goethe's observations. Just as for the vertical tendency, we shall now describe the connection of the plant with the movements and rhythms of the universe for the spiral tendency.

part of a year (30.45 days). From one conjunction with the moon to the next, the sun progresses through almost one-twelfth of the zodiac. The moon thus reflects the sun's light from one section of the zodiac through the entire perimeter of the zodiac to earth. Immediately following the conjunction with the sun, the moon is invisible for about two days. Next it appears as the thin crescent during dusk. Its size increases from new moon to full moon in just over two weeks, the highest rate of increase occurring during the first quarter. During that period, an increasingly modified effect from the sun reaches the earth from the moon. The full moon, in opposition to the sun, is the cosmic mirror image of the sun, since it appears equal in size to the sun. Then the reflection becomes weaker, most markedly during the last quarter. Finally, it disappears within the sun's sphere at the time of the next conjunction.

This rhythm of the increasing and decreasing of the moon's effect from one new moon to the next, the 29.53 day synodical revolution of the moon, has further significance in the planetary sphere. If the synodical revolution of the moon were only one day longer, the conjunction

21. The distances of the planets from the sun follow certain mathematical laws. Calculated in astronomical units (from the heliocentric view-point, the astronomical unit is the long half-axis of the earth's orbit—the distance of the earth fromthe sun), the following distances result for the individual planets (the exact numbers are listed in parentheses):

N	Planet	Distance from the Sun in Astronomical Units	
1	Mercury	0.4	(0.39)
2	Venus	0.7	(0.72)
3	Earth	1.0	(1.00)
4	Mars	1.6	(1.52)
5	planetoids	2.8	
6	Jupiter	5.2	(5.20)
7	Saturn	10.0	(9.54)

The numbers of this sequence established by Titius approximate the mathematical relationships set up by Bode very closely. According to this, the distance from a planet to the sun is 0.1 (2n-2x3) astronomical units.

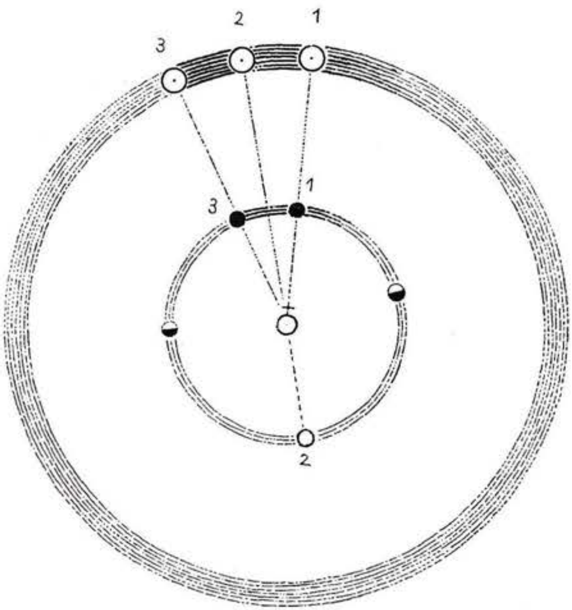


Fig. 2 While the sun moves through almost 1/12 of the zodiac (1 ⟶ 3), the moon reflects the light of the sun towards the earth in one synodical cycle (1 ⟶ 2 ⟶3).

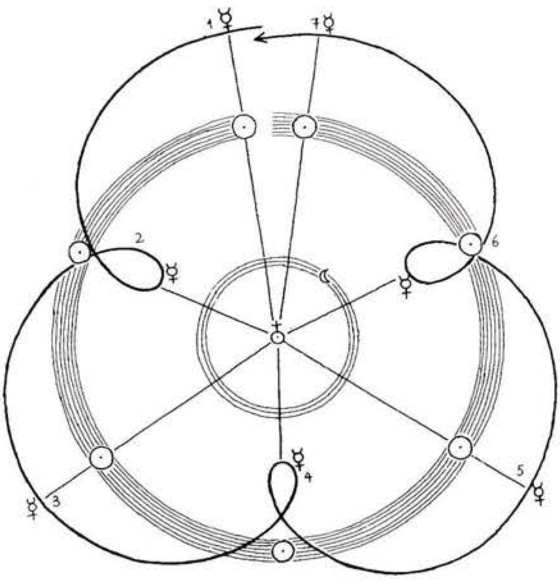


Fig. 3 In about one year (1 ⟶ 7) Mercury completes three synodical cycles with four (1,3,5,7) or three upper and three (1,4,6) lower conjunctions (after Schultz, modified).

with the sun would occur after 30.53 days, precisely at the time when the sun progresses through more than one section of the zodiac. Hence, the movement of the sun and that of the moon are interrelated according to the order of the zodiac.

Among the planets, Mercury has the closest connection to the sun. It orbits so close to the sun that, seen from earth, it rarely appears as an independent object within the sun's sphere. Following an upper conjunction with the sun, Mercury moves from beyond the sun in an eastern direction away from the immediate sphere of the sun.

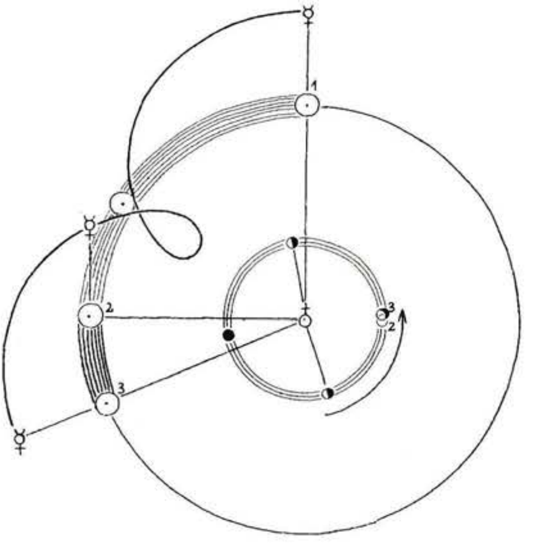


Fig. 4 Mercury orbits the sun in almost a quarter of a year (sidereal cycle, $1 \longrightarrow 2$). The moon with its synodical cycle ($2 \longrightarrow 3$) mediates between the zodiac-related rhythm and the earth-oriented synodical cycle ($1 \longrightarrow 3$).

After about 36 days, it reaches the point of greatest distance from the sun (greatest eastern elongation), during which it now and then becomes visible during dusk. Then it again approaches the sun, enters the sphere between sun and earth, and after 22 days enters its next conjunction. After this lower conjunction, it reemerges from the sun's sphere, this time in a western direction, and after 22 days reaches its greatest western elongation. Here it may be seen during early dawn. This is followed again by a movement towards the sun and a new upper conjunction after 36 days. This double rhythm of Mercury's moving away from the sun and reapproaching the sun is called the synodical cycle of Mercury.

Of all planets, Mercury with its synodical rhythm of 116 days, as well as its close position, most completely relates to the sun. During the course of the year, mercury completes its synodcial cycle three times (3 x 116 = 348 days). There are six conjunctions with the sun. Three conjunctions occur in the sphere between the earth and the sun (lower conjunctions) and three beyond the sun (upper conjunctions). These six conjunctions mark the corners of a hexagon formed by the sun and Mercury.

Close relationships exist also from Mercury to the moon. During one synodical cycle of Mercury, the moon completes close to four synodical revolutions (4 x 29½ = 118 days). The period from one full moon to the one after next is approximately that period during which Mercury completes the rhythm of moving away from and then reapproaching the sun—that is, the movement of Mercury from one conjunction to the next.[22]

In addition to the synodical cycle, the sidereal cycle of the planets is also of importance. During one sidereal revolution, a planet moves through the zodiac once and returns to its point of departure. For Mercury (but also for Venus) this is a complete revolution around the sun, after which Mercury reaches the same orientation to the zodiac in relation to the sun. This occurs every 88 days. The difference between Mercury's sidereal and synodical revolutions points to yet another inter-

22. Mercury's rhythms vary a great deal; the synodical cycle is between 104 and 132 days. The median time period is 116 (exactly 115.88) days. As for Mercury, we will list the median time period for the rhythms of the other planets.

Between the 116 days of the synodical cycle of Mercury and the four revolutions of the moon with 118 days, there is a time difference of two (2.24) days. Therefore, at first it may appear arbitrary to connect these two rhythms so closely. Such an objection suggests that in the planetary sphere different rhythms may only be brought into relationship with each other when they correspond exactly. This view is based on a formal and mechanical conception.

In the sphere of the planets, there are no two rhythms that correspond to each other exactly, not even when one of the two rhythms, or both, are multiplied with integral factors. Thus there are no identical constellations. The differences and novelties are an essential peculiarity of the planetary world. Therefore we must not base the comparison of rhythms on identical numbers but on a closer observation of the differences. The difference of 2.24 days, for example, relates to the movement of the moon. During 2.27 days the moon traverses one-twelfth of the zodiac, that is, the median expansion of one zodiacal sign. When Mercury, after an upper conjunction with the sun, approaches another conjunction, the moon completes approximately four synodical revolutions. It falls behind by one-twelfth of the zodiac. In the rhythm of the synodical Mercury-movement, the synodical moon-cycle is shifted by about one zodiacal sign. It is sensible to draw a connection between the moon and Mercury rhythms—not in spite of, but because of, this difference.

As in this case, we will also observe other planetary rhythms in their connections, despite their differences in time. The time differences are minimal in comparison to the duration of the rhythms. There may be other principles concerning their relationships although we may not always discuss them here.

relationship between Mercury and the moon. This difference of 28 days corresponds to about one sidereal revolution of the moon (27.32 days). This means that between the sidereal cycle of Mercury, which is related to the entirety of the cosmos (zodiac), and the cycle during which Mercury reaches the same position in relation to the sun, as seen from earth, the moon progresses through the zodiac once. The moon mediates between the sidereal cycle of Mercury relative to the cosmos, and the synodical cycle of Mercury relative to the earth.

Venus, too, in its rhythms, is closely connected to the sun and the planets. As with Mercury, the sun is central, but Venus is not quite so intimately connected with the sun. Venus, much more so than Mercury, appears as an independent body, since as morning and evening star it moves much farther away from the immediate sun-sphere. This relative separation from the sun is also expressed by the fact that the synodical cycle of Venus is no longer contained in the one-year cycle of the sun. With 584 days, it clearly stretches beyond the annual cycle. Still, there are some rather close connections to the sun's rhythm: 584 days correspond rather accurately to 1 3/5 years. (3/5 of one year is 3 x 73 = 219 days; 1 3/5 years also are 365 + 219 = 584 days.) During the course of one such synodical cycle, Venus, after an upper conjunction, moves in an eastern direction from the sun for several months. After thirty-six days, Venus appears dimly shining during dusk, still close to the sun's sphere. Then it gradually moves away from the sun, and half a year later, shining rather brightly, it reaches its point farthest from the sun. Then Venus moves towards the sun at an ever-faster pace. There is a lower conjunction with the sun 292 days after the upper conjunction. This rhythm of moving away from the sun's sphere and reapproaching the sun for the next conjunction takes place in a similar way to Mercury's, which, during the course of the synodical cycle of Venus, occurs for a second time. There Venus, as the morning star, moves away from the sun in the opposite direction.

Mercury with its conjunctions with the sun describes a hexagon during the course of one year; the five upper conjunctions between the sun and Venus during the course of eight years (5 x 1 3/5 years = 8 years) describe a pentagon.

The rhythm of Venus and the sun is particularly closely interwoven with the rhythms of Mercury and Mars. During the period of one synodical revolution of Venus, Mercury completes approximately five synodical cycles (5 x 116 = 580 days). Venus' synod and Mercury's have a 5:1 ratio to each other. Venus is connected with Mars by means of the rhythms of the conjunctions. During the time it takes Venus to complete four synodical cycles (4 x 584 = 2336 days), Mars completes almost three synodical revolutions (3 x 780 = 2340 days).

The characteristic relationship between Mercury and the moon appears absent between Venus and the moon. The rhythms of Venus are much more closely tied to the course of the sun. Thus the connection between the sidereal (225 days) and the synodical cycles (584 days) is dominated by the sun. During the sidereal cycle—from the sun relative to the zodiac—and the synodical cycle—oriented towards earth—359 days pass, during which the sun moves through nearly the entire zodiac.

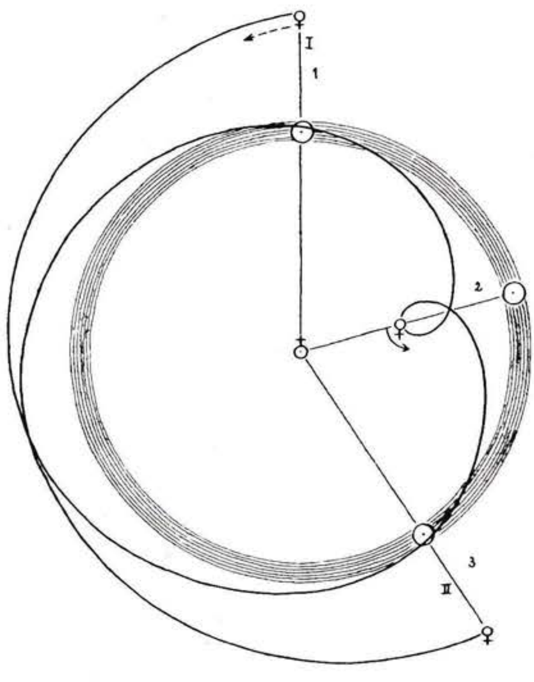


Fig. 5 During its synodical cycle (1 ⟶3) Venus comes in the first year from an upper conjunction to the following lower conjunction (1⟶ 2). During the next year, the sun moves through another 3/5 of the zodiac to the next upper conjunction with Venus (3).

A thorough observation of the planetary movements will reveal a multitude of such rhythmical connections. This is true also for the other planets, particularly for Mars, Jupiter, and Saturn. Later, in connection with the formative processes of the plant, more will be said about these planets *(v. p. 42)*. At this point we merely wish to stress, by way of examples, that the motions of the planets are coordinated and their rhythms are interwoven with each other. Therefore, it is not sufficient to view the planets and their rhythms as isolated facts. When in the morning sky Venus, for example, is at a certain distance from the sun at a particular position in the zodiac, then the basis for this phenomenon is not only the sun-Venus rhythm. The combined rhythms of Mercury, Mars, and the moon also affect it. Thus the entire universe partakes in a certain planet's position. Just as it is not propitious to view an organ isolated from the organism, lest the interconnectedness of life be lost, so a planet cannot be understood without the sun and the other planets, since the rhythms of the other planets affect its own rhythm.

The planetary system is a complete whole. Its unity is based on its parts not only interacting in the sense of external causality but also on their mutually interpenetrating as in a cosmic organism. Therefore, it appears that reality in the planetary world does not lie in the manifest phenomena of the individual planets but in the harmony of their rhythms. Here, on a large scale, is found what modern rhythm research calls rhythmical coordination: wherever the sun, moon, or a planet manifests in the world, this manifestation is connected simultaneously with the rest of the planetary universe.

3. The Gesture of Foliation

From the previous discussion, there follow important consequences for the study of nature. A growth process connected with the sun's rhythm or a planet's rhythm reveals its relationship to the entire planetary system, though this may not be noticed right away. When we accept the assumption that a reflection of the ascending movement of the sun is found in the center shoot of the herbaceous plants, then we must investigate to what extent the other plant organs are connected with the center shoot, relating these connections to those between sun and planets. Do plant forms, in their dependency upon the sun, also express a relationship to the other planets? Let us first examine Mercury and Venus, since they have a particularly close connection with the sun. During their revolutions around the sun, they repeatedly pass through the sphere between the sun and the earth. For this reason, they used to be called "near planets." Jupiter and Saturn complete their movements entirely in the sphere beyond the sun and thus encircle earth and sun. As the "far planets" they act in opposition to the sun *(v. Fig. 15)*. This is also true for Mars, though during its opposition to the sun it leaves the sphere of the far planets and enters the sphere between the sun and the earth. In this respect, Mars occupies a peculiar intermediary position between the spheres of the near and far planets *(v. Fig. 14)*.

Of all the planets, Mercury is closest to the sun, circling in a relatively narrow orbit and accompanying it during its ascending movement during the mutual ascent of sun and Mercury (two lower and one upper, or one lower and two upper conjunctions), during which Mercury entirely disappears in the ascending path of the sun. Shortly thereafter, Mercury reappears on the other side of the sun path. Meanwhile, the sun has climbed to a higher position. Mercury then moves away from the sun's path for a short period of time.

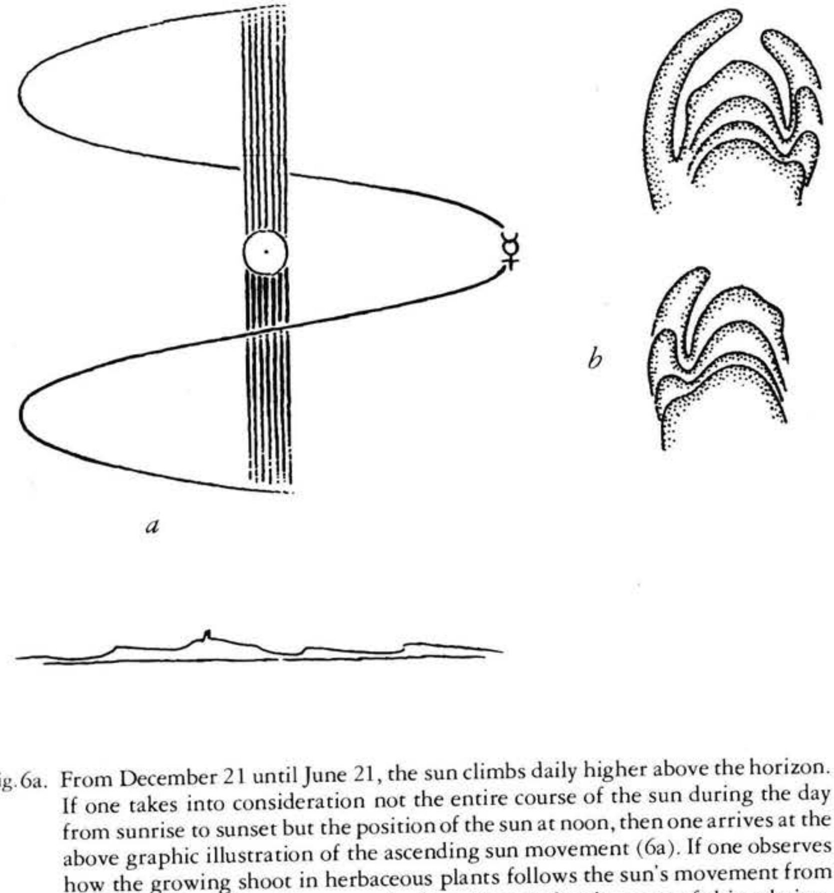


Fig. 6a. From December 21 until June 21, the sun climbs daily higher above the horizon. If one takes into consideration not the entire course of the sun during the day from sunrise to sunset but the position of the sun at noon, then one arrives at the above graphic illustration of the ascending sun movement (6a). If one observes how the growing shoot in herbaceous plants follows the sun's movement from morning till evening (phototropism) and how it develops out of this relationship to the sun (morphogenetic effect of light), then it appears that a description of the processes as follows is justified: out of the phototropical movement of the plant with the daily path of the sun, the vertical shoot develops.

6b. The vegetative point of a grass species during eight successive developmental stages. The gesture of shoot formation and the resulting development of leaves on a small scale form the mirror image of the movement of the sun and Mercury.

Having learned to see the reflection of the sun's movement develop in the processes of life in the center shoot, one next encounters the plant as a reflective image of the movements of sun and Mercury. As Mercury after a conjunction gradually leaves the sun's path again and then extends the path away from the sun-sphere, so the leaf buds develop similarly in the tip of the shoot. Initially they appear as slight elevations; then they swell up and grow stronger towards the sides, and finally in this movement of growth they appear towards the tip of the shoot. The small leaflets finally bend and meet above the apex of the shoot in a movement similar to that in which Mercury, during its conjunction with the sun, crosses the sun's path above.

The sun's path is reflected by the shoot, and likewise the sun-reflected movement of Mercury becomes visible in those formations which protrude from the shoot and grow outward. This gesture is still found in the fully developed leaves of many monocotyledonous plants. For example, the leaves of the tulip, and of various lilies, emerge directly from the stem without a petiole. Their parallel-veined structure and upward-rising form imitate the movement of Mercury as it turns away from the sun's path.

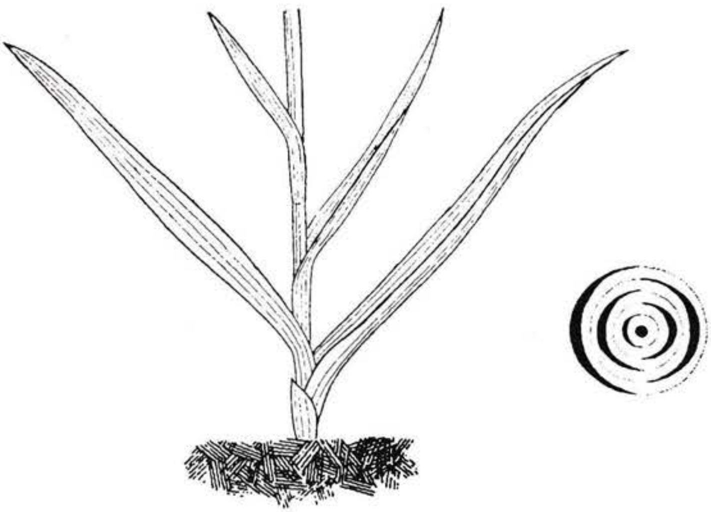


Fig. 7 The gesture of the ascending movement of the sun and Mercury is particularly striking in monocotyledons such as this orchid species. In contrast to their original position at the vegetative point, the leaves exhibit much stronger growth forces in the vicinity of the shoot. (The diagram shows the one-half positioning of the leaves.)

Numerous monocotyledons are a faithful imitation of the movement of sun and Mercury in their form-expression, down to the spatial relationship of the leaves to the shoot. The alternate position of the leaves is prevalent in monocotyledons. The leaves together form two vertical ranks of leaves *(Orthostichus)*. In a similar way, Mercury emerges alternately from east to west of the sun's path. Mercury alternately stands to the right and left of the sun, just as the leaves alternate.[23]

The leaves of some dicotyledons also develop according to the law of alternate one-half positioning along the shoot. This arrangement is characteristic of the monocotyledons, but quite rare for the dicotyledons. This coincidence of a leaf form and a leaf position which is unusual for dicotyledons points to an even more profound connection to sun and Mercury, which is expressed in the form and position of the leaves. In most dicotyledons, other leaf positions prevail. Furthermore, the pinnately veined leaf blade is generally connected to the central shoot by a petiole. Here, other forces enter into the foliation process in a modifying way, which will be discussed later.

If the rhythm of the sun and Mercury were the only influences acting upon leaf formation, the leaves would be positioned according to the rhythms of the conjunctions, one after the other. The bird of paradise, a relative of the South African banana, would develop a leaf every two months, for example. The rhythms of the earth, however, also strongly affect the growth of the shoot *(v. p. 16)*. When the earth blocks off the influence of the sun and Mercury at night, many plants expand only in the shoots. The formative processes in the leaves are renewed in the morning by the sun and Mercury. Thus, leaves are often formed in rapid succession—for example, spaced two days apart. The moon, through

23. Schultz, in his work about the leaf positions (cf. note 6), attempts to deduce the one-half positioning of the leaves from the movement of the moon and, in particular, from the position of the full moon and the new moon. The manifestations of the moon during a full moon and a new moon are opposite in every respect. That is one of the reasons why it is so difficult to imagine that this manifestation of the moon affects the plant in a like manner, i.e. in the development of the leaves. Our dissatisfaction with the manner in which Schultz treats the problem of the leaf positions lies in the fact that he does not begin by examining the development of the leaves on the shoot, which is a basic phenomenon. With this approach we cannot find a relationship with the moon. The leaves develop from the vegetative point on the shoot, the reflection of the sun. Leaf growth, therefore, points from the sun to the cosmic world—the planets—and not to the moon. This conception corresponds to R. Steiner's description: he states that "the line along which the leaves of the plant grow on the shoot .... is linked up with the movement of the *planets*," and "these lines are miniature images of the movement of the *planets*." *(Menschenwerden, Weltenseele und Weltengeist*, part 1, GA 205 (Dornach: 1967) p. 58. And in another context we find: "When you see how in a plant the forces develop as in spirals from the base of one leaf to the next, then you have the activity of those forces affected by the *planets*." *Die geistigen Wesenheiten in den Himmelskörpern und Naturreichen*, GA 136 (Dornach: 1974), p. 169. In still other lectures, R. Steiner pointed to the leaf positions and always placed them in a connection with the planets.

its synodical rhythm, also affects the sequence in which leaves grow. The leaves of the Coventry bell grow more during the time of the new moon.[24] In the sweet flag, the period of seven days between the origination of two leaves clearly points to a connection with the course of the moon. Such an interplay of various rhythms may sometimes obscure the rhythm of foliation.

With its leaves, the plant is characteristically part of the interrelatedness of nature. Its spatial expansion expresses the manner in which the leaf becomes a part of the surrounding atmosphere and the light streaming toward the earth. In the leaf blades, with their narrow, wide, or divided forms, this connection with the atmosphere becomes obvious to varying degrees—a manifestation of how the air, with its active, expanding substance, penetrates the leaves, usually from below. Most importantly, one notices, when looking at the underside of the leaves, how they "grow together" with the light-sphere during their development and how they become a part of that sphere of light when it shines through them. The veins of the leaves, originating in the shoot and becoming increasingly divided into ever finer veins in the blades, are the image of the sap rising in the shoot and permeating the leaves.

In these facts, the most important life process of the leaves—assimilation—becomes vividly comprehensible. Through the meeting of the sap rising from the ground and the gaseous carbon dioxide taken from the atmosphere and utilized by the photosynthetic processes with the aid of light, living substance (sugar and starch) is created, which, in the end, is used to build up the entire plant. This life process, like the leaf itself, is the manifestation of Mercury. When something (which is to be dealt with later on) is added to the above, namely that the root and the water in the plant are the representatives of the moon on earth *(v.* p. *54* and p. *125*, then the following view results: as Mercury is contained in the sun's sphere and rhythm, so its own rhythm contains that of the moon, and the leaf lives completely in the atmosphere permeated by the sun, while water rising from the root permeates the leaf from within, as it were through the veins. More concisely, as Mercury unites within itself the rhythms of the sun and moon, so the leaf unites the gaseous carbon dioxide and sunlight with water into the most original source of living substance.

4. The Formation of the Perianth

With the development of the flowers, the plant elevates itself above mere vegetable life. With its leaves, the plant is connected with the sun, since it utilizes light in its material processes. Now the plant as a whole

24. Giovanni Abrami, "Correlations Between Lunar Phases and Rhythmicities in Plant Growth Under Field Conditions," *Can. Journ. Bot.*, 50 (1972).

turns with its blossom to the sun. The simple assimilation of light intensifies into a total yielding to the light, resulting in a complete unfolding of the leaves; in a parallel way, the green leaves change into colored petals. Grohmann, Böckemuhl and Bünsow[25] have convincingly described how within this metamorphosis the upper green leaves not only reduce in size but also, with their radiate form, already point to the flowering stage.

Thus the plant, through the development of flowers, enters into a closer connection with the rhythm inherent in the sun's course. Vegetative development on earth, despite all its differentiations, has a relatively uniform character. Insofar as climatic conditions permit, plants from tropical regions form shoots and leaves in temperate regions, too. The same goes for central European plant species in tropical regions. There, they often cannot form blossoms. For many years they may continue to develop exclusively in the vegetative stage. They develop blossoms only when the days are clearly longer than the nights, that is, when the sun, in the way characteristic for temperate or northern regions, dominates the day with its abundance of summer light (generally called long-day plants). Likewise, most tropical plants form their blossoms when day and night follow each other in regular, even alternation, that is, when the plant may surrender to the sun's rhythm in the tropical and subtropical regions (short-day plants).

There are also, however, herbaceous plants which are not tied to the sun's rhythm of the northern or southern latitudes and thus are included more in the general life of the earth, like the shoot and the leaves. Since most of these day-neutral plants develop only miniature blossoms (e.g., shepherd's purse, garden mercury, small-blossomed buttonweed, horseweed, and common groundsel), they remain tied to vegetative life even during their flowering stage. An extraordinarily large number of these plant species are annual herbaceous plants (*v.* p. *73* ff.).

By connecting more strongly with the cosmic rhythm during flowering, the plant frees itself from the more substance-related processes of life. Those processes become increasingly weaker in the upper leaves of the shoot. The developing blossoms are frequently carried far beyond the region of the leaves and beyond the vegetative growth by means of an intense stretching of the shoot. As in the budding of the leaves the rising of fluid from the root is decisive, so the blossoms develop under the increased influence of warmth from the sun.

25. J. Bockemühl, "Der Pflanzentypus als Bewegungsgestalt," in *Elemente der Naturwissenschaft*, number 1 (1964). R. Bünsow, "Die Bedeutung des Blühimpulses für die Metamorphose der Pflanze," in *Elemente der Naturwissenschaft*, number 5 (1965). G. Grohmann, *Die Pflanze*, vol 1, 5th ed. (Stuttgart: 1975).

With pollination, the plant is dispersed in the warmed space. In the fruits and seeds, structures originate that reach far beyond the life of the individual plant. In all these processes, the plant also frees itself from the earthly gravitational forces which work in a solidifying way in the shoot. Between the region of vegetative growth and the processes through which life goes beyond the boundaries of the individual plant, the perianth develops.

The laws working in the development of the perianth are best understood when one begins by studying the more simple blossoms of the monocotyledons. Six "petals" (three are actually sepals) develop in two circles of three each, placed closely over each other as with tulips, lilies, irises or gladioli. If one regards the image of the sun as the receptacle, and from it the six petals developing rather uniformly in all directions, then this six-fold perianth at first appears as an image of Mercury's movements: as Mercury after its conjunctions moves away from the immediate sun-sphere on its course with the sun through the zodiac, so six petals originate from the receptacle. After the three upper conjunctions, Mercury moves away from the sun's sphere rather slowly towards earth. After the three lower conjunctions, Mercury pulls swiftly away from the earth towards the sun's sphere. Correspondingly, the three sepals are lower, that is, closer to the earth, and the three petals are somewhat higher than the receptacle. The three inner (higher) petals expand in their entire form much more strongly towards the surrounding space, as an expression of Mercury's swift movement away from the earth.

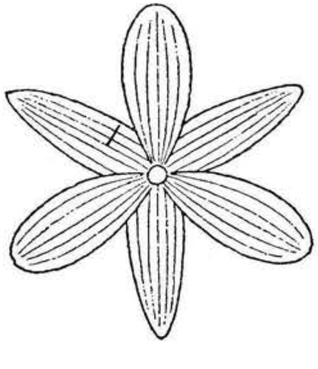


Fig. 8 The six petals of a tulip blossom (after Troll). The three lower petals are quite similar in their form to the green leaves of the shoot.

This contrast, between the inner three petals bending upward and the three sepals turned down towards earth, is most exquisitely expressed in the iris. As soon as the blossoms unfold, the outside sepals bend downward, while the three inner petals bend strongly upward. Some genera in the family *Alismaceae* and the spiderwort even develop the sepals of the lower circle in green color, resembling a calyx.

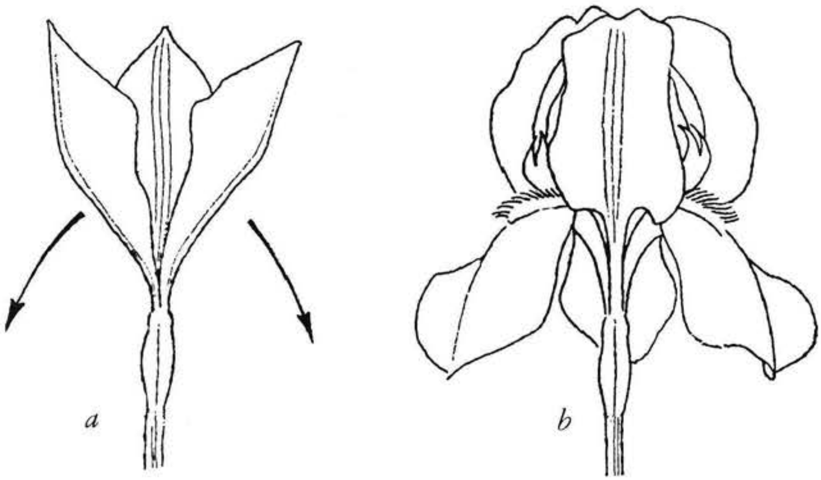


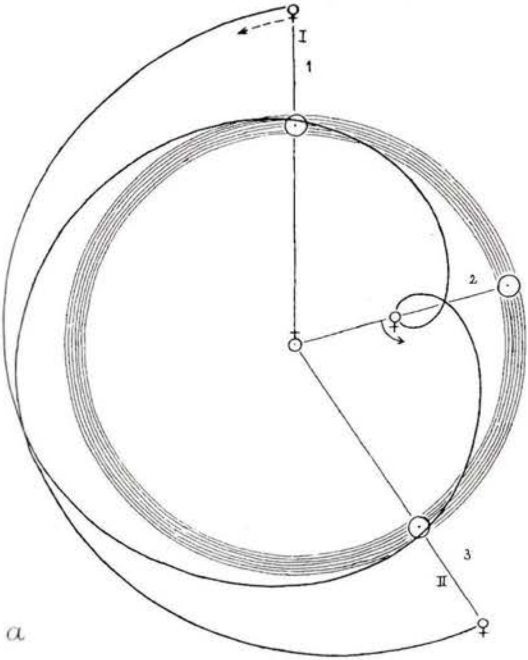
Fig. 9 The iris blossom has the typical blossom form only during its early development (9a). As the flower continues to develop, the three lower petals turn their inside surfaces towards the surrounding space (9b). The character of the blossom here is determined strongly by the contrast between the three upward-curved petals and the three petals bending downward.

The perianth thus appears as an extraordinarily pure reflection of cosmic processes. The development of the flower is not solely related to Mercury, however, or else the petals would have to develop one after the other like the leaves on the shoot. The Mercury-related development is permeated by forces that bring forth the uniform, higher plant organ—the perianth—from the individual leaf structures. The character of these forces may be recognized when the transformation into this overlapping, uniform corolla is observed. It appears that these forces have a close connection with the sun, since the petals surround the receptacle as their center. Furthermore, the corolla is influenced by the sun to a high degree. Through the petals developing at the tip of the shoot, they are incorporated in the sun's ascending movement. The forces working in them in a formative way, however, clearly point beyond the shoot and, with that, past the yearly course of the sun. The perianth, in its entire gesture, shows that the plant is elevated above the sun's influence on the earthly shoot.

Venus, which similarly to Mercury moves entirely within the sun's sphere, manifests itself in these influences. It moves farther from the sun than does the more closely connected Mercury, however. This movement away from the sun's sphere, particularly during Venus' synodical rhythm, leads Venus far beyond the yearly rhythm of the sun. Thus it maintains a close connection with the sun during its movement, as the perianth is connected with the receptacle, but it is not tied into the yearly course of the sun like Mercury. It follows the sun's course, but its rhythm goes beyond it—as the corolla in its gesture goes beyond the shoot. This connection of Venus with the sun and its going beyond the sun's rhythm is reflected in the plant kingdom when the petals emerge from the shoot and turn to the space beyond the shoot.

The development of the flower reaches a higher level in certain dicotyledons such as roses, carnations, or the buttercup or the geranium families. There the corolla emerges from the bud-like covering of the green calyx. Herbaceous perennial plants develop from buds in the ground in the springtime. The blossoms of the higher plants have their buds in the higher sphere of light. The calyx is reminiscent of the region of leaves. It is a repetition of the green plant on the advanced level of metamorphosis. The sepals are generally narrow and have parallel venation. They correspond to the leaves and petals of monocotyledons as long as these plants are still green and the flower bud is closed. The calyx is connected to Mercury, much as are the corollas of the monocotyledons.

Fig. 10 (a) During the course of one synodical Venus period, with two upper (I, II) and the intermediate lower conjunction (2), Venus gradually moves east (→), and then quickly moves west (→), away from the immediate sun sphere.
(b) During the eight-year cycle of Venus and the sun, Venus, after the five upper conjunctions (I, II, III, IV, V), moves east at slow speed and, after the following five lower conjunctions (1, 2, 3, 4, 5), swiftly moves west toward the sun's sphere.
(c) The sun, with its five positions from the previous illustration (b), is pictured as centered in the earth since the form expression originated by the sun is tied to the earth through the shoot. The directions in which Venus moves away from the sun after the five upper and five lower conjunctions are marked as in (b).
(d) The calyx of the double perianth in dicotyledons appears as the image of the slow movement of Venus away from the sun's sphere after the upper conjunctions. In the five petals, the image of the much swifter movement of Venus away from the sun after the lower conjunctions is revealed.



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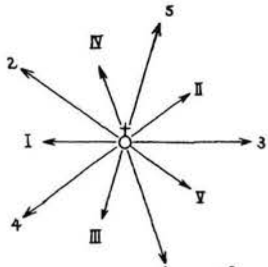

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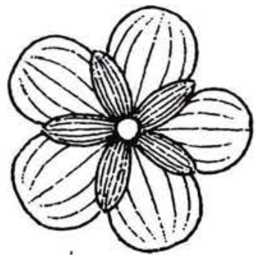

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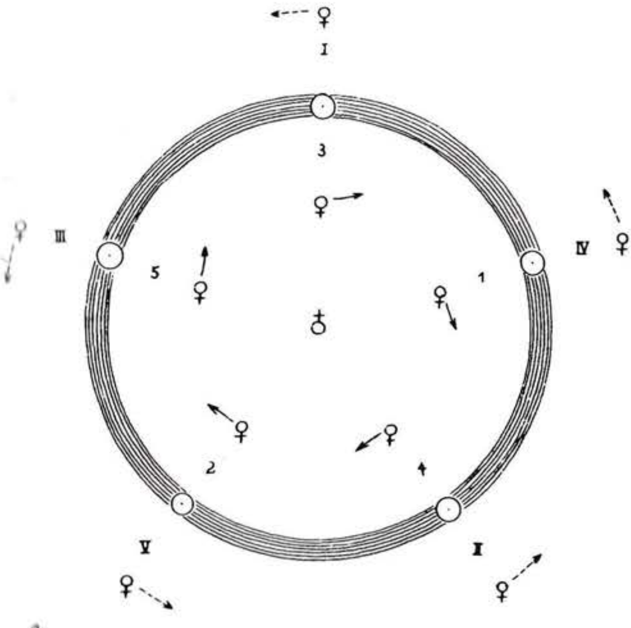

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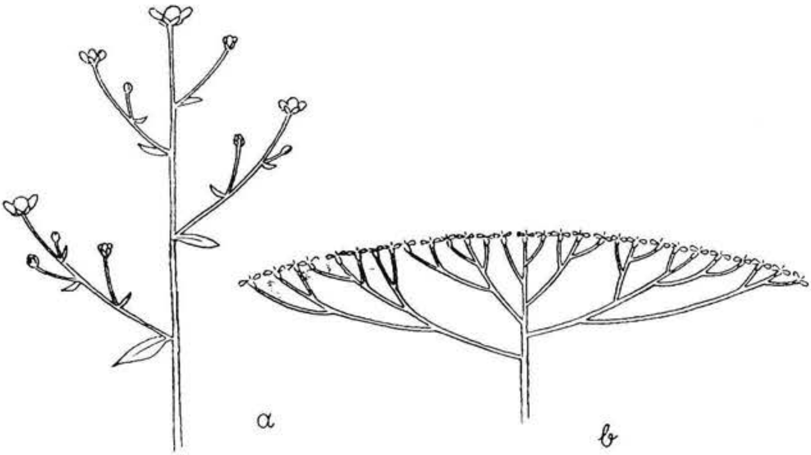
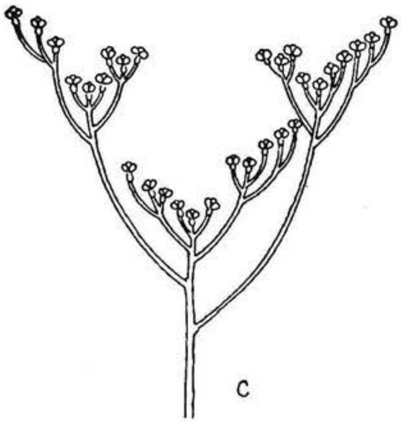


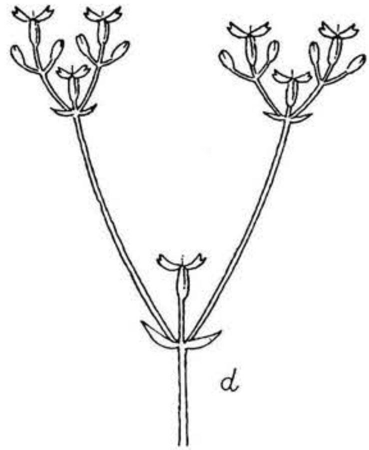
Fig. 11 "Closed" infloresences: in the panicle (a) the center shoot determines the form of the inflorescences. In the transition to the umbrella-shaped panicle (b) the inflorescence is uniformly turned toward the surrounding space. In the anthela (c) and the dichasium (d) the center recedes opposite the part of the flower along the periphery. The development of the flowers in the panicle is clearly located in the vicinity of the shoot. This gesture is heightened by the central axis receding more and more.

The plant is elevated to a higher level in the corollas of the dicotyledons. Their petals do not develop gradually from an early green-colored stage, as with most monocots; they immediately emerge in color from the bud. Their material consistency is more delicate than in most monocotyledons. Even in the lilies, for example, the more substantial condition of the green leaves is still present in the petals. Only in the corollas of the dicotyledons is perfect flowering achieved. Here Venus manifests itself perfectly in the plant.

Frequently, corollas expand wide and bowl-shaped directly from the receptacle. The form of the petals corresponds to this gesture. They are not narrow like the petals of many monocotyledons, but wide. The corollas not only radiate from the center to the outside, but widen in the vicinity of the receptacle like the movement of Venus in the periphery of the sun's sphere.

The perianth of monocotyledons is marked by sixfoldness, of the dicotyledons by fivefoldness. The parallel to Venus is expressed particularly clearly in this fivefoldness. It is the image of the synodical movement of Venus, i.e., the rhythmical moving away of Venus into the periphery of the sun's sphere and its return to the sun's sphere. During a





period of eight years, five such synodical revolutions complete nearly one full cycle (5 x 584 = 2920, 8 x 365½ = 2924 days). After the eight-year period has ended, the sixth period of Venus begins anew, approximately in the same place that the first period started. During this long time period, a pentagram is drawn in the sky by the sun and Venus completing their courses. This pentagram appears briefly in the blossom of the dicotyledons.

After an upper conjunction, Venus moves slowly eastward out into the sun's periphery and displays its increasing brightness as the evening star. After a little more than seven months, Venus reaches its greatest eastern elongation. Then it quickly re-emerges in the immediate sun-sphere for a lower conjunction. And just as swiftly, it moves out into space as the morning star. This movement may be likened to a sudden flare. Several weeks later, it reaches its most intense radiance and soon thereafter (after a total of 72 days) its greatest western elongation. In this way, Venus displays its brilliance twice during one synodical period. During a complete cycle of eight years, it moves out into the sun's periphery ten times.

When observing the blossoms of dicotyledons with the understanding that the receptacle is the earthly image of the sun, one recognizes the five sepals and the five petals as the image of this tenfold moving away of Venus from the immediate sun-sphere into its periphery *(v. p. 35)*. As Venus approaches the earthly sphere five times in a slow, restrained movement, and five times rather rapidly and radiantly moves away from the earth, so the structures emerging from the receptacle vary in character: the sepals are shorter and narrower, and the petals generally expand into surrounding space and upwards.

The five sepals and five petals develop in a tightly packed spiral. This may indicate that the development of the perianth is based on a chronological order, although it does not manifest itself as such. The internodes between petals, which in the Venus cycle would correspond to the sun's movement between conjunctions, are suppressed. They must remain undeveloped on the shoot—a manifestation of the sun and its yearly ascending course. They cannot unfold in a formation that is originated by much shorter rhythms.

Herbaceous plants that have merely one blossom are rather rare. They belong predominantly to the group of monocotyledons in which the flowering process appears restrained because of the mercurial character affecting the blossoms. The unifloral plants are to a large extent springtime flowers that are little developed: for example, the winter aconite, the snowdrop, the crocus, the wood anemone, the daffodil and the tulip. The summer, with its abundance of vegetation, has few uniforal plants. The poppy, the love-in-a-mist and the wood nymph or waxflower *(Moneses uniflora)* are exceptions. In general, the gesture of flowering, of expansion into the periphery of the shoot, seizes the entire plant during its flowering season.

So, when the first rudimentary forms of the flower organs develop, an abundance of buds develops in the axils of the upper part of the shoot. They become inflorescences on which flowers arrange themselves in the space around the center shoot in the most varied ways.

The center shoot of many herbaceous plants ends in a terminal bud. The vegetative point of the shoot becomes the receptacle. In these closed or determinate inflorescences, the flower formation expands rather strongly into the periphery of the central axis. In the case of the buttercup and the rose, for example, the flower formation dominates the shape of the whole flowering plant. In the umbel-carrying plants (such as the common elder, the meadowsweet and various carnations), the flower formation retreats into the umbel *(v. Fig. 11)*.

The other group of inflorescences does not end in a terminal bud. In these open or indeterminate inflorescences, the center shoot continues to grow and forms spicule-like inflorescences (in, for example, plaintain and many grasses), or sometimes strongly upward-striving racemose inflorescences, as, for example, in the crucifers, the larkspur and the monkshood.

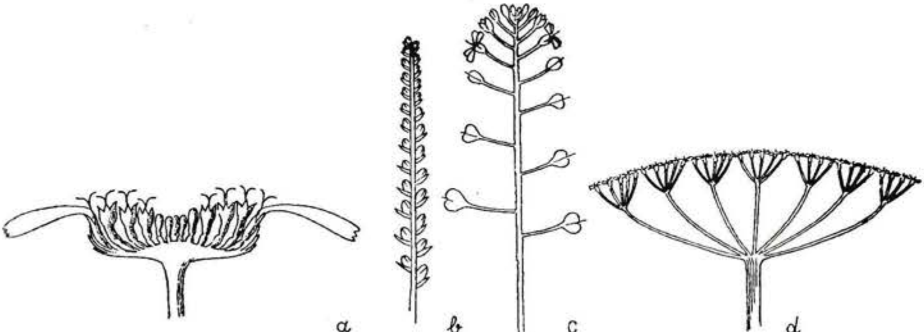


Fig. 12 "Open" inflorescences: the head (a) with its numerous individual blossoms is a contracted inflorescence. Since the shoot axis is first compressed and then expanded into the receptacle, an inflorescence with a rudimentary strong form becomes a flower of a higher order (compare with the chapter on composite plants). In the spicule-shaped inflorescences (b)—here with still-closed blossoms—only the center shoot develops in the inflorescence. From this center, the blossoms expand into the surrounding space in the racemose inflorescences (c). The umbels and double umbels (d) come about through the blossom's originating not directly from the shoot but from its tip, and expanding above it. In contrast to the "closed" inflorescences, here the development of the center shoot and the diversified emergence of the blossoms from it are at the base of the formative processes.

The flower heads of the clover, the teasel and the *Compositae* appear tightly clustered, as though in an undeveloped stage. The most perfect development, radiating as it were even beyond the center shoot, is to be found in the true umbels. Among the open inflorescences, those of labiate plants may also be counted. In the axils of the opposite leaves, tightly contracted inflorescences, as, for example, in the dead-nettle and sage, occur. The center shoot continues to grow through these tiered inflorescences.

5. Pistils—Stamens—Pollination

The stamens and the pistil, which develop within the flower, are quite opposite organs. The stamens with their anthers and particularly with their pollen reach far beyond the shoot. The pistil relates to the surrounding space through the stigma. It is, however, also centered in the ovary. In determinate inflorescences, the stigma is the conclusion of the central shoot. Stamens and pistil clearly point beyond the shoot, which is under the sun's influence, and to their role in sustaining the life of the plant species or type through pollination and fruit and seed development beyond the course of one year, even when the individual plant has died.

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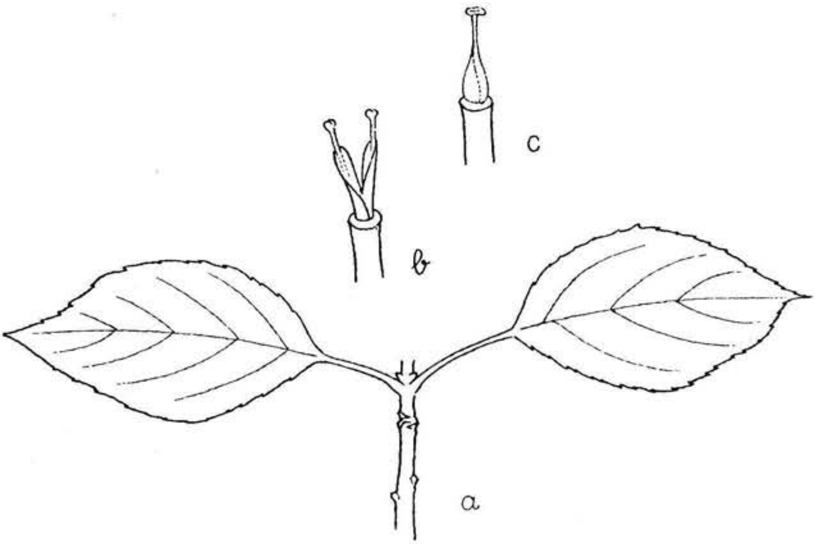


Fig. 13 The transformation of leaves (a) into a pistil with the ovary (c) comes about by the leaves' dissolving their connection with the atmosphere and the sun and building a space of their own, isolated from the sun. There the seeds may develop. The intermediate stage of an incomplete metamorphosis (b) illustrates how the development of the leaf is seized by contracting, isolating forces (partly after Rauh).

26. The term "formative forces" is used in the sense expressed by R. Steiner: the forces working in a form-giving way in life, according to spiritual laws. They must be distinguished from those substances in which they are active (cf. R. Steiner, *Theosophie*, GA 9). We are able to describe only the formative forces that have already expressed their lives and laws in the material sphere. Thus, we are in an intermediary sphere that already reaches beyond sense perceptions related to material form but is not yet based on a perception of the formative forces that are, in essence, supersensible.

Our perception of the formative forces corresponds somewhat to that which E. Marti expresed in his essay "Über die notwendige Unterscheidung der ätherischen Bildekräfte von den Ätherarten" (*Die vier Äther*, Stuttgart: 1974). Our entire description aims at searching for the origin of the formative forces active in the plants in the cosmos in that we come to know the form-expression in the plant as a sort of reflection of the planetary world.

Most plants contain only one pistil within each flower. Several carpels are generally enclosed in its base to form one uniform ovary. In a number of plants, for example in many buttercup species and some rosaceous plants, a kind of pistil develops out of each carpel. Thus more than one, and often many, individual and self-contained carpels may be found sitting loosely next to each other. The round bottom part of the pistil, the ovary, encloses the rudimentary form of the seeds or ovules. Plant organs, which ordinarily would have unfolded as leaves into the surrounding space and yielded to the sun, have closed together here to comprise the interior of the developing ovary. With this contraction, a so-called congenital fusion, the plant isolates itself to a large degree from the sun. During the development of the ovary, the sun-related forces that normally act in the development of the leaves are supplanted by other formative forces,[26] which lead them into this isolation.

The moon is the cosmic image of the transforming forces at work here. In the planetary sphere, the moon's position is such that it reflects the sun's light into its own sphere during its course through the zodiac. It creates a space around the earth where the forces that usually radiate throughout the universe are isolated by the circulating reflection. The effects emanating from the sun and Mercury reach the earth in two ways: once directly and once as reflected by the moon.

The image of the direct influences is encountered in the upward-stretching shoot. The influence mediated by the moon may be better understood through the following illustration. In the tip of the shoot, rudimentary leaf forms develop so far as to reach their connection with the light, but are transformed, during their development, in such a way that they correspond to the sun's image as reflected by the moon; the rudimentary leaf forms are isolated from their connection with the sun, contrary to their nature. They form an isolated space like the one the moon forms through the reflected sunlight. The ovary appears as the influence of the sun and Mercury, isolated by the moon into a space of its own.

The style and the stigma are elevated above the ovary. The development of the stigma runs opposite to that of the ovary. Through the stigma, the plant, here as in no other place, yields intensely to the surrounding space with its special, gland-like, delicate tissue. Here it receives the pollen from the surrounding space and permits the pollen and other substances to penetrate to the stigma and move through the style down to the rudimentary seed forms (ovules) inside the ovary.

The stamens originate between the petals and the pistil. The usually delicate filaments carry the anthers upward. With the anthers, those small, three-dimensional structures, the plant moves away from the receptacle. The stamens with their extreme centrifugal form have quite a different relationship to the shoot and to the receptacle than do the petals. Like the latter, they originate on the receptacle; the petals, however, merely expand from the center to the periphery, while on the stamens the anthers are positioned in the surrounding space.

Pollination intensifies this gesture. The plant dissolves into the surrounding space, which is filled with light and warmth. It expands into a region that goes beyond the formations originating from the sun, Mercury and Venus (shoot, leaves, perianth). When the pollen of a certain plant species is carried into space by the wind or by insects, the plant-being reaches a position superior to that of the individual plants. Here, spatial coexistence is dissolved. Through pollination, the next stage of the plant's development—the development of the fruit—is initiated.

There are two distinct phases: the development of the stamens, and pollination. The processes that are active here in the plant go beyond the previously discussed developments.

During the initial phase, rudimentary stamens develop around the vegetative area. They bring forth the anthers. The anthers are then lifted upward by the filaments during the flowering stage and move away from the receptacle. Finally, they are not only above the receptacle, but also above the ovary, which is dominated by the moon. In these formative processes, there becomes visible an image of the planet which (a) in contrast to Mercury and Venus is no longer tied in its movement to the immediate sun-sphere, but (b) moves in the periphery of the sun's sphere, and (c) still comes close to the moon's sphere.

Mars, during the first half of its synodical cycle, fits this description. During the conjunction, the sun is located in front of Mars, which gradually moves farther out into space. Then Mars slowly moves west out into the periphery of the sun's sphere. Because of the much swifter movement of the sun, the distance increases rapidly. After a little more than one year (one year and twenty-five days), Mars stands in opposition to the sun. Mars has moved away from the sun, as in (a) and (b) above. Simultaneously, it has emerged from the depths of space into the sun's sphere and from there into the vicinity of the moon's sphere, as in (c) above. During its opposition to the sun, it is the planet closest to the earth. Between the sun and Mars lies the moon's sphere, as the ovary lies between the receptacle and the anthers in the open blossom. The filaments during their development are the image of Mars' movement away from the sun after the conjunction.

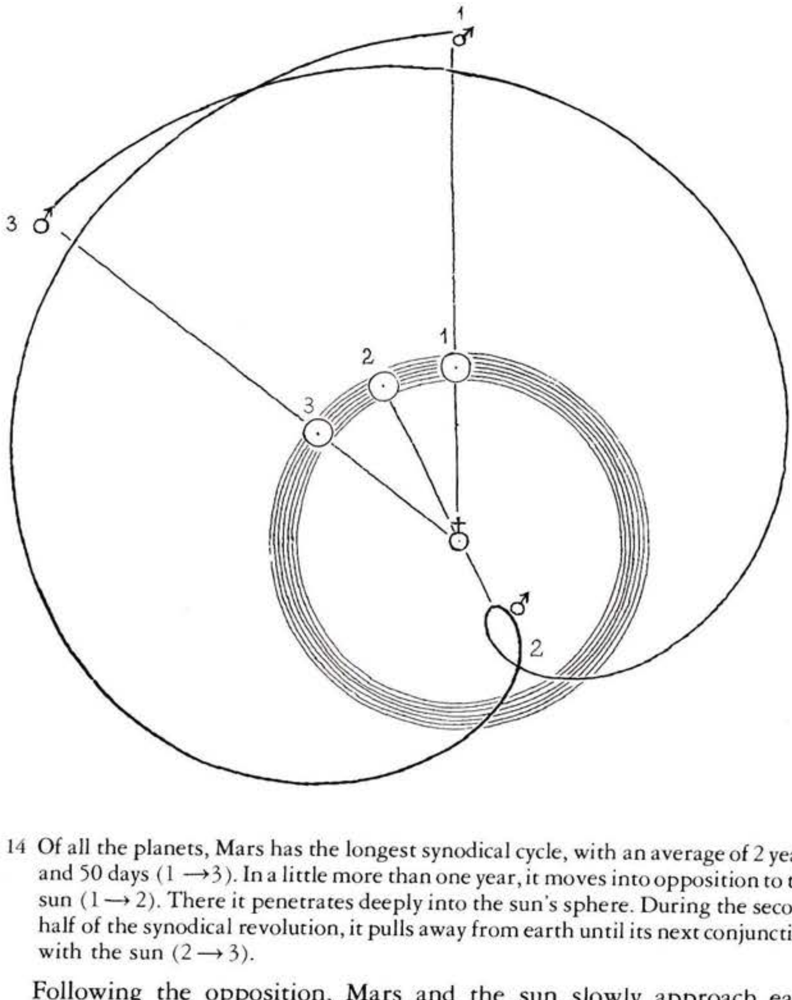


Fig. 14 Of all the planets, Mars has the longest synodical cycle, with an average of 2 years and 50 days ($1 \longrightarrow 3$). In a little more than one year, it moves into opposition to the sun ($1 \longrightarrow 2$). There it penetrates deeply into the sun's sphere. During the second half of the synodical revolution, it pulls away from earth until its next conjunction with the sun ($2 \longrightarrow 3$).

Following the opposition, Mars and the sun slowly approach each other. At first, the movement of Mars is retrograde.* It moves away from the earth and its moon-sphere, leaves the sun's sphere and moves far into the space enclosing the sun's sphere. This tremendous expansion in movement manifests itself vividly in the processes of life in the pollination of the plant when the pollen—originating in the anthers—is carried beyond the shoot, leaves and perianth, those plant organs marked by the sun, Mercury and Venus. During the conjunction, the sun moves into the same sphere as the slower Mars. The sun blends with Mars for a brief period of time. The sun is then positioned between the

*The movement of Mars relative to the earth's position in its orbit seems to be backward in the zodiac.

moon's sphere and Mars; it is elevated above the moon's sphere as the style with the stigma is above the ovary. The conjunction itself correlates with pollination: in the plant kingdom—as in the universe between the sun and Mars—there is a junction between the stigma, and the pollen being dispersed in space by the movement of air or by insects. Pollination initiates the development of fruit and seed.

6. A Look at the Far Planets and the Planetary System

Before we turn to the final stages in the development of the plant, it is advisable to take a look at the far planets. The study of the stamens and of pollination has already directed our glance in that direction. Before the discovery of Uranus by Herschel in 1781, only Mars, Jupiter and Saturn were known as the far planets. Their cycles stretch over longer periods of time than those of Mercury or Venus. Most importantly, however, they are not part of the immediate sun-sphere. They encompass the sun's sphere, and with it the earth, with their movements, at such a distance that they reach an opposition to the sun.

Mars is the mediator between the spheres which are located within the sun's sphere and those that encompass it. With its approximately two-year synodical rhythm, it is rather close to Venus, which widens the sphere of the near planets. During its opposition, Mars penetrates deeply into the sun's sphere. There it becomes the planet closest to the earth; then it moves into the region of the far planets for its conjunction with the sun. Jupiter and Saturn, however, move entirely outside the sun's sphere.

Jupiter—that mighty, calm planet— is not only located in the sphere between the sun and the fixed stars, but, because of its peculiar movement, it also establishes a harmony between the sun's course and the zodiac. Its sidereal rhythm amounts to approximately twelve years (11.84 years). So, it takes about one year to move through each sign of the zodiac. Its movement is adapted to the surrounding cosmic space, where the yearly cycle of the sun is the measure of Jupiter's movement. While the sun revolves through the whole zodiac once, Jupiter reflects its light from one region of the zodiac. Jupiter establishes a connection between the yearly course of the sun and each individual region of the zodiac, and thus becomes a part of the zodiac.

Saturn—with its bluish, glowing light—moves even farther out into the depths of the universe. With its rings, it is a most sublime phenomenon among the planets. It takes Saturn about 29½ years

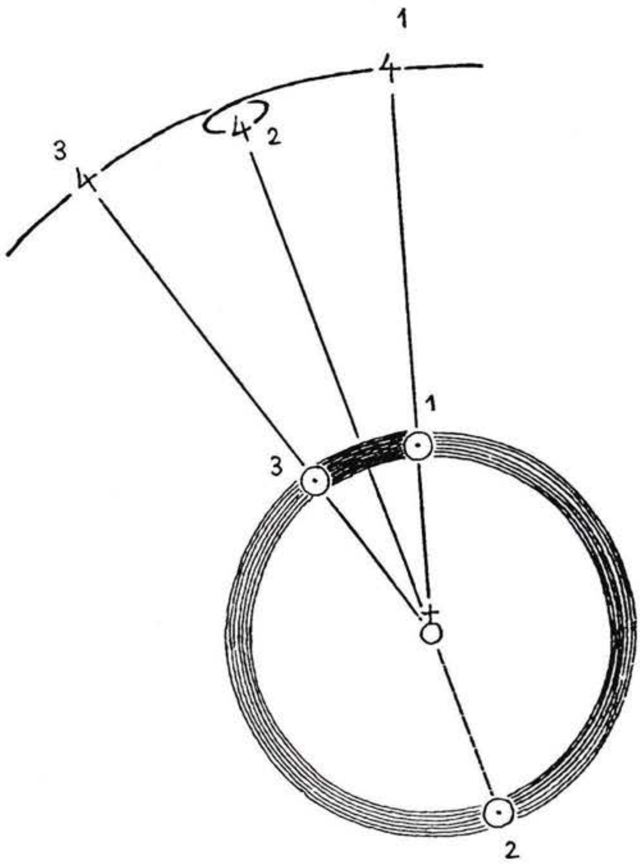


Fig. 15 The synodical cycle of Jupiter encompasses 1 year and 33 days (1 ⟶ 2 ⟶ 3). After a conjunction (1), the sun and Jupiter reach their opposition after a little more than half a year (2). From one conjunction to the next (1 ⟶ 3), Jupiter moves through approximately 1/12 of the zodiac.

(29.46 years) to revolve around the zodiac once. In contrast to Jupiter, it remains in one region of the zodiac for two and a half years. The connection between the sidereal rhythms of Jupiter and Saturn are quite evident. During the period Jupiter takes to move through the zodiac five times (5 x 11.84 = 59.2 years), Saturn completes two revolutions through the zodiac (2 x 29.46 = 58.92 years). The cycles of Saturn and Jupiter have a 2:5 ratio.

Both Jupiter and Saturn have a characteristic link between their sidereal rhythm (relative to the fixed stars) and their synodical rhythm (relative to the moon's movement together with that of the sun). Later in this work, in connection with the further stages of the plant's development, we will elaborate on the conformities shown by Jupiter and Saturn outside the sun's sphere, which inside the sun's sphere are revealed by the moon (*v.* p. *48* and p. *52*).

From the facts discussed above, a view of the planetary world results that corresponds neither to the geocentric view of Ptolemy nor to the heliocentric view of Copernicus and Kepler. It does, however, correspond largely with Tycho Brahe's view. With its geocentric starting point, it is directed toward the following phenomena: the sun, like the moon, revolves around the earth during its movement through the zodiac. At the same time, Tycho Brahe's view of the central position of the sun is expressed: it is the center of the planetary spheres excluding those of earth and moon. Mercury and Venus revolve around the sun at a distance from it smaller than the earth-sun radius.

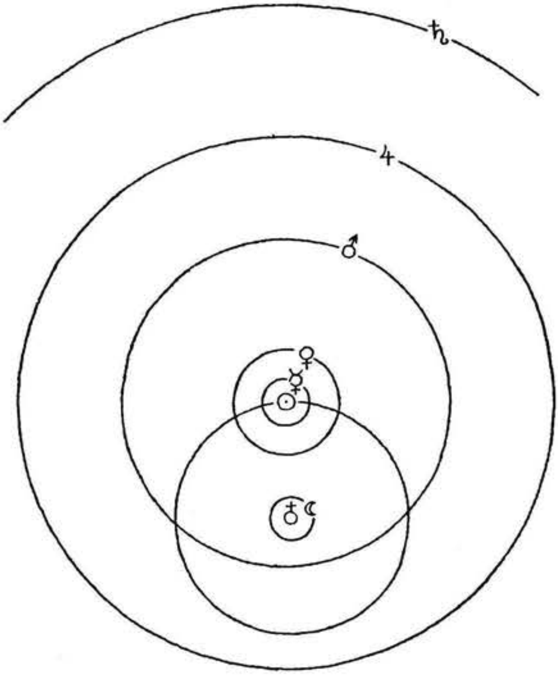


Fig. 16 The order of the planetary system according to Tycho Brahe. The planetary world does not have one center as postulated by Ptolemy (earth) and Copernicus (sun), but two centers: the earth as center of the orbits of the sun and moon and the sun as center of the orbits of the planets.

Their movements, as seen from earth, are closely tied to those of the sun. Mars, Jupiter and Saturn are so far from the sun that their orbits enclose the earth, too. Mars, as the closest of the far planets, only partially encloses the sun's sphere; it merely dips into it for a few months.

We may distinguish between five different spheres:

1. The earth as the center of the moon's sphere and the sun's sphere;
2. The moon's sphere, which mediates between the sun's sphere and the earth;
3. The sun and its sphere as the center of the planetary orbits;
4. Mercury and Venus as planets revolving only around the sun;
5. Mars, Jupiter and Saturn and their spheres, which enclose the sun, Mercury, Venus and the earth.

Tycho Brahe's view of the universe provides the key to understanding the plant kingdom as presented in the following text. The omission of Uranus, Neptune and Pluto will be discussed later. (*v. 52* p.).

7. Fruit and Seed: the Liberation of the Plant from Vegetative Life

The development of the fruit creates new dimensions for the plant. First, the fruit may be distingushed from all previously studied plant organs in that basically it develops above the shoot and the receptacle, beyond the reach of the sun's influence on the plant. In contrast to the previously studied parts of the plant, it is connected to an already existing organ, the ovary. While the leaves, perianth, stamens and ovary develop out of the sun's region in the plant, the fruit, from the very beginning of its development, is focused on regions above the shoot, where its development is also usually initiated by pollination. So, a new viewpoint is necessary to better understand the fruit.

When the fruit is seen as the continued development of the ovary, the consideration of environmentally related causes is indispensable. The development of the fruit is not just a continuation of the growth of the ovary; to a large degree it develops in the opposite direction. The ovary is the result of a process of isolation and contraction; the fruit matures by expanding into space. This expansion has a completely different character from the development of the rest of the plant. Generally, the growth of organs occurs from newly formed cells. During the development of the fruit, new cells are formed, at the most, only during the initial period of development. As a rule, however, the cells already present in the ovary merely expand. The development of the fruit is, to a great extent, a development without cell division.

With many fruits, this expansion takes place rather uniformly in all directions into the surrounding space. This is particularly true of the berries (for example, pumpkin, melon, orange, tomato, grape, deadly nightshade, gooseberry, currant, blueberry and the berries of various liliaceous plants such as truelove, Solomon's seal, lily of the valley, and asparagus), for several fruits of rosaceous plants (for example, apple, peach, cherry, raspberry, blackberry, and strawberry), for the capsules of the poppy, for the fruits of many plants of the *Dianthus* family, etc. Many fruit clusters yield strongly to the entire surrounding space. In the buttercup this gesture is still weak. It becomes stronger in the pasque-flower, herb bennet, clematis and mountain avens. The most beautiful form is reached in the dandelion, the goatsbeard and other liguliflorous plants of the family *Compositae*. It may be found also in the scabious and in the perfectly developed spherical form of the bur-reed and the plane tree.

The fruits, however, may expand in one preferred direction: in width, for example, as in the maple or some umbelliferous and cruciferous plants; or in length, as in other cruciferous plants, numerous papilionaceous plants and, most importantly, in the evening primrose, the willow-herb and cucumbers. The basic fact that the plant during the development of the fruit expands into space is varied accoring to the different directions it takes.

When the influences coming from the closer sun-sphere (the sun, Mercury and Venus) have receded, new forces, which focus growth out towards the surrounding space, appear with pollination. Just as the moon earlier led the influences coming from the sun into isolation and contraction in the ovary, these influences now expand into the entire surrounding space. The development of the fruit finds its corresponding image in that region which encompasses the sun and moon alike and relates the forces from there to the surrounding space. It calls attention to Jupiter. Jupiter is outside the sun's sphere, but with its twelve-year cycle it is closely connected with the sun's course. As discussed earlier *(v.* p. *42*), it establishes a relationship between the annual course of the sun and the rest of the universe. In view of that, it is the counter-image of the moon relative to the sun. While the moon completes twelve synodical revolutions during one sun-cycle, Jupiter moves through nearly one-twelfth of the zodiac.

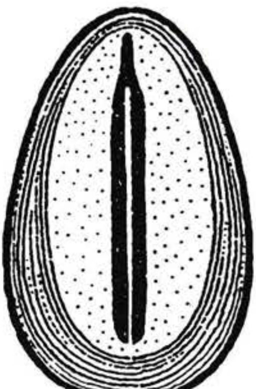
The moon moves within the sun's sphere in such a way that it reflects the sun's light successively from all twelve regions of the zodiac towards earth (*v.* p. *19*), and, as the image of these cosmic relationships, it leads to the development of the ovary in the plant. Correspondingly, Jupiter moves outside the sun's sphere and during one sidereal revolution reflects the light of twelve sun-cycles successively through the twelve regions of the zodiac. As the moon leads the influences of the sun's sphere into isolation (ovary), Jupiter adjusts them in space through expansion.

The image of this cosmic duality appears in the contrast between the development of the ovary and the fruit. When the interplay between the sun/Mercury and the moon has been given form in the ovary, it comes under Jupiter's influence through pollination, by way of Mars' mediation. Jupiter imprints its character upon the ovary, and during the formation of the fruit expands it greatly in all directions into the surrounding space. Since Jupiter with its twelve-year cycle goes far beyond the sun's rhythm, structures develop in the fruit that detach themselves from the life processes of the green plant. They differ from the leaves and green shoots in that their life processes do not have to have continuous stimulation because, during maturation, they go into an indefinite state of rest. Thus the fruit is generally preserved long after the other plant organs have withered. Here the plant achieves its independence from the sun, Mercury and Venus.

The fruit of the plant frees it significantly from the immediate influence of the sun. With pollination—the beginning of the development of the fruit—respiratory processes begin that become stronger until maturation. The developing, particularly the maturing, fruit assimilates more oxygen from the atmosphere than ever before. Processes of oxidation and warmth are stimuated. The shoots, leaves and perianth receive warmth from without; in the development of the fruit, however, the life processes are also permeated by warmth processes from within. They are of great importance for maturation—i.e., the achievement of independence from the other life processes. These internal processes of warmth lead in most plants to a withering and drying out of the fruit. The dry fruit is therefore in no way, as perhaps might be presumed, the result of ordinary withering. In the withering state, e.g. when the leaves wither, the plant sinks below the level of previous life. When the fruit dries up, however, the plant progresses beyond the normal level of plant life because of the warmth processes. The following may be said of maturing fruit on withering plants: here the forces of life that usually strive for external development enter a stage of rest; they progress beyond the level of sprouting and withering plant existence. All sprouting growth must have, as a necessary element of life, moisture, which is repressed by the processes of warmth. A higher stage of life is reached with the achievement of independence and the period of rest in the mature fruit.

Plant growth concludes with the development of the seed. The seeds develop inside the maturing fruit. The processes of drying and warmth that were at work in the fruit also play a big part in the development of the seeds; the seeds contain hardly any water and have dry, hard coats. The plant frees itself from the influences of moisture rising from the ground.

Until the development of the fruit, the plant "unfolds" under various planetary influences. With the development of the seeds, the plant retreats from this process of unfolding. Following fertilization, the embroyo develops in the rudimentary seed form (ovule) that develops from the carpels. This is a condensed plant of the simplest form, with its cotyledons, hypocotyl and radicle. Here, a form that points to the sun and Mercury develops in isolation. Later, after the plant is freed from this isolation, it develops under the direct influence of the sun, Mercury, Venus, etc., into a complete plant. The development of the seed, however, shows a clear manifestation of the moon, which leads the plant development initiated by the sun and Mercury into the isolated space of the seed as the plant embryo.



Inside the seed coat is an embryonic plant. With its hypocotyl, plumules and radicle, it is connected with the sun, Mercury and the moon. However, it is isolated from the universe and the conditions of life on earth. In rare cases it is surrounded by three spheres as it is in the universe by the sun, Mercury and the moon: by the hard seed coat, the perisperm and the endosperm in which the embryo rests.

Fig. 17

The embryo, as the image of the sun and Mercury, is generally imbedded in a certain tissue, the endosperm. The germinating plant derives from the endosperm its substances and energy for the first developmental period. Sometimes the endosperm is also encased in the perisperm, which develops from another part of the rudimentary maternal tissue, The encasement of the seed form, the one- or two-layered integument, becomes the dry seed coat. The embryo is generally enclosed by two, or, in rarer cases (e.g., in the family of water lilies), by three layers. It appears then that the embryo, as the image of the sun-Mercury sphere, is enclosed in additional spheres.

The seeds, as concentrations of the planetary world created by the moon, are dispersed in space in the most varied manner. When they fall to the ground and remain there throughout the winter, important prerequisites for the development of new plants have been created. This may best be understood in a comparison with lower plant species such as mosses and ferns, which form spores and not seeds. As small unicellular structures, the spores do not have an embryo. A so-called prothallus develops, which is quite dissimilar to the mature plant and is totally interwoven in its development with the environmental conditions essential for life, particularly with moisture. The plant form struggles out of this interwovenness only very slowly.

If the plant is to develop in such a way that its form is connected with the universe during all developmental phases, its formative processes must not become subjected quite so strongly to external conditions. Independence is achieved through the formation of seeds. In the seed, an already complete plant form is placed into external conditions. The seedling is initially nourished by substances stored in the endosperm, perisperm and cotyledons, such as the starch in cereal grains, the oil in linseed, poppy seeds, beechnuts, rape seeds and sunflower seeds, or the protein stored in the seeds of leguminous plants. The development of the seed, as a part of the plant's development, makes the plant a self-contained, unified organism. Forces are activated that unify the planetary spheres active in the development of the plant. One is led beyond all previously discussed planetary spheres to the one that contains the others in their entirety—to Saturn, the distant planet, glowing faintly with its majestic rings.

Saturn's sphere forms the approximate boundary of that part of our planetary system that is directly influenced by the sun, just as the seed contains the plant within its boundaries. Astrophysical calculations have established that the gaseous radiations expanding from the sun into the universe reach as far as Saturn. There, the boundary of the sun's sphere is to be found. The earth and the previously discussed planets are contained in this sphere. This incredibly vast space is encircled by Saturn every 29½ years (in the sidereal time of revolution). Saturn takes as many years for its course through the zodiac as the moon takes days for its sidereal revolution. The relationship of Saturn to the yearly course of the sun is equal to the relationship of the moon to the rhythm of one earth day. The moon, as we have seen, forms a sphere of isolation from the sun in the earth's sphere. When these observations are applied to Saturn, we notice this: through Saturn's influence, a sphere of isolation from the universe that is beyond Saturn is created in the 29½ sun-cycles of revolution around the sun. This corresponds to the astrophysical concepts described above. Saturn reveals something in the planetary world that corresponds to the significance of the development of seeds: Saturn encloses in its own cosmic sphere the planetary world of the sun's sphere, as opposed to the universe beyond that sphere, just as the plant through the development of the seed becomes a unified organism as opposed to the sphere of life outside it.

The development of the seed takes place under the influence of the processes of warmth much more so than does the development of the fruit. Many fruits still contain a lot of moisture. The plant is completely removed from the external conditions of life through the drying effect of warmth during the development of the seeds.[27] The development of the seeds is connected with those forces that flow to life on earth from the universe.

8. Germination and the Root: The Plant's Connection with the Earth

The habitat of the plant is, on the one hand, water (or moisture) and earthly, solid (or dissolved) substances, and on the other hand, air (the atmosphere), warmth and light. The air has no boundary to another sphere. Through the air, the earth is totally open to, and connected with, the surrounding cosmic space. From there, warmth and light stream towards the earth. As long as light and warmth are active on earth, it remains a part of the universe. Water, however, already distinguishes itself clearly from its environment through its

27. Plant substance consists mostly of water. Soft leafage contains 80% to 90%, and fresh wood about 50% water. Through the described drying-out process, the content of water in the seeds decreases to 10% to 15%, or in some fat-containing seeds even to 5% to 7%. On the other hand, in the cape lily genus some species have seeds with almost a 90% water content.

surface. Within this isolating boundary, it has its own sphere of existence. The more earthy substances with their solid forms belong even more to the earthly sphere.

Following the development of the seeds, during which the plant is subject to the effects of warmth, a new development begins in connection with the watery, moisture-element and the solid, earth-element: the seed absorbs moisture. It swells and breaks open the seed coat. When the germ is permeated by moisture, the processes of life are awakened. First the radicle emerges; it is subjected to gravity (positive geotropism) and penetrates down into the moist soil. The plant becomes a part of the earth, as it were, through the radicle's growing extremely rapidly and branching out in the soil.

Although the roots of the individual plant species have quite various forms, they cannot be compared in formative processes with the shoot, the leaf and the blossom. With the exception of such root structures as in the carrot, radish, beet, bryony or yellow gentian, which display specific forms, the root primarily resembles an unraveling of fibers into the soil. This is in a way the opposite of form expression.

The formative processes active in the root are thus basically different from all other formative processes in the plant. We may arrive at the correct view only when we do not let the usual concepts mislead us, i.e. that the root may be observed in the same way as the shoot and leaves. The root should not be examined from this point of view. When we walk across a field or pasture we must imagine how the roots are isolated from the light-sphere and develop below the surface in the darkness of the moisture- and earth-sphere. Beginning with germination, they develop below the sphere of sun and light and thus continue their isolation from the world of light and air which was present within the seed.

Growing above ground, the plant appears, as our previous observations have shown, to be an organism whose formation was originated by the sun and the planets connected to the sun. In order for the rhythms of movement and the time-related formative processes of the planetary sphere to be translated into the earthly plant kingdom, they must be transferred and arranged in the moisture- and earth-sphere, which is isolated from the universe. In that way, the cosmic archetypal image finds its earthly reflection. The organ that connects the influence of the sun, Mercury and Venus, etc., with the earthly region is the root. This may be seen in two things: first, the manner in which the root "dissolves" and connects itself with the ground and in which the parts of the plant influenced by the sun, Mercury and

Venus are attached to the top of the root; and second, the way in which these parts of the plant are penetrated by moisture rising from the root and by the dissolved salts derived from earthly, moist existence.

It becomes clear that the root is the direct manifestation of the moon within the plant. In the development of the ovary and the embryo resting within the seed coat, the moon had only an indirect role, leading the forces from beyond its own sphere into isolation. It is not the moon which is found in the ovary and the seed, but the influence of the sun and Mercury modified by the moon. Only when we go beyond the influence of the sun and Mercury does the moon's image become clear. Together with its sphere, that cosmic region which is interwoven with the planetary world located above it *(v.* p. *19*), the moon is still totally centered in the earth in its relationship to the sun and the planets. In exactly the same way, the root relates to the entirety of the plant. In its development, it is directed towards the center of the earth. Above it, however, the shoot, leaves and flowers are related to the root in the same manner as the planetary world is connected with the moon.

Above ground, the plant develops in the sphere dominated by the sun. The root develops by completely turning away from the sun's sphere, as the moon manifests itself most perfectly as a full moon in opposition to the sun. The moon is then located in that sphere of greatest darkness caused by the earth's material form. Just as the moon appears fullest when the sun is blocked out the most, the plant with its root grows in dense matter and darkness.

The relation between root and moon is also evident in the root's form expression, particularly when it is compared to the shoot. Through the leaves, the plant is connected from the shoot to the surrounding space and sun. The moisture streaming upward from the root is distributed very finely within the leaf structure, particularly in the pinnately veined leaves of the dicotyledons *(v.* p. *65*). This centrifugal streaming out into the light-permeated atmosphere originates in the shoot. The vascular bundles, those delicate vessels through which moisture rises, are located in the periphery of the shoot or close to the surface. A cross-section reveals that they are arranged in a circle. A complicated transposition takes place where the shoot goes over into the root. In the root, the vascular bundles are concentrated in the center and are surrounded by a relatively thick cortex. The so-called central cylinder is separated from the cortex by a thin layer of often wood-like tissue (endodermis). The moisture rising in the stem is clearly oriented toward the periphery. Its location in the central cylinder of the root, however, is the effect of a contracted isolation in which the moon expresses itself particularly vividly *(v.* p. *41* and p. *84*).

The secondary roots do not originate, as do the secondary shoots, on the surface of the growing center shoot, but inside the root from the central cylinder. First they must push through the endodermis and the cortex before they are able to reach into the soil.

Many herbaceous plants, particularly the biennials and perennials, develop beyond this simple root growth through secondary development in width. The primary cortex is ruptured and cast off. The root in its entirety originates from the central cylinder—that sphere isolated by the moon within the primary root.

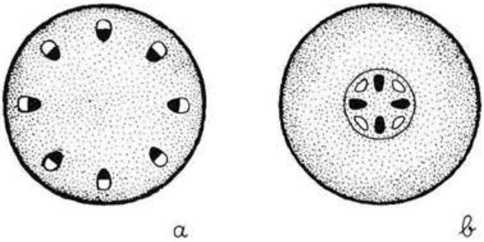


Fig. 18 Cross-sectional model of a young shoot (a) and a young root (b). In the shoot, the vascular bundles are located close to the surface. Its inner sections directed toward the center—comprising the xylem (darker)—are filled with the moisture rising upward from the root. In the peripheral half—the phloem (lighter)—the organic substances produced in the leaves circulate. In the root, the vascular bundles are concentrated tightly in the center cylinder and cut off from the surrounding space by the tissues of the cortex. Initially, the xylem and phloem develop as two separate strands next to each other.

9. Summary: The Plant as an Organism

The flowering plant displays in its form the interplay of the planetary world surrounding the earth (including the distant Saturn), with the sun as its center and the moon as its lower boundary. The following relationships are to be considered in detail:

The seed, including the germ, endosperm and perisperm, as a prerequisite for a self-contained plant form	Saturn
Seed development	Image of the isolation of the the sun's and Mercury's effect by the moon

Fruit development	Image of Jupiter oriented towards the zodiac
Ovary	Image of Mercury's effect isolated by the moon
Stamens and Pollination	Image of Mars
Perianth	Image of Venus moving out into the periphery of the sun's sphere
Leaves	Image of the movement of Mercury closely tied to the sun
Center shoot	Image of the sun and its movement
Root	Image of the moon

The sun and moon together with the so-called near planets (Mercury and Venus) and the far planets (Mars, Jupiter and Saturn) compose that factual relationship which is the source of the archetypal plant—or which is the archetypal plant itself. The plant patterns the stages of its metamorphosis on the sequence in which the planetary spheres arrange themselves around the earth. First the moon with its swift rhythm brings its influence to bear. Then Mercury, the sun, etc., on up to Jupiter and Saturn, follow with their increasingly longer rhythms.

As the plants with their rhythmical, interrelated movements are interwoven into one unit, the planetary system, the individual plant organs are also interrelated within the plant. The organs have a certain spatial and chronological sequence. Life processes and formative processes influence each other, and thus unite into one organism.

The growth of the stem is a prerequisite of leaf expansion into the light-flooded atmosphere, where the leaves exercise their most important function—assimilation. In this respect, the leaves owe their existence to the stem. The stem, however, exists only through the leaves. Its development depends on a stream of life-sustaining elements from the leaves, which is the basis of all organic development in the plant. Thus the leaves depend on the stem and the stem depends on the leaves, as in the planetary sphere Mercury is unthinkable without the sun, and the rhythms of the sun and Mercury are coordinated with each other.

The life processes in the leaves can be understood only in conjunction with the influence of the root. The water absorbed by the root from the soil rises through the stem into the leaves and there becomes an important part of all substance-forming processes. Just as the upward-rising water makes the life of the leaves possible, the roots can survive only through the life-sustaining substance formed by the sunlight in the leaves, which flows down to the roots. This relationship corresponds to the relationship between the synodical rhythm of the moon and that of Mercury. The root and leaf regions are organically interwoven, and the shoot is also involved in this relationship. The quantity of substance formed by the leaves is related to the growth of the entire green plant and the root, just as the amount of water absorbed by the root (and the salts dissolved in it) is related to all the life processes.

We must develop a way of thinking that does not search only for causes and effects. This kind of linear thinking misses the most essential facts which concern living things. *A fact must be seen both as cause and effect in the sense that it is the effect of what it causes.* Common thinking patterns tend to look for the cause outside of the manifested effect. As a result, comprehension is complicated by an ever-increasing interrelationship of facts. If we learn, however (as we must to observe plant development and the rhythmical interwovenness of the planetary system), to understand that the cause is simultaneously the effect, thinking becomes an organism of interrelated ideas acting upon each other.[28]

We may extend these observations to the developing plant. The sepals and petals of the corolla have been metamorphosed from the green leaves: the calyx and the corolla are an effect of a previous stage of development. The leaves preceding the blossom—particularly those of the dicotyledons—become increasingly simple in contrast to the lower leaves. In this much-described metamorphosis, the so-called upper leaves already indicate the blossom. The calyx and the corolla,

28. Correlations are generally interpreted from a cybernetic point of view, nowadays. One applies the regulatory processes in the field of technology and transfers the concepts valid there (feedback control system, measuring gauge, control medium, etc.) to the phenomena of life. The correlations system in technology is the expression of the corresponding thought-forms in apparatuses and circuits. There are correlations on different levels. The area of life is on a higher level than technology. When we apply concepts valid for the technological level as a model for the higher levels, essential differences are covered up: most importantly the fact that the necessary regulations cannot be subjected to fixed structures or systems. When in a plant the life processes occur in certain correlations in the leaves, shoot, and roots, then those affect the life processes and the processes of form expression, too. What becomes material structure through the human thought-forms expressed in technology is a spiritual, order-creating principle in the area of life which does not result in frozen forms.

which are a further development of the shoot and its green leaves, determine the processes of metamorphosis in the uppermost region of the stem. Further discussion will reveal that the form of the green leaves is, in part, influenced by the petals which are to follow *(v. p. 64 ff.)*. Furthermore, the substance-forming processes of the leaves govern the entire flower development.

From another point of view, the blossom appears as the most perfect expression of the forces active in the shoot. In the shoot, the plant reaches out from its inner relationship toward the sun but is continuously being solidified by earth forces. In the blossom, these forces recede, and thus the reaching towards the light is increased to a gesture of yielding to the light. This intensification of forces already active in the development of the shoot frequently influences the section of the shoot below the blossom, or below the inflorescences. In many plants, this so-called base internode lengthens greatly and carries the blossoms upward toward the light.

The root also interrelates with the shoot, leaves and perianth. As the moon's rhythm is less important to Venus than to Mercury, so the stream of fluid rising from the roots recedes in the perianth. In the leaves, water remains an essential basis for the process of assimilation and other life processes. In the perianth, particularly in the colorful corollas, the plant transcends the substance-forming processes. Water maintains the sepals, the petals of the corolla, and through turgor, the overall plant form.

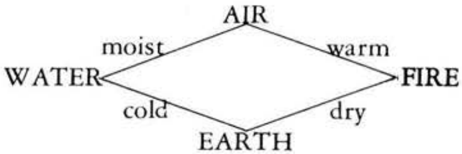
The organs within the blossom—the stamens and the ovary—and the fruit and seeds relate to the plant in a way different from that of the root, stem, leaves and perianth. Through the latter organs, each plant develops as an individual expression of the species. Fruit and seed development and pollination elevate the plant above the limitations of the individual plant form. Externally, this striving occurs with pollination—functionally, in the development of the fruits and seeds. In the final and highest stages of its development, the plant, by means of warmth, increasingly frees itself from the influences that rise upward from the root. All substances that go over to these more advanced regions of plant development must undergo drastic transformations in order to transcend the individual plant, just as the far planets surround the near planets. The green plant-form requires moisture as it progresses from the blossom to the fruit and seed stage. In this way, the plant's entire life span is founded on the relationship between formations originated by the moon, Mercury, Venus and the sun, and those which relate to Mars, Jupiter and Saturn.

10. The Connection between Form Expression and the Processes of Life

The formative processes of the plant, which reflect the movements and the rhythms of the planetary world, are connected with certain life processes. Life in the growing-point must be permeated by warmth much more intensely when the plant moves from a germinating stage (shoot and leaves) to the higher form development originating with the corolla.[29]

The processes of life must be distinguished from the substances occurring through them. Physiological chemistry analyzes the material composition of these substances and their derivations. Plant physiology approaches life processes in terms of how moisture, dryness, heat, cold, light, darkness, etc., influence growth and organ development.

Life itself, however, is a realm which, although it is active on a material plane, is not of intrinsically material character. We may become familiar with this realm only by transcending our sense perceptions, which are dependent upon material manifestation. Aristotle discusses this in the fourth book of his *Meteorology,* and in the second book of his writings, *On Coming to Be and Passing Away,* which concerns the four elements. Aristotle presents the thesis that we must first study the four qualities: warm, cold, moist, and dry. Warm and cold are "active," initiating all creation and development; moist and dry are "passive" to the influences of warm and cold. The four elements originate from the following interaction of these qualities:



First we must understand the mode of perception underlying this system. The concept of water proceeds from the quality of moistness. Moistness, according to Aristotle, is "that which, without forming itself, easily adopts any form" *(On Coming to Be and Passing Away,* Book II). One can imagine moistness as, for example, a delicate, undefined, dissolving fog. When the contracting forces of coldness become active in this moistness, it becomes denser. The fog thickens,

29. Biennial herbaceous plants, various perennial herbaceous plants, and trees blossom only when they have been exposed to several weeks of cold during the winter, particularly with temperatures between 3° and 5° C. The coldness, with its contracting effect, has a form-giving force. Through the coldness, the future form-giving process that leads to the blossom stage is stimulated in the respective plants. The blossoms develop sometime after the influence by the cold, after the form-giving tendency caused by the coldness has passed.

forming a cloud, and the contraction produces rain water for lakes, rivers and oceans. We can recreate in our thoughts the origin of the element, water. In "water," moistness is always active with its mobility and changeability of form, but its consistency is denser. At the same time, coldness acts to condense the indeterminately expanding moisture until it forms a surface, that is, until it is isolated from the surrounding space. We experience in the water element the interaction of moistness and coldness, not with our sense perception but with an idealistic perception of great vitality.

Moistness permeated by warmth forms the air element. Anything dense in the moistness dissolves, resulting in greater lightness, expansion and mobility. That which is voluminous and flexible in moistness is found in the air element. The expansiveness of warmth overpowers all density and heaviness.

We must differentiate between elements and substances: the substance water may be perceived like any other object; the element water is an interaction of qualities, comprehensible only on a spiritual plane. When we study the elements, we enter into a living process; with substances we are confronted with objects.

Through these ideal perceptions of the elements, we can penetrate the life processes of the plants. All germinating growth originates when moistness becomes particularly active in the plant, causing a vital formability and changeability. The life forces of moistness are shaped into a narrow form in the sprouting shoot. The contracting force of coldness manifests itself in this narrow growth process. The upward-stretching growth process turns to firmer, drier, substance-forming processes in various ways in different plant species. Other elements also become active here *(v. note, 38)*. Primarily, however, moistness and coldness are fundamental during the contracted upward-stretching development. We must thus consider coldness as an active force within the realm of life.

The stems of herbaceous plants are continuously perfused by moistness rising from the root. (It is better to speak of moistness than of water, since water rises as moisture in the delicate capillaries of the plant.) The moisture is distributed throughout the leaf surfaces. In contrast to the stem, the leaf blade is loose and expanded; warmth leads the moist-cold element from the narrow shoot to the expanded form of the leaf.

Though narrow leaves emerge directly from the shoot of many monocotyledons *(v. p. 28 and p. 64)*, the moist-cold quality still determines their character. The leaves are often permeated by moist mucus. Warmth has a greater influence on the more pronouncedly widened or evenly divided leaves of the dicotyledons *(v. p. 65)*. Not only do the leaves have a more detailed form, they are also less moist. The moist-cold quality is transformed, to a greater or lesser degree, into a moist-warm quality. The element water is influenced by the element air.

Many herbaceous plants form their first leaves in the moist-coldness; therefore, their forms are undivided and simple. As the plant rises with each new leaf higher above the ground into the surrounding space, the moist-warm quality gains in importance. The leaves expand, and their blades dissolve into finger or fan forms. The moist-coldness diminishes, and, with it, vegetative growth. The leaves become drier and smaller. As the flower develops, vegetative growth slows down. The moist-warm quality is active where the plant forms its corolla: the petals have a delicate consistency; their tissue is loose and airy; their form expands tremendously to express the warm quality active in the moistness *(v. Fig. 10 and Fig. 19)*.

The form of the leaves and their metamorphosis indicate whether the watery or the airy element predominates. This influence of the elements on the formative processes continues during the following stages. The fiery element combines warmth with dryness into a desiccating force. It consumes the moistness in the plant and inhibits growth and development. This is especially evident when the stamens are studied as metamorphosed petals. Planar expansion is completely inhibited in the filaments. In the anthers, the tissue dissolves into pollen through this desiccation.

The plant progresses from its unfolding, through the fiery element, to pollination. The processes of life in the ovary reach their highest stage through the fiery element (see the chapter "Seed and Fruit"). They are freed from their dependence on external nature. They reach a stage of maturity where the growth process changes to rest and permanence. The individual plant transcends itself. The species forms, with its dry, desiccated seeds, the germ for the next plant generation, by means of the fiery element.

The fiery element permeates the entire plant with its influence. The shoots, leaves, needles, thorns, etc., have, while they are being formed, a soft and delicate consistency. During the early stage of development, the watery element predominates in the life processes. It activates the formability of life and is prerequisite for the formative processes. In this delicate, flexible condition, the plant organs are rather vulnerable; cold, heat, dryness, etc., are much more damaging at this stage than at any other. As the plant organs mature, they become drier and harder. During this maturation process, the fiery element works through its desiccating, condensing influence. Thus the development of the plant begins in the watery element, but it reaches its fully matured form through the fiery element. The "maturing" of the form varies according to the individual plant. Different herbaceous plants in the same location may maintain the moist-watery condition, or they may go over to the warm-dry condition. The change to a dense, permanent condition through the fiery element is partially accomplished by the development of cellulose in the tissues of the cell walls *(v. note, 38).*

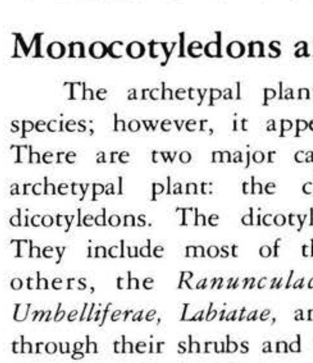
The earthly element works in the region of the root. The roots are organs of intense growing force, particularly during the first weeks when they penetrate the ground. In the intensively growing tips of the roots, the moist-cold quality is so strong that the tissue in the root cap becomes mucilaginous. But only a few millimeters from the tip of the root, growth comes to a complete halt. (The above-ground shoots, on the other hand, often continue to grow several centimeters below the tip of the shoot, because of the watery element.) The moist-cold quality in the root is active only in the tip. It solidifies (i.e., becomes dry and cold) extraordinarily rapidly. The contracting form of coldness manifests itself in the narrow form of the root. During the solidifying process, it takes on a dense dryness. Only the storage roots of the carrot, parsnip, radish, sugar beet, etc., preserve moistness and expand tremendously through its vitality.)

We gain genuine insight into the development of plants when we: (1) see the image of the planetary cosmos in the formative process; (2) follow how the laws of formation derived from the universe express themselves in the activities of the four elements; (3) recognize the effect of the four elements on the substances of the plant organism. (In this book, only one example has been further elaborated on—see note, 38).

Polarity in Plant Growth Through Predominant Moon/Mercury- and Venus-Character

Monocotyledons and Dicotyledons

The archetypal plant does not appear completely in any plant species; however, it appears in specific, one-sided form expressions. There are two major categories of specific form expression of the archetypal plant: the class of monocotyledons and the class of dicotyledons. The dicotyledons are considerably more differentiated. They include most of the families of the flowering plants: among others, the *Ranunculaceae, Rosaceae, Cruciferae, Leguminosae, Umbelliferae, Labiatae,* and *Compositae*. In addition, the dicotyledons, through their shrubs and trees, have much more varied forms than the monocotyledons. These are predominantly herbaceous plants, as, for example, the lilies, narcissus, irises, sedges, grasses and orchids. Only the palm tree and some aloe and palm lily species are tree forms.



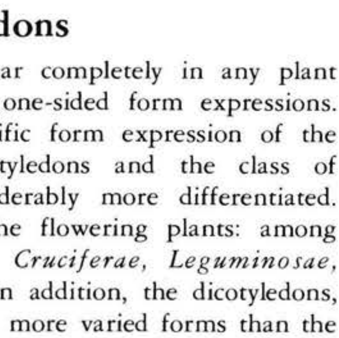


Fig. 19 Corolla of a monocotyledon (tulip) and of a dicotyledon (rose) as seen from above.

This differentiation of the flowering plants into two main groups is particularly obvious in the blossoms. As was discussed earlier (*v. p. 36*), the perianth, as a pure image of Venus, expands much more in the dicotyledons than in the monocotyledons, and the individual petals also expand visibly from their rather narrow floral tube into the surrounding space. In the monocotyledons, they remain quite narrow, even in such magificent flowers as the lilies and gladiolas.

This varying relationship to the surrounding space also governs the development of the leaves. The leaves of monocotyledons, with their parallel venation, are very much self-contained. Generally, they expand very little in width and commonly emerge directly from the shoot as the leaf blade. The vascular bundles of the shoots go over directly into the veins of the leaves, showing us the close connection between the shoot and the leaf through their anatomical structure.

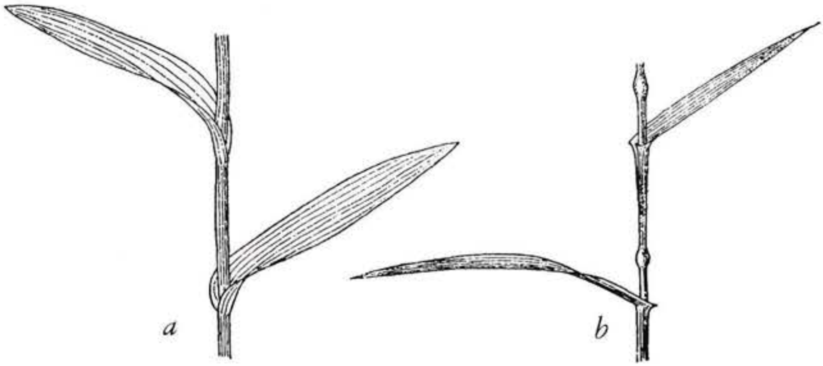


Fig. 20 The parallel-veined, simple leaf-blades of the monocotyledons generally originate directly from the shoot (a); in the grasses (b) they even partially envelop the shoot.

Most importantly, however, they also show the direct connection between the leaves and the roots, from which water rises in the vascular bundles. Here everything reflects Mercury and its close interwovenness with the sun. At the same time, the close relationship between Mercury and the moon may be observed in the direct connection of the roots and the leaves.

The rudimentary leaf forms of the flowering plant are divided during the early stages of their development into the so-called lower leaf and upper leaf. In the monocotyledons, this division is of no importance for the later form of the leaf. The mature leaves of, for example, the tulips, lilies, orchids, irises, daffodils or sedges are simple and undivided. In the grasses, however, the leaf base develops into the leaf sheath, which envelops the stem. The apical portion of the leaf

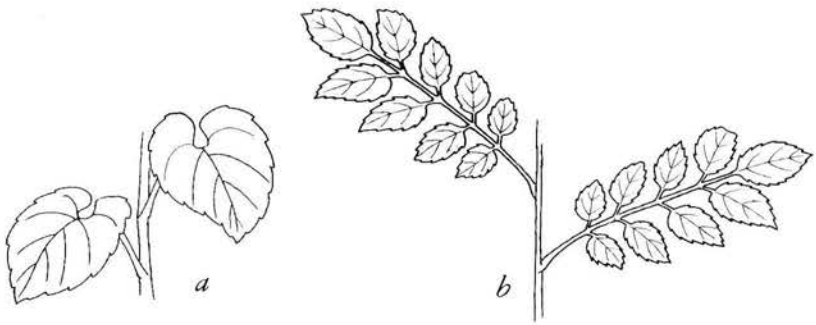


Fig. 21 In dicotyledons, the leaves are often separated from the shoot by means of a petiole, and then unfold pinnately-veined (a) or pinnately-compound (b) leaves into the light and air sphere.

becomes the leaf blade by separating from the stem. In the dicotyledons, this division is of greater importance. The leaf base with its stipules often originates in the lower leaf. The upper leaf develops into the leaf blade and into an organ that is missing in most monocotyledons: the petiole (leaf-stem). The petiole carries the blade out into the space surrounding the shoot, where it expands from the center vein of the leaf in both directions through its pinnately veined structure. Naturally, there are also cases of simpler leaves among the dicotyledons. In contrast to the characteristic leaf-form of the monocotyledons, the leaf-form of dicotyledons expresses Venus' gesture: the movement farther away from the sun in the development of the petiole and the stronger relationship to the periphery of the sun's sphere in the pinnately veined structure of the leaf blade.

The position of the leaves on the shoot also reveals extensively the cosmic connections in movement between the sun and Venus. The two-fifths leaf position is predominant in dicotyledons. Each successive leaf digresses in its position from the previous one by two-fifths of the shoot's circumference, that is, 144°. The development of the leaves then follows a spiral in which each sixth leaf is positioned above the first. This conformity also expresses itself in the corolla. It is the reflection of the synodical movement of Venus *(v. p.34 ff.)* and is expressed in the two-fifths position of the leaves, even down in the region of the shoot. The development of the leaf, according to its type, is determined by Mercury, but in many dicotyledons it is further influenced by Venus.

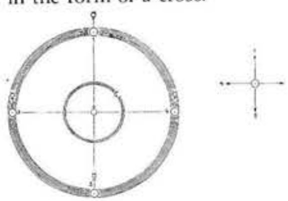
Much rarer is the three-eighths position of the leaves, which is found mostly in the family of the crucifers but also in aconite, hawkweed and snapdragon. The most perfect visual example may be seen in the leaf rosettes of the hoary plantain. Venus is also expressed in the three-eighths position of the leaves, though not with its synodical but with its sidereal rhythm *(v. p. 24)*. Here the development of the leaves is related to purely cosmic conditions. During the 225 days that Venus takes to orbit around the sun, the sun continues to move through roughly five-eighths of the entire zodiac.[30] Seen from earth, Venus

30. After closer observation of the rhythms, the following conditions appear: (a) 5 revolutions of the sun through the zodiac: 5x365.26=1826.30 days. (b) 8 revolutions of Venus around the sun: 8x224.70=1797.60 days.

The difference of 28.7 days means that the moon with its rhythms mediates between the sidereal rhythm of Venus and the yearly course of the sun. Aside from this difference, we may see the positions relative to the sun resulting from Venus' sidereal rhythm in its reflection on earth as a cosmic three-eighths position. As Venus changes its position with the sun during its sidereal revolutions according to this law, so the leaves and petals develop on the shoot according to this cosmic order.

The sidereal rhythm of Mercury plays an important part in the understanding of the leaf positions. During 88 days on one sidereal Mercury-revolution, the sun traverses almost one-fourth of the zodiac. Approximately four sidereal cycles of Mercury cover one year (4x88=352 days). The sun's positions, determined by this Mercury rhythm, depict a square. Mercury's positioning with the sun forms a cross from the four corners of the square.

When we imagine that this order, resulting during the course of the year, appears as a reflection within the plant during one moment, then we see how four leaves develop from the shoot in the form of a cross.



Connection between the sun's movement and the sidereal cycle of Mercury.
As seen from earth, Mercury—during the course of four sidereal revolutions—positions itself within the sun as depicted on the right. During (1) it is behind the sun, during (2) at its greatest western elongation (in the morning sky), during (3) in front of the sun, during (4) at its greatest eastern elongation (in the evening sky).

The blossoms of the crucifers, the evening primroses, the plantains, and various species of other plant families (e.g. the lady's mantle, the cinquefoil, the bedstraw) are an expression of that. In the poisonous truelove, the four leaves are even arranged in the form of a cross on the flowering shoots.

The crucifers seem to be a plant type particularly closely connected with the sun with regard to the leaf positions. The leaves on the shoot, and the perianth (calyx and corolla), express in their form the sidereal rhythms of Venus (leaves) and Mercury (perianth).

Schultz, in his essay on "Die Blattstellungen . . . ." (*v. note* 6), brings the three-eighths position in relationship to Mars. He points out, however, that the connection (also that between Jupiter and the five-thirteenth position, and Saturn and the eight-twentyfirst position) can hardly be illustrated. He is obviously thinking of the sidereal Mars rhythm, which with its 687-day average is 43 days shorter than two years (730 days). These 43 days are a little less than one-eighth of a year (45.6 days). Disregarding this difference, we may arrive at a one-eighth position, but not at the three-eighths position.

changes its relative position to the sun by about three-eighths of the sun's circumference, during the course of one such sidereal cycle. The cosmic rhythm through which Venus, relative to the sun, always maintains its identical orientation towards the sphere of the fixed stars appears to us on earth, by reason of the sun's movement, as a change of position by three-eighths. When we observe how the plant with its shoot

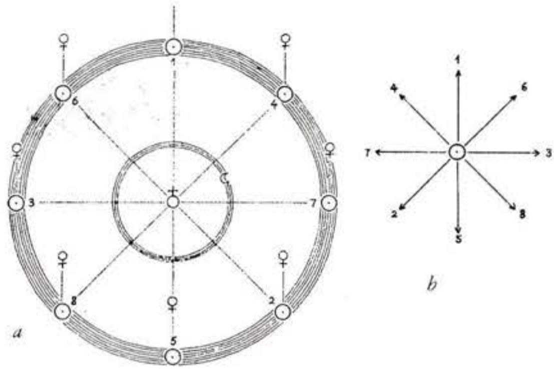


Fig. 22 While Venus revolves around the sun once, the sun orbits through roughly five-eighths of the zodiac ($1 \longrightarrow 2, 2 \longrightarrow 3$, etc.). In five years, eight positions of the sun result from the sidereal cycle of Venus, approximately marking the corners of an octagon (a). A study of how Venus, as seen from earth, is positioned in these eight places in relation to the sun results in the diagram of directions (b): at (1) Venus is behind the sun, at (2) the evening star is approaching earth, at (3) as the morning star, it reaches the point of greatest western elongation from the sun, etc.

is oriented from the ground toward the sun and how the growing tip represents the impression of the sun in the plant, this conformity of the sidereal Venus movement appears as the leaf organs developing in the three-eighths position. This manifestation of the sidereal rhythm is particularly evident in the celandine, the mountain avens and the rather rare yellow wort *(Blackstonia perfoliata).*

Mercury's gesture in the monocotyledons is quite similar not only in the form of the leaves but also in their position on the shoot. The one-third position characteristic of the blossoms determines the position of the leaves in the large family of the sedges and in the white hellebore. Much more frequent is the one-half position; its connection with the Mercury-sun movement has been discussed earlier *(v. p. 29).* The dominant cosmic principle in the monocotyledons is Mercury; in the dicotyledons, it is Venus.

The inflorescences reveal these varied relationships to the universe in a particularly striking manner. Unless the monocotyledons form only one blossom (as in the case of the snowdrop, the daffodil, various types of narcissus, the tulip and the truelove), the blossoms are usually clustered around the center shoot. The most important inflorescences are the raceme, spike and simple umbel. The blossoms and, in the grasses, the narrow inflorescences, emerge with their usually short stems directly from the center shoot. The blossoms of the iris and the gladiolus are also situated close to the central axis.

Generally, inflorescences in the dicotyledons expand much more widely than in the monocotyledons, although there are also tightly compressed inflorescences, as, for example, in the plantain, the mullein, the foxglove, the rampion and the entire family of the crucifers. Characteristic are the panicles, of which the buttercup and the rose are good examples. The complex umbels of the *Umbelliferae* and the umbellate

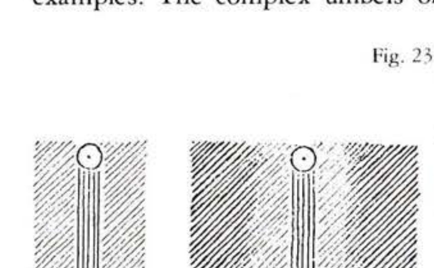


Fig. 23 Diagram of the ascending path of the sun with the surrounding Mercury sphere (a) and the Mercury-Venus sphere (b). In the monocotyledons, the leaf blades and the individual blossoms usually emerge directly from the shoot. This corresponds to the relationship of Mercury to the sun (a). In dicotyledons, the leaf blades are usually carried out into the space surrounding the shoot by means of petioles. They are located in a sphere that is separated from the shoot by an intermediary region. In the inflorescences, the blossoms stretch out far into the space surrounding the shoot. The relationship of the leaves and blossoms to the shoot corresponds to the relation between Venus and the sun shown in the above diagram (b).

panicles of the elder and the snowball are particularly strong in their development and expansion in width and height. In the dichasia of various *Caryophyllaceae,* the blooms inch their way upward into space. The flower can ultimately reach far into the atmosphere in the complex synflorescences.[31] Even where the blossoms are clustered around the center shoot, they are arranged in more or less richly structured inflorescences, as in the labiate plants *(v. Fig. 11).*

On the spikes and racemes of monocotyledons, the blossoms frequently turn sideways and arrange themselves on the upward-striving shoot. As Mercury follows the sun's path and always remains close to the sun, so here the flowering is limited to a close sphere around the center shoot. In the further-developed inflorescences of the dicotyledons,

31. The details can be found in the work by W. Troll, *Die Infloreszenzen,* vol. 1 (Stuttgart: 1964); vol. 2, Part 1 (Stuttgart, Portland: 1969).

the flowering, influenced by Venus, goes beyond the vicinity of the center shoot.

The form expressions below ground are also quite differentiated. Only the dicotyledons and the embryo plants of the monocotyledons form their roots in the manner described previously *(v. p. 53 ff.)*. The primary root of the monocotyledons dies shortly after germination; it does not continue to develop into an independent root system. Instead,

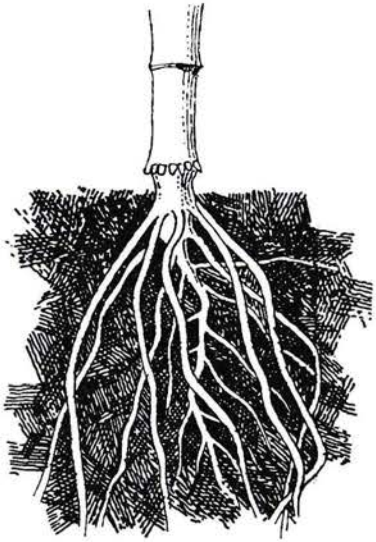


Fig. 24 On monocotyledons, the roots grow out of the shoot, as in the corn plant. Root formation is connected with the shoot. This is also true of leaf formation. The various functions are not yet differentiated into individual organs as in the dicotyledons.

roots (secondary homorrhizia) emerge from the lower section of the shoot, usually directly above the first nodes. The lunar-influenced root development does not achieve complete independence; it enters into a close relationship with the shoot, which is thus strongly affected by the moon's influence. This interdependence of shoot and root is also present in a rudimentary form in the dicotyledons. Even when the root is attached as an individual organ to the shoot, roots may develop on the shoot under certain conditions. This ability to develop roots recedes in the upper sections of the shoot; it comes to a full halt only in the region of the inflorescences, that is, where the plant finally frees itself from influences rising from the ground. The more intense interdependence in the development of the roots and the shoot, and the greater dependency of the entire plant on the forces emanating from the moon, are the causes of many peculiarities in the monocotyledons. One characteristic formation of the monocotyledons is the bulb; among the dicotyledons it is found only as a rather insignificant bulb in the bleeding heart (a plant of the poppy family) and in the cuckoo sorrel. In the layered bulbs of the snowdrop, the daffodil, the tulip, the gladiolus, etc., colorless scale leaves develop from the short, stout shoot and are joined together in a bud. In the middle, several small, pale buds usually develop. Such a bulb in its entirety is an intensely swollen bud that lives and roots in the darkness of the ground. In the scaly bulbs of the lily, this bud is not quite so closed in itself. The shoot and the leaves, which should unfold from their relationship with the sun and Mercury in a light-and warmth-filled atmosphere, are tightly contracted and totally isolated. As in the ovary, the formations influenced by the sun and Mercury are led into isolation from the

Fig. 25 Layered bulb of a tulip (a) with the undeveloped flowering shoot and the two rudimentary new bulbs (after Lorenzen, revised); scaly bulb (b) of the Turk's-cap lily.

universe by the moon. Thus, in the darkness of the ground, the bulb is created from the plant-being. The development of the bulb is an intensification of those conditions present in the shoot-related rooting process of the monocotyledons. The moon's influence, initially interwoven only in the development of the shoot, reaches into the normal development of the shoot and leaf to such a degree that it is drawn down into isolation from the sphere of light and air.[32]

The rhizomes of the monocotyledons are a further transformation of the shoots. The shoots of various grasses, the iris, the lily of the valley, the Solomon's seal, asparagus, truelove and other monocotyledons grow horizontally below the surface of the soil. Only the blooming shoots reach up into the light. In the darkness, the leaves become pale scales. Roots develop extensively on the underground

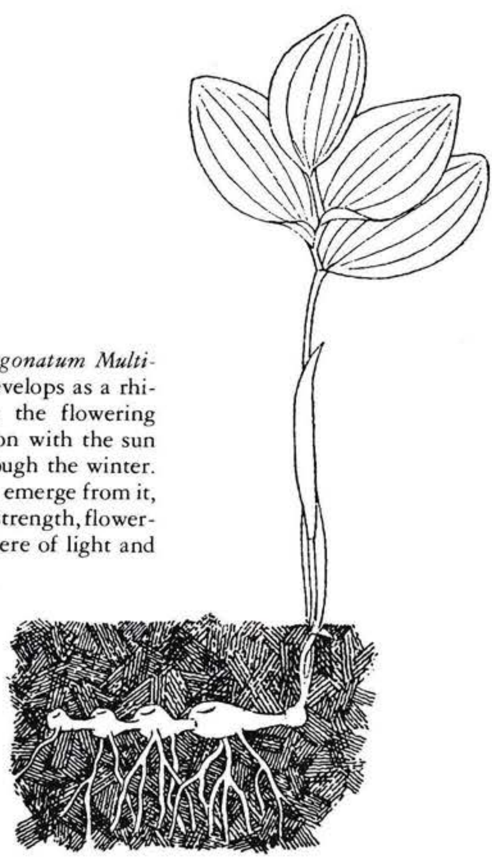


Fig. 26 In the Solomon's seal *(Polygonatum Multiflorum)* the center shoot develops as a rhizome particularly early in the flowering plants. It loses its connection with the sun and, like the root, lasts through the winter. Each year shoots with leaves emerge from it, and after years of gathering strength, flowering shoots rise into the sphere of light and air.

nodes and interact with the moist soil. The plant is to a large degree under the influence of root development. Whereas in most plants, the roots originate only in the lower section of the shoot and connect the upward-reaching shoot with the ground, the root development process

32. G. Grohmann in the 2nd edition of his work, *The Plant*, has dedicated a detailed chapter to the bulbous plants. He there reaches an explanation that in all essential points is the opposite of that described in this work. Grohmann writes that the bulb, through its obstructed shoot and the tightly pushed-together layers or scales, is similar to a blossom. This then would have to be true of all buds; the bulb is a swollen bud. The buds, however, and especially the mucus-filled bulbs, cut off from the sun, are the greatest possible opposite to a blossom. Grohmann indirectly points to this by writing that "the bulb is a watery organ."

Furthermore, Grohmann points to the relationship between the simple, parallel-veined leaves and the form of the petals in bulbous plants. From here, Grohmann reaches the conclusion that the bulbous plant in its entirety, naturally including the leaves, is blossom-like. A careful characterization should initially come up with a particularly close connection between the region of the leaves and blossoms. We gain a more complete view when we compare the calyxes of the dicotyledons to the still green petals of the bulbous plants. Most importantly, the petals of their corollas show a higher degree of blossom-like development than do those of the bulbous plants. Thus the bulbous plants are not more cosmic, in Grohmann's terminology, but more earthly than the dicotyledons.

in these plants permeates the entire shoot. The moon's influence overpowers those regions which would otherwise be dominated by the sun's influence. In this matter, the shoot comes to life underground, where usually only the roots have their existence.

In comparison with the bulbous plants, the rhizomatous plants are less influenced by the power of the moon; the shoot is much less restrained. It nevertheless develops even if its form is determined by the moon. Thus it is interesting that there are almost no bulbous plants among the dicotyledons, but there are rhizomatous plants. The latter are particularly characteristic of spring, when the developing plant rises above ground; then, for example, the coltsfoot and the white and yellow wood anemones come to flower.

The following view results from the above: in the monocotyledons, the interplay of those forces that constitute the archetypal plant is modified by the increased influence of the moon and Mercury. Form expression in the region of the shoot and leaves is rather harmonious. From below, however, the influences from the moon penetrate with their shoot-related rooting process. It appears that the region of the shoot and leaves is drawn too deeply into the sphere of water and earth. The region of the blossom is also still connected to Mercury's influence. The plant in its entire development does not elevate itself fully above the moon-sphere to the sun-sphere, and from Mercury's sphere to Venus' sphere. It is therefore under the predominant influence of those cosmic regions that with their rapid succession of rhythmical processes are completely incorporated into the yearly course of the sun. Now it becomes more understandable that almost all monocotyledons are herbaceous plants, that is, plants that are subject to the yearly cycles. As the development of the shoot and the leaves is closely interwoven with the development of the root, Mercury and the moon are closely connected out in the universe.

In the dicotyledons, the above-ground part of the plant is freed from an excessive lunar influence through its independent root system. The development of the shoot and leaves is permeated by forces that are already related to the development of the flowers. The dicotyledons are oriented towards the outer regions of the universe by the forces from Venus, as the monocotyledons are oriented towards the earth through the moon. The synodical rhythm of Venus, which reaches beyond the yearly course of the sun, helps to explain how many dicotyledons appear as perennial herbaceous plants, shrubs or trees, because they are no longer subject only to the sun's annual cycle. The following chapter is concerned with the plant's form-expression in these various modes of growth.

The Differentiation of the Flowering Plant into Various Growth Patterns

Further insight into the differentiation of the plant into various types of form is gained through observing the growth patterns. In his book *Metamorphose* (Metamorphosis), Julius dedicated several important chapters to the growth patterns and pointed out the inner relationship of the plant form to the planetary movements. For Julius, growth patterns result from a differentiated interplay of the vertical and spiral tendencies, both of which were discovered by Goethe as fundamental principles of plant growth. The classification of the flowering plants into so-called forms of life, according to Raunkiger, is oriented mostly by the location of those organs that aid the plant's survival during adverse times of the year (winter, drought periods) relative to the ground. The following takes as a starting point the development and formation of plants according to the various rhythms.

1. Annual Herbaceous Plants

All previous studies of the herbaceous plants have been of a general nature; now we will differentiate between annuals, biennials and perennials. The annual herbaceous plants are the most easily understood. They undergo their entire development—from germination, through the development of the shoot with its leaves and blossoms, up to the fruit and seed stage—during one year. As the seeds mature, the plant dies.

As the sun ascends, the plant unfolds during the first half of the year. In our region, it usually flowers during June and July.[33] When the sun's influence recedes during the second half of the year, life gradually seeps out of the organs, while the plant provides for a new cycle of development in the seeds. In contrast to the perennials, which already form their rudimentary provision for shoots and leaves in their buds during late summer and fall (in part even for the blossoms of the coming year), the annuals develop their organs out of the direct coexistence of the plant and the sun. The first leaves of such a plant

33. This refers to the median time of flowering for monocotyledons native to Germany.

send their substances, which are formed by the light through assimilation, to the newly developing leaves and roots. These develop rapidly. In this way, the plant enters a closer relationship with the light and the atmosphere, while the root—particularly during droughts—penetrates deeply into the ground and there takes up moisture for its rapid growth. For a certain period of time, the plant develops in this way in conformity to the sun-Mercury rhythm. When it goes over to the development of the flowers, this transformation to a higher level of plant development dominates the life processes. The old leaves fade, and assimilated matter from the newer leaves rises to the developing blossoms. When the plant reaches the final stage of its development in the fruit, the flow of substances enters into the development of the fruit and seeds with its warm, desiccating life processes. Thus growth is a process of life that is seized by upwardly expanding development. With the maturation of the fruit and seeds, the plant declines, withers and dies.

The annual herbaceous plant is most closely connected with the yearly path of the sun; through its growing and withering it indicates the increasing and decreasing power of the sun.

Among the annual herbaceous plants are those that utilize light most intensely in their earthly lives: millet, corn, sugar cane, various goosefoot varieties and many others. The plants' life processes yield in such a way to the light streaming forth from the sun that their assimilation is even increased in the abundance of light during a tropical noon. In these plants the sun affects earthly life most strongly.[34]

The close connection between the annuals and the sun is also reflected by their distribution. In our temperate climatic zone, with its long winters, the perennials dominate among the herbaceous plants. The annuals, however, are strongly represented in the desert regions where the sun stimulates intense growth processes, which after only a few weeks go into the flowering stage, then to fruit and seed development. Through this change from a brief germinating development—in which moisture is active—to longer periods of rest in the seed stage—which are the results of warm, desiccating processes—an intimate connection is established between annual herbaceous plants and the deserts. There are desert regions where four-fifths of all plant species are annuals.

34. These plants take up carbon dioxide much more intensely than do other plants. In their life processes they relate to the atmosphere very intensely and also to the sun, which is active in the transformation of carbohydrates. The science of plant physiology describes how these plants incorporate the gaseous carbon dioxide into their life processes in a particular way—through dicarboxylic acid. Compare with this newer studies of plant physiology: for example, W. Larcher, *Ökologie der Pflanzen* (Stuttgart: 1973).

The year-long developmental period actively determines the form of these plants. The sun in its annual path encompassses the rhythms of the moon and Mercury. Of Venus' rhythms, only the sidereal cycle and the period between the two conjunctions (292 days) lie within a one-year period. These conditions are particularly evident in those plant families whose type is closely interwoven with the course of the year.

The *Chenopodiaceae* varieties in particular exemplify this among our native flora. Except for two species, all are annual: examples are spinach, orach and goosefoot. The shoot and the leaves develop very strongly, and in part even abundantly, as on the Good-King-Henry. These formations that go back to the sun's and Mercury's influence determine the plant's character. The flowers usually remain green; they do not free themselves from the sphere of vegetative life. Their corollas are insignificant; in oraches they are missing altogether. The flower formation, governed by Venus, is only hinted at in those plants whose developmental phase relates to less than an entire Venus synod. Life and form are determined mostly by the sun and Mercury.

The crucifers are also closely connected with the yearly course of the sun. Almost without exception, they are herbaceous. Of the 140 native species, a little more than 60 are annuals: examples are mustard, joint-podded charlock, radish, most cress species and various hedge mustard species. The annual herbaceous plants generally are dominated by an upward-surging unfolding of life. This is particularly forceful in the crucifers. The inflorescences are elevated above the leaf region, and some keep growing right into fall. The flowers themselves are usually small. The pods with their abundance of seeds originate from them. The individual flowers appear merely as an ephemeral episode between the lively development of the shoot, which is determined by the sun, and the seed development, in which the moon manifests itself in the above ground plant.

In various other plant families, it may be observed how the year-long course of development with its inner relationship to the sun's rhythm is expressed in their form. Among the *Caryophyllaceae,* only the perennial genera develop beautiful, bright blossoms—for example, the true carnation, the lampflower, the catchfly and the soapwort. In contrast, the annuals (spurrey, sand spurrey, knawel, whitlowwort, herniary) have tiny, stunted flowers that often even remain green. The flowering process does not come to full expression and remains in the beginning stage, as with all *Chenopodiaceae*.

In this connection, the *Rosaceae,* with their forceful blossom development, are very interesting. In our flora there are only two annual species. They belong to that genus in which the blossoms remain small and green and do not develop corollas: the genus of the lady's mantle *(Alchemilla vulgaris).* But there are also annual herbaceous plants with large bright blossoms, such as the corn poppy, the opium poppy, the foxglove and the sunflower.

2. Biennial Herbaceous Plants

In contrast to the annuals, the life cycle of the biennials, from germination to seed development and withering, stretches over two years. This slower development is linked with characteristic processes of form expression. The biennial herbaceous plants differ greatly: for example, the friar's crown from the celery and the burdock; the reseda from the mullein; and the henbane from the hollyhock, the viper's bugloss and the spoonwort. Still there is a comprehensive developmental conformity. During the first year, the plant develops only a strong root and a rosette (low ring of leaves). If the plant could yield to the sun's influence, the leaves would develop on an upward-stretching shoot. The life-sustaining substance developed in the leaves would rise upward, as in the annuals, and would express itself in new shoots and leaves. However, the influence of the sun is totally suppressed. The substances move instead in the opposite direction, downwards into the root, and are stored there. Often the root enlarges immensely.[35] In the celery, this swelling affects the repressed shoot; in the red beet it affects only the hypocotyl, which was already present in the seed. Forces opposing the sun's influence dominate the life processes.

The shoot develops all the more during the summer of the second year. The biennials—such as melilot, evening primrose, teasel, hollyhock or some thistles—then become the largest plants within their families. The shoots and inflorescences are seized by a strong upward-stretching impulse. In many thistles and in the mulleins, the vertical development is so intense that the leaves are caught up in it and for a short stretch grow together with the shoot before they finally separate from it. The energy collected in the root during the previous year and stored over the winter now streams upward and causes this tremendous development, during which the plant moves far out into the summery sphere of light. In contrast to the annual plants, the biennials concentrate on a long period of flowering.

35. Secondary growth in the thickness of these roots originates from the center cylinder. Either the peripheral layers expand, as in the carrot, or the central region expands, as in the radish. When these roots do not solidify—as in the carrot, the parsnip, the radish, or the evening primrose—they may serve as food for man.

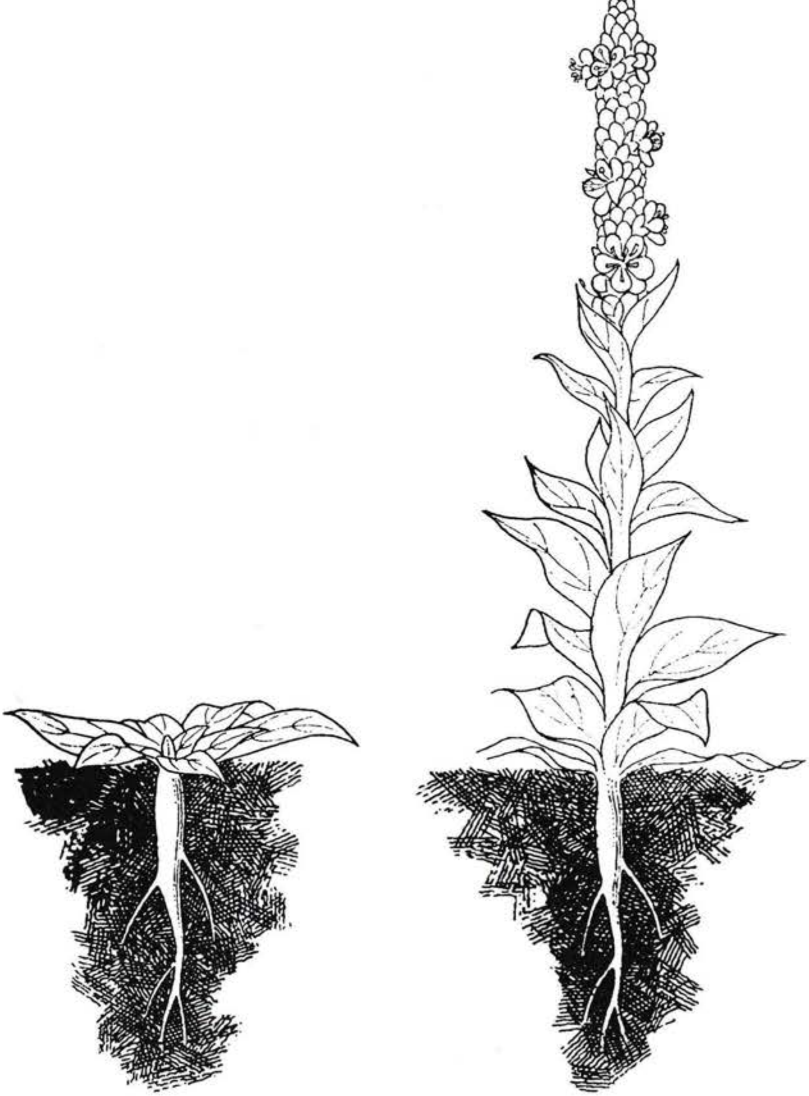


Fig. 27 A biennial plant (mullein, *Verbascum*) during its first and second year. During the first year the shoot is suppressed. A rosette and strong root develop. In contrast to this downward directed development, a flowering shoot forcefully stretches upward during the second year.

In comparing the annuals and the biennials, we observe how the latter are taken over by forces that stretch their development (determined by the sun's rhythm) through two sun periods, by suppressing the formative influence of the sun during the first year and increasing it during the following year. These forces do not only add a new element to the formative forces already present in the annual plant, but they also influence them totally. We recognize in the biennial plants that these forces encompass and impress their particular character upon the entire "system" of the annual plant's form expression. If the images of the moon, Mercury, the sun and (by way of suggestion) Venus are reflected in the annuals, it appears that, through the particular formative conditions and the two-year life cycle of the biennials, reference is made to the region of the far planets—particularly to Mars with its roughly two-year rhythm (synodical period of revolution: 2 years and 50 days; sidereal period of revolution: 1 year and 322 days.)

During its two-year period, Mars enters, as previously discussed, completely contrasting relationships with the sun's course. After the conjunction, its relative movement for one year is opposite to that of the sun. When during spring and summer the sun is ascending and plant life unfolds again, Mars, in that it lags farther behind the sun, moves in the zodiac into regions opposite the sun. There it enters deeply into the sun's sphere from the distance of the far planets. These dynamics, opposing the sun, find their reflection in the development of the rosette of the first year, the inhibition of the center shoot, a strong root development and the flow of energy downwards into the root.

After the following year's opposition, the sun and Mars move in the same direction. Mars with its increasing speed knits an ever closer relationship with the sun as it moves out into the more distant region of the far planets. The sun ascends into its summery height in connection with the powerful movement of Mars. This interplay of Mars and the sun manifests itself in the tremendous developmental impulse of the biennial plant during the second year. Thus the sun's influence, modified by Mars, is reflected in the biennial plants.

Each year, fully developed flowering plants naturally mingle with the rosettes. Because the synodical rhythm is 50 days longer than two years, the conjunctions and oppositions of Mars and the sun occur in ever-changing sections of the zodiac. There are years, then, during which Mars enhances, and others during which it obstructs, the sun's influence. During some years, we may, for example, see more mulleins and thistles than during others. It should be studied, however, over a period of years and in various locations, with what clarity the cosmic dynamics between Mars and the sun are reflected in the life rhythm of the biennial plants.[36]

3. Perennial Herbaceous Plants

Most of our herbaceous plants develop anew, year after year, out of buds which have developed underground or closely above the ground towards the end of the previous vegetative period. During spring and early summer, new shoots sprout up from these buds. They die off, at the latest, in the fall. In this respect, the perennials also grow and wither with the sun's yearly passage.

During the first year, the perennial plants concentrate on vegetative growth. From the leaves, organic substances flow downwards to the roots, rhizomes, bulbs or tubers and are stored there. Using this life stored in the previous year, the plant develops much more forcefully—even where the vegetative period is quite short because of long winters or periods of drought. In many cases, the plant moves on to the flowering stage after a year or two of vegetative growth.

In contrast to the annuals, the perennials develop an intense life below ground, where the buds and storage organs are formed. In the buds and stored substances, the life of one year affects the next year. The annual plant is made up of the forces that currently stream towards it from the universe. When perennial plants develop in the spring, they too are under the sun's influence, but are only formed by it in part.

36. One particular group of biennial herbaceous plants includes the various kinds of cabbage. In the head cabbage (white cabbage, red cabbage, and Savoy cabbage), the development of the shoot is not inhibited from the beginning in the rosette. The plant develops a bit, and then the inhibiting effect of Mars seizes the bud of the center shoot. The bud swells up immensely. During the first year, the plant remains totally undeveloped. It cannot quite adjust to the external influences of nature. The leaves and the shoot, inhibited in the interior of the bud, do not solidify.

In the kohlrabi, three internodes develop initially. The following internodes become shorter and shorter and swell up. Mars here influences the development of the shoot. Through the inhibiting effect on the shoot—metamorphosed into a shoot nodule—the plant in this region is lifted away from the solidifying forces of the earth. In the Brussels sprouts, the cauliflower, and the broccoli, the plant comes under Mars' influence at later stages. Thus the development of the secondary shoots—in the swelling axillary buds on the one hand and the inflorescence on the other—comes to a halt during an earlier or later stage. As in the head cabbage and the kohlrabi, the plant maintains the delicate consistency of an initial stage through the effect of Mars on the respective organs.

This is the basis for these plants serving as vegetables in human nutrition. As soon as the plant unfolds beyond this initial condition, it solidifies in the stronger connection with the external forces of nature. This process would have to be reversed by man during digestion if he wanted to nourish himself with fully developed plants as some of the animals do. The cabbage becomes a food plant through Mars, which obstructs the plant in the first year of its development. Similar is the case with the roots when they become root vegetables in the biennials as, for example, in beets.

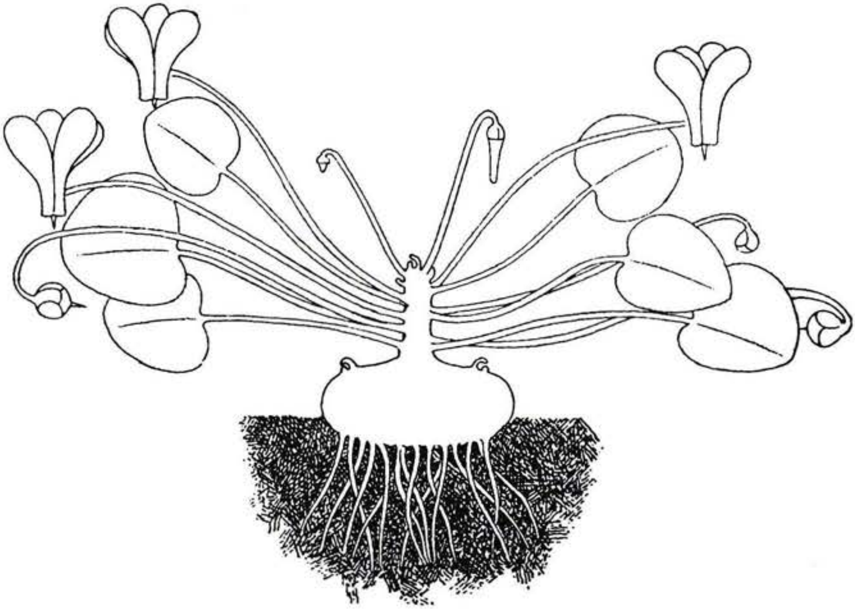


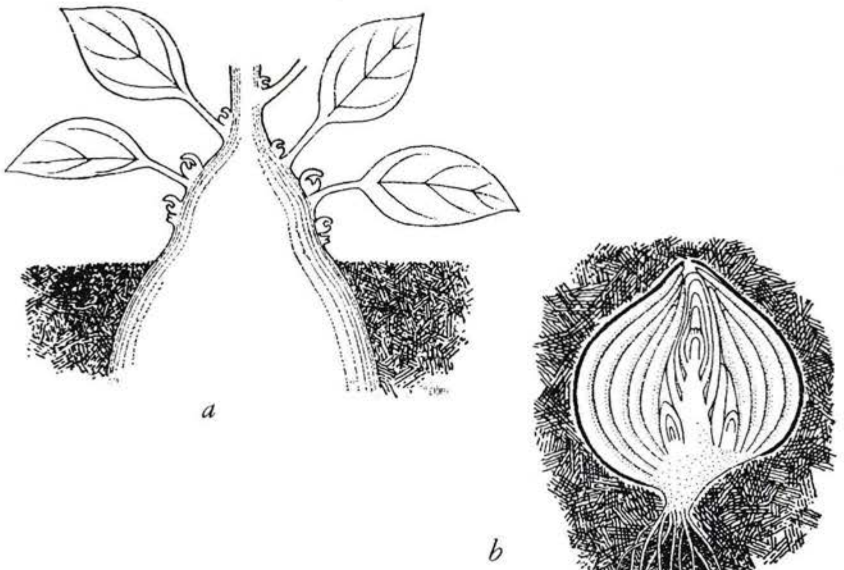
Fig. 28 Cyclamen *(Cyclamen persicum)* during its first year of development. The hypocotyl has swollen up into a tuber like a short stem. From it, the short center shoot with its leaves and axiliary blossoms originates (after Hagemann, slightly modified).

The leaves and shoots, and usually the flowers of some woody perennials, have been differentiated in the buds of the previous year. This is also true of the early flowering herbaceous plants like the coltsfoot, the anemones, the primrose, the hellebore and most of the bulbous plants. In the tulip, narcissus and hyacinth, it is easy to observe how the finished flower buds emerge out of the darkness of the bulb. Most of our summer plants, however, form their blossoms under the sun's influence of the current year.

The shoots of the perennial plants, beginning with the second year, develop as secondary shoots out of the buds. The plant branches out more and more into the surrounding space. In the region of the shoot, new conditions arise. Even though the shoots develop under the sun's influence, they are no longer totally dominated by it, as are the annuals.

In many perennials, the center shoot is suppressed. In tuberous plants like the cyclamen, the hypocotyl, which is the shoot of the germinating plant, swells up immensely during germination and develops into a dark corm. A short piece of the center shoot above the cotyledons becomes part of it. The tuber functions as an extremely compressed stem on which crowded vegetative shoots and flowering shoots develop. The growth of the shoot is strongly inhibited. With its corm originating from the greatly enlarged hypocotyl, the entire plant develops from that part of the shoot which was formed under the moon's influence in the seed. Thus the cyclamen, under this lunar influence, appears as an underdeveloped tree. This is also true of such plants as the winter aconite *(v. p. 129),* the birthwort and the holewort. Their corms also originate from the hyocotyl. They also reveal their connection with the moon through their subterranean development.

In other perennial plants, such as the yellow gentian, the columbine and the bryony, the lower part of the center shoot joins with the primary root to form a beet-shaped organ. This lowest section of the shoot also has a strong connection to the development of the root; shoot-borne roots develop particularly easily from it. The buds of this shoot section develop into flowering shoots during the following years. At the same time, the "beet" develops at an increasing rate. The root is thus the dominating organ in beet-like plants, just as is the hypocotyl in the corm-forming plants. Joining the root, influenced



a

b

Fig. 29 In the perennial rapes (a) the lowest part of the shoot joins with the root. The rest of the shoot and the leaves die during the fall. The following year, new shoots germinate from the buds of the rape. In the bulb (b) one part of the plant continues to exist as a bud at all times (after Troll and Lorenzen, modified).

by the moon, is a section of the shoot that is even less elongated than that of the cyclamen. It appears as if the aspiring tree form were held back to an even greater degree.

The bulbous plants are the least fully developed. Not only the shoot, but also the root, is suppressed tremendously. During the plant's winter rest period, only a bulb remains. It surrounds the so-called renewal bud, from which the new shoot emerges in the spring. Thus the bulb, too, contains the rudimentary provisions for a plant that might expand far out into space if the leaves and internodes could develop completely and were not, due to the moon's influence, isolated from the light sphere of the sun *(v. p. 54)*.

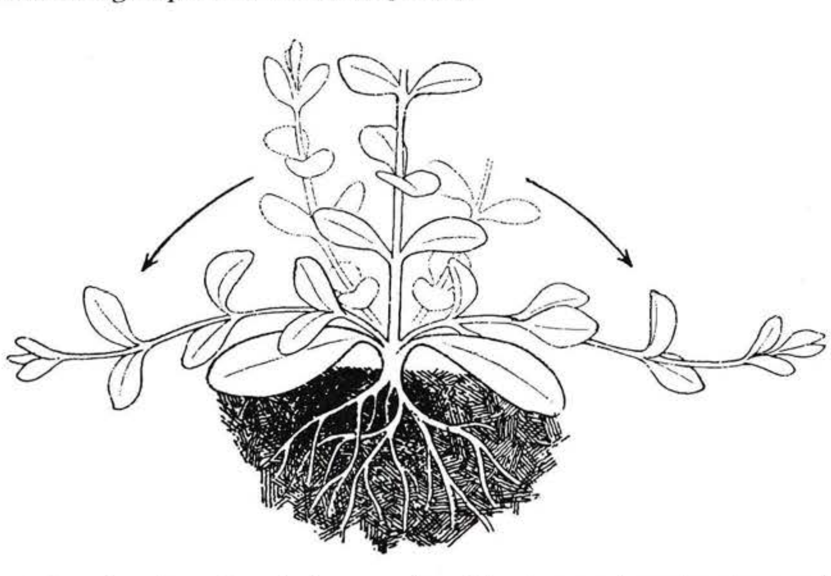


Fig. 30 Secondary shoots from the lowest section of the shoot reach out along the ground and there, particularly in their tips, develop roots. The runners are similar to the rhizomes insofar as they lose their relationship with the sun to a large degree. They form roots much more intensely than vertical shoots.

In contrast to these tuberous, beet-like and bulbous plants, other perennials expand tremendously. In stolon plants like the creeping buttercup, the creeping bugle, the wild strawberry or the moneywort, the buds on the basal part of the shoot develop into long horizontal stems. These secondary shoots develop in the immediate neighborhood of the root and often spread far into the surrounding area. There they root from the slightly swollen nodes. During the following year, new shoots with leaves and flowers develop from them. The fact that the secondary shoot first of all initiates root growth again shows the influence of the moon rather than the sun.

This influence is even stronger in the rhizomatous plants. Here the tendency to root formation actually penetrates into the major shoot. The hypocotyl of these plants already bends away from the sun, or it does not turn towards the sun at all during germination. The center shoot then grows horizontally on or in the ground. During the first years of growth of most rhizomatous plants, only leaves evolve from the shoot into the light sphere. Then, as in the wood anemone, Solomon's seal or iris, the shoot also expands towards the sun to develop its flowers. The rhizome continues growing through its secondary shoots (sympodial rhizome). It is quite rare to have the flowering shoots develop as secondary shoots, as in the truelove (monopodial rhizome). Thus the stoloniferous and rhizomatous plants develop entire shoot systems which do not appear in striking vertical growth patterns because they are tied to the ground by the moon.

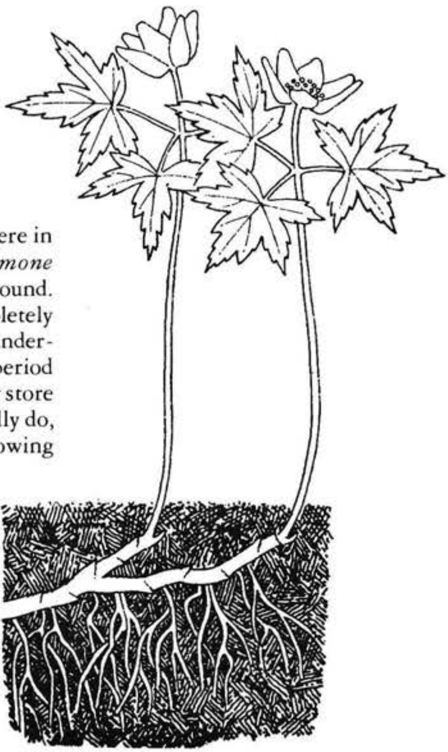


Fig. 31 In the rhizomes the shoot system, as here in the case of the white anemone *(Anemone nemorosa)*, develops mostly underground. Through this the plant is almost completely separated from the sun's rhythm: the underground shoots continue to grow over a period of several years. During the winter they store organic substances, as the roots generally do, for the flowering shoots of the following year.

All perennials, in contrast to the annuals, are permeated by the moon's influence to a greater or lesser degree. This influence finds its most vivid expression in the renewal buds. They develop during the second half of the year, when growth, in connection with the lower position of the sun, begins to stagnate, while the moon (particularly the full moon) rises higher and higher during the increasingly long nights. Its light is a cool reflection of the sun's light radiated into the moon's own sphere.

The renewal buds are a manifestation of the sun's weakened influence. They develop when the internodes stop growing and the leaves grow together to form the bud scales. The bud scales, like the moon's sphere, envelop an isolated space of modified solar influence. Here then the delicate, pale, embryonic shoots originate, as well as the leaves, and, in part, the flowers and inflorescences. The sun, with Mercury and Venus, exerts a considerably moderated influence within the bud scales. The forces of plant formation are modified by the moon.

In the fall, the moon's signature becomes visible in the buds. At the winter solstice, when the full moon is as high in the sky as the sun during midsummer, the moon unleashes its greatest force. The buds—particularly on trees— are now no longer capable of germination.[37] The bud and seed dormancy is now at its deepest. The deepening dormancy until December and the beginnings of reawakening in January are a reflection of the moon's course. The moon parallels the perennials, as it carries the life from one year through the winter dormancy into the following year. As the shoots with their leaves and blossoms mirror the sun and the planets in the summer, the buds reveal the moon's influence in the winter.

Through the bud development, the moon gains a strong influence over the entire plant form. This influence, however, manifests itself only in those organs through which the plant is already associated with the moon:

37. The trees of tropical rain forests do not have any real buds. "The rudimentary leaf forms are enveloped by hairs, mucus, succulent scales, or distinctively formed stipules. Although the conditions for growth are continuously favorable, the growth of the shoot occurs little by little." (H. Walter, *Vegetationszonen und Klima*, Stuttgart: 1970), p. 53 f. The tropical rain forests thrive mostly in the equatorial regions. There we don't have the change between the sun-dominated summer and the moon-dominated winter as in central Europe. At no time during the year does the moon predominate over the sun. Therefore, there develop on the trees no buds in which the rudimentary shoot and leaf forms are isolated from the surrounding space through bud scales—although times of dormancy and development follow each other.

In contrast, we notice a particularly strong bud development in the arctic tundra dominated by the moon during the long winter months. In Greenland, the blossoms in half the species are even enclosed in the buds, which means that the entire plant development is subject to a strong influence from the moon. This is also revealed by the fact that only very few annual varities grow in northern latitudes. And almost all plants have strikingly thick roots.

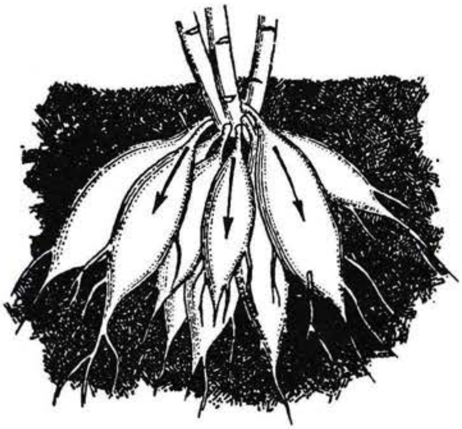


Fig. 32 The dahlia *(Dahlia variabilis)* lasts through the winter because of its roots, which break forth from the lowest section of the shoot. These shoot-borne roots become storage organs, filled with organic substances for the development of the shoots for the following year (after Weber, modified).

a) The *hypocotyl,* the stem between root and cotyledon:
   1. by swelling up, it develops tubers;
   2. by bending horizontally, it develops into a rhizome.

b) the *lowest section of the center shoot,* which sits right on top of the root and tends to develop roots:
   1. the renewal buds grow into horizontal rhizomes;
   2. the renewal buds develop into upward-stretching stems, as in the tall buttercup, the lungwort and many other plants;
   3. the lowest section of the shoot and the primary root develop into a beet-like organ;
   4. the shoot-borne roots become tuberous organs, which, as in the dahlia and the orchids, form hibernation buds.

c) the *buds:*
   1. they result in bud development.

d) the *roots:*
   1. from buds on branching roots, new shoots grow, as in the Canada thistle and the sheep sorrel.

The renewal buds are a prerequisite for the new development of the plant. Through them, the plant usually expands farther and farther into space surrounding the original center shoot. Only trees, however, perfect this expansion.

Just as the annuals are most abundant in regions of strong sun influence *(v.* p. *74*), the perennials occur where the moon is particularly active in nature. Closer to the polar regions, long nights—and thus lunar domination—increase, and the perennials (including the so-called hemicryptophytes) proliferate. In Italy they constitute 40%, in central Switzerland 65%, and in Denmark 72% of all species. The annuals recede significantly: 42% in Italy, 20% in central Switzerland, and 18% in Denmark. In high northern latitudes, the buds often contain the blossoms, too. All flowering herbaceous plants blooming during the northern summers were already formed the previous year under the moon's influence. Here there is a clear connection between the cosmic rhythm and its image in the plant kingdom.

4. The Deciduous Trees

The trees fill the space above ground into which the herbaceous plants have to struggle year after year. The deciduous trees arrange themselves quite well in this sphere of light, air and warmth, in that their branches grow from the trunk in all directions. The branches

Sheep sorrel *(Rumex acetosella;* after Rauh, modified). This small plant grows in dry meadows, sandy fields and pastures. The delicate panicles form stamens or ovaries in their modest blossoms. Underground buds develop on the roots, from which new shoots sprout. Certain of these buds rest during the winter as renewal buds. Various other herbaceous plants develop similarly, as for example the creeping thistle *(Cirsium arvense)* and the cypress spurge *(Euphorbia cypardissias).*

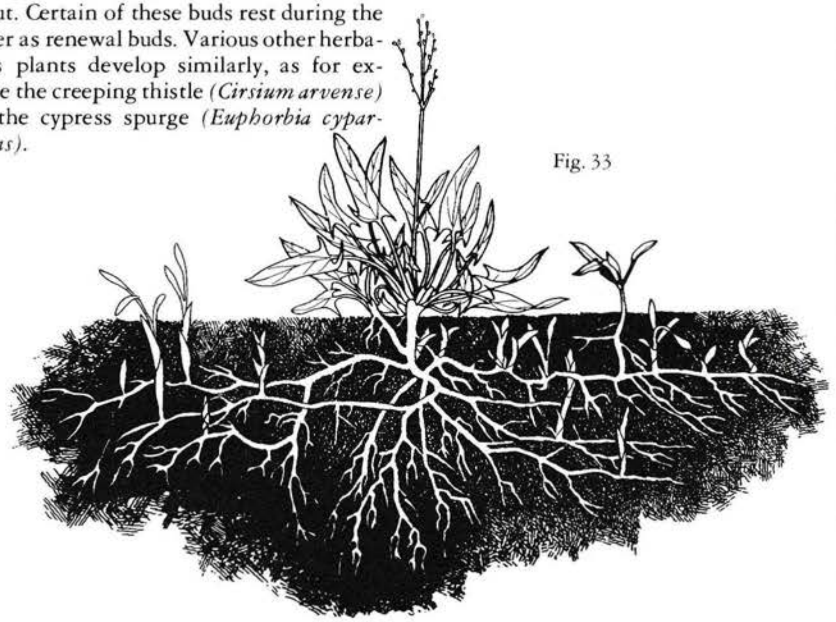


Fig. 33

of the conifers also expand far into the surrounding space, but they remain more subordinate to the central trunk. Like all herbaceous plants, deciduous trees are either monocotyledons or dicotyledons. In contrast to the conifers, they form seeds in ovaries or fruits.

The trees grow for many years before they achieve their complete form. Generally, this process is initially much slower than in the herbaceous plants. During the first year, the shoot grows barely ten centimeters. It usually stops growing in July, just as do later the new shoots on the full-grown tree. The development of the shoot is slowed down considerably.

This lag is related to the life processes characteristic of trees. While the photosynthetic products originating in the first leaves of the annuals stream upwards into the expanding leaves and then into the fruit, they are also used to build the trunk in small trees. Here soluble substances such as sugar and coniferyl alcohol are polymerized into dry solids. During the transformation of these substances into wood, a warming and drying process results in the excretion of water.[38] When

38. In order to penetrate these life processes, we must cultivate views that were developed during antiquity, in particular by Aristotle, about the so-called four elements of earth, water, air and fire (warmth). Modern plant physiology, in its descriptions of substances and metabolic processes, arrives at its view through the chemical analyses and molecular structures thus derived. How these substances (represented by formulas) relate to the living plant remains incomprehensible, since we see merely the atomic and molecular restructuring. However, through the ancient element-system we may comprehend the life processes of lignification. Cellulose, a main component of wood, develops from sugar (glucose). In its ability to dissolve in water, the sugar has an inner relationship to water. According to the ancient study of the elements, it carries the quality of moistness within. This becomes apparent during the formation of cellulose, since cellulose originates from sugar through poly-condensation; i.e., through concentration by separation from water. Cellulose, therefore, is a dense substance that no longer is water-soluble. Its character is "dry." Similarly, lignin results from cumaryl, coniferyl, and sinapyl alcohol through dehydration (water separation) followed by polymerization (substance condensation). In this substance transformation, we see the working of the fire element (warmth). The qualities of "warmth" and "dryness" interact as, for example, "moistness" and "coldness" are present in the water element. Under the influence of warmth and dryness active in the fire element, moistness is eliminated from the sugar. Thus new substances are created in the cellulose and lignin, in which the fire element reveals its qualities (dryness, warmth). This is to be understood quite realistically. We must study cellulose and wood according to their various qualities, from our sensation of touch to their resistance to moisture and flammability.

In no way must we forego modern chemistry for the ancient Greek study of the elements, or vice versa. Modern chemistry observes how the simplest materials in the substances—the elements, in the sense of modern chemistry—relate to each other, and how from this point of view the relationships change. The mode of observation developed by Aristotle looks at how life works within these substances. These workings of life are fourfold—they may tend to be more or less moist, dry, warm, or cold and thus may change the substances accordingly. Both views have validity. Since it is true that today only the composition of the elements carbon, hydrogen, nitrogen, sulfur, etc., is looked at, we must add another mode of observation, lest the connection of the substances with life and the laws of form-expression manifest in life remain an unsolvable riddle.

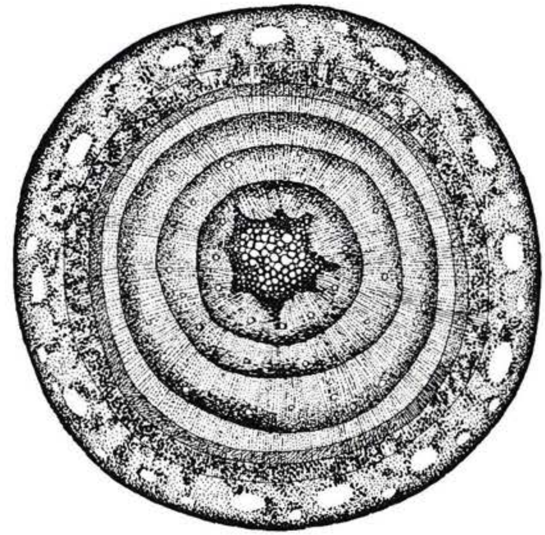


Fig. 34 Cross-section of a small tree trunk. Around the shoot of the first year (in the middle) the wood of the following year has been formed in annual rings. The loose spring wood goes over into the denser summer wood; it abruptly joins the wood of the last annual ring. This hardened wood tissue orginates from the delicate, living sheath of cambium; towards the periphery the cambium forms the so-called phleom. Wood and phloem are enveloped by the bark. The rhythmically occurring wood formation is an image of the sun's rhythm. Each year it expands more into the surrounding space away from the first annual shoot, which is comparable to the shoot of the herbaceous plants and, with that, to the sun.

plants grow vigorously, the life processes occur in a moist environment. When life, however, is dominated by desiccating warmth processes, germination is obstructed. Wood formation takes place mostly during the warm summer months until the second half of August. In this way, a permanent trunk develops out of a transitory shoot. Through wood formation, the maturing tree separates itself somewhat from the close tie to the moisture rising from the ground, which dominates the life of herbaceous plants. The plant's form goes from a rapid alternation of growth and decay to a condition of relative permanence.

The young tree continues to grow from its terminal bud. Its axillary buds lie dormant for a long time. Herbaceous plants and shrubs usually begin their seasonal growth before the trees. New tree growth often begins only after the sun, from its elevated position, has warmed nature considerably. Year after year the trunk thickens. Around the old layer of wood a new layer is formed, and likewise a new layer of bark is built within the old bark from a living intermediary section, the vas-

Fig. 35 Young beech *(Fagus silvatica)* at the end of its fourth vegetative period (after Troll, modified). From the annual growth, it can be seen how much growth is slowed down in comparison to the herbaceous plants.

cular cambium. While the new shoots are growing, spring wood develops. It is composed of large cells and greatly permeated by rising fluid. The denser summer wood is still being formed in August. Thus wood formation is integrated not only with the development of the entire tree—with the expanding crown and the further consolidation of the trunk—but also with the changeover from the moist early summer to the dry late summer. Over several years, an immense amount of photosynthetic product results in the three-dimensional tree form. The same principles are at work in the shoot as in the fruit: growth proceeds outward; in many cases warmth leads to lignification; the growth period stretches beyond one year.

Trunk development is related to the center shoot development in the herbaceous plants. Initiated by the sun, the trunk develops under the influence of the far planets, which imprint their character on the trunk. Their longer cycles relative to the sun show up in the plants' inhibited growth; their rhythm lends a permanency to the shoot; they lie beyond the sun's sphere, just as the young trunk outstrips the rudimentary annual shoots and enters further into the atmosphere. The role of the far planets in shoot development is the key to understanding the trees.

The trunk may develop in two ways. In the beech, maple, oak, ash, alder and horse chestnut, a bud develops in the tip of the initial shoot and unfolds during the following year to continue the development of the trunk. The trunk is thus the result of years of vertical growth. This so-called determinate growth creates a uniform trunk in which the lengthy rhythms of the far planets are clearly expressed. In other trees like the hornbeam, birch, linden, and elm, however, the new terminal bud aborts each year. The shoot of the following year emerges from the topmost axillary bud. In this way, a so-called indeterminate trunk is formed of burgeoning secondary shoots. Here the one-year rhythm of the sun affects the development of the tree more than in the determinate growth. A stronger branching tendency dominates.

When, after several years, the crown spreads, the three-dimensional development still restrained in the trunk achieves its final form expression. On the young shoots of the trunk, the upper axillary buds develop into secondary branches. These become the main branches, which reach farther out year after year. The relationship to the surrounding space develops further when the main branches send out strong secondary branches, mainly from their lower side.

The deciduous tree stands as a powerful expression of Jupiter in the plant. During the development and maturation of the fruit in herbaceous plants, Jupiter manifests itself in one particular plant organ; in trees, it takes over the entire development. Jupiter contains the sun's sphere, and with its nearly twelve-year cycle encloses the sun within the zodiac *(v. p. 44)*. During the first period of the tree's development, Jupiter acts only in so far as it slows down and consolidates the shoot and leads it into perennity. With this, the second period is prepared. If the plant is to relate fully to Jupiter's sphere containing the sun, it first must rise above the ground into the external environment. The topmost branches diverge from the trunk in all directions, just as Jupiter directs the forces radiating from the sun. The crowns of deciduous trees show the shoot expanding into the surrounding space under Jupiter's influence.

The deciduous tree can normally develop only where the annual growing season lasts at least 120 days. It must unfold its leaves for

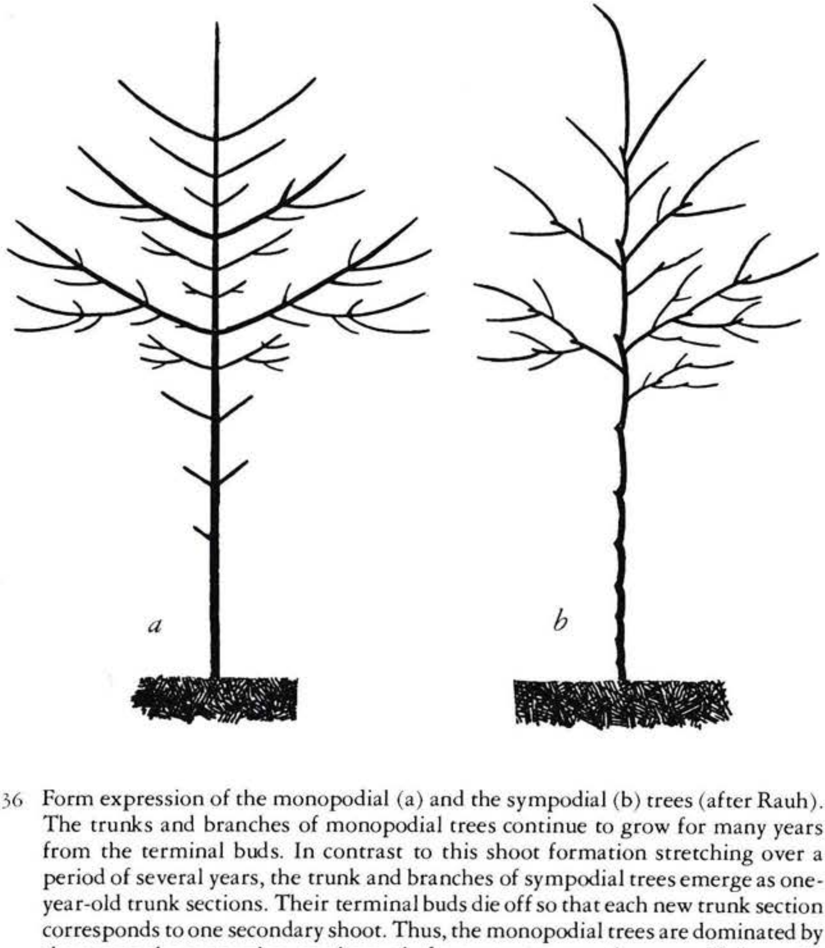


Fig. 36 Form expression of the monopodial (a) and the sympodial (b) trees (after Rauh). The trunks and branches of monopodial trees continue to grow for many years from the terminal buds. In contrast to this shoot formation stretching over a period of several years, the trunk and branches of sympodial trees emerge as one-year-old trunk sections. Their terminal buds die off so that each new trunk section corresponds to one secondary shoot. Thus, the monopodial trees are dominated by the young shoot growing continuously from year to year, the sympodial trees by their branching out. The trees shown above are eleven years old. During one revolution of Jupiter, the deciduous tree develops its characteristic form.

the duration of one Mercury period (116 days) in order to gain, from the connection with the sun, the substances and forces necessary for growth. During the vegetative period, the new shoots develop rather rapidly, and, in some trees, reach their complete development after only two weeks (horse chestnut), four weeks (certain beech and ash species) or eight weeks (birch, poplar). When the trees achieve their typical form, a developed crown, they generally begin to bloom and fruit. Thus they achieve their full level of plant existence.

The shoots, which develop above ground rather rapidly from the buds, correspond to the annual shoots of the herbaceous plants. The German romantic poet Novalis formulated this connection precisely: "The trees seem the most noble among all the plants, because the innumerable individual trees are connected directly with the ground and, as it were, are already plants on top of plants." Rudolf Steiner characterized the trees in a similar way.[39] Tree shoots distinguish themselves from those of herbaceous plants in that they grow in an "earth-like condition" permeated by processes of warmth and do not root in the moist ground. In their life processes, they intensively yield to the development of blossoms and fruits, through which the plant is always freed somewhat from the influences streaming upward from the ground (water and salts). In most of our deciduous trees, the blossoms differ greatly from those of the herbaceous plants. In our native flora, only the trees of the family *Rosaceae,* the locust tree, and the horse chestnut form blossoms with colorful corollas. The perianth in the linden, the maples and the elms remains small and green. On the large, dominating deciduous trees such as beech, oak, and ash—but also in the birch, alder, poplar and willow — there is no longer a perianth. Particularly in this modification, the formative forces of the tree prevail in the blossoms. With the calyx and corolla, those blossom organs recede in which the near planets are active. The fact that the calyx and corolla are missing in the blossoms of many trees points out that the flowering stage, from the very beginning, is outside the influence of the near planets.

The blossoms here are formed according to laws different from those governing the herbaceous plants. Stamens and pistil generally occur separately in male and female flowers. Male flowers gathering in large numbers form catkins. They are arranged around a tender shoot that carries them out into the surrounding area, as the anthers are carried upward by the filaments in the blossoms of herbaceous plants. In such catkins, the entire inflorescence is formed according to the dictates of the stamens and pollination. The ovaries in the oak, beech and sweet chestnut are enveloped by a sheath, the so-called cupule. In the Chinese chestnut, the spiny cupule envelops the fruit; in the beech,

39. According to R. Steiner, the tree trunk is a formation comparable to a "turned-up" piece of soil. In the fourth lecture in *Agriculture,* the specific conditions of life in such a turned-up piece of soil are compared to life in the tree trunk. On the tree trunk and the crown, numerous small plants develop from the bud, just as numerous small plants germinate from the below-ground buds of the herbaceous plants. Looking at a tree from this point of view, we must compare it to a pasture on which numerous plants of the same species grow. In the discussions published under the title "Erziehungskunst-Seminarbesprechungen und Lehrplan-Vorträge," R. Steiner characterizes the tree in a like manner: "When we see a tree, it is as if the earth itself is propped up, turned up, and pulled inside out."

the cupule opens its four flaps upon maturation of the fruit; in the oak, the fruit pushes out of the cupule and sits in it as in a small bowl. In these trees, the gesture of isolation characteristic of the ovary reaches over into the shoot, in that the latter forms the cupule to enclose the fruit. Where the female flowers form catkins, as on the birch, alder and poplar, these are generally much more tightly packed than the male catkins. In the beech, oak and sweet chestnut, the female flowers develop in shorter or longer shoots and thus are also ordered according to the principles of formation governing those trees.

Many trees develop fruit abundantly. Occasionally, the fruits mature quite perfectly. Herbaceous plants generally produce dry fruits containing the seeds. In a number of trees, a rich flow of substances reaches the developing fruits and ripens as pulp. Of the organic substances originating in the leaves of the beech, about one-fifth, in the poplar one-fourth, and in the apple tree more than one-third are passed on for the development of the fruits. Fruit development may influence the life processes so intensely that the entire vegetative growth, most of all in the roots and buds, begins to stagnate somewhat. During the development of the fruit, Jupiter *(v. p. 48 f.)* unfolds a particularly strong influence, which takes hold of the entire tree.

At this point, we may look back again at the perennial herbaceous plants. When the center shoot connected to the hypocotyl is seen as formed by the sun, the secondary shoots appear to be influenced by Jupiter and directed into the periphery of the sun's sphere. With these secondary shoots, the perennial herbaceous plants—similar to the trees—expand around the original center shoot. Yet this branching-out originated by Jupiter is tied to the ground through the moon's influence. The perennial herbaceous plants, on their way, so to speak, to developing into trees, are arrested by the moon in the most varied ways during their early stages, in part even during germination.

5. The Coniferous Trees

The durability which distinguishes the deciduous trees from the herbaceous plants is even greater in the conifers. The deciduous tree—with its leaves unfolding in the spring, its fully foliated crown during summer, the coloration of the foliage during the fall and the withering and falling of its leaves, even the flowering and maturing of its fruits—remains entirely within the confines of the yearly cycle of the sun. In most conifers, this connection with the sun can be found only in the budding and pollen formation during spring and early summer. Thereafter, the life processes dissociate themselves from the sun's rhythm. The leaves often last for several years and the ripening of the female cones through the seed stage also stretches far beyond a single year. The dark-green conifers during mid-winter impressively reveal that the plant's life processes have general independence from the sun. Among the conifers in our region, only the larch, changing its color to yellow in the fall and shedding its needles, is linked to the sun's rhythm to a greater degree. Among the families of our native conifers, there are only woody plants, and those are, almost without exception, trees. Only the juniper and the knee pine have a shrub-like development. In contrast, the deciduous trees are dicotyledons which to a great extent take the form of herbaceous plants. The conifer, therefore, manifests the tree type in an extreme form.

This characteristic is revealed in many details of form. Many deciduous trees are indeterminate: the one-year shoot formation of their trunks *(v. Fig. 36)* is reminiscent of the perennials. In the conifers, determinate growth dominates without exception. The trunk's continued growth through decades and centuries determines the entire form. In the whole plant kingdom, there is no more striking illustration of the permanence of a living structure than the trunk of an old fir or spruce. The total form is subordinate to the trunk. While the branches in the crown of the typical deciduous tree spread outwards, and the tree dissolves, so to speak, into the crown, the branches of the typical conifer arrange themselves along the trunk. From there they reach far into the surrounding space, yet they hardly mingle with it. In the araucarias of the southern hemisphere, the branches penetrate the surrounding space without yielding to the sphere of light and air.

This quality is revealed in the peculiar form of the leaves on our native conifers: the needles. The needles are not just smaller leaves; the characteristic unfolding of the leaf blade is obstructed. A cross-section barely reveals it. Thus a connection with the air and sun is minimal. The conifer, with its needles, is separated to a large extent from this inner connection with the sun, and the growth and decay of the yearly cycle. On the fir, for example, the needles may become as much as eleven years old; on the pine with its often wider, looser crown, the long needles, which are more strongly connected with the light, drop off within three or four years. The needle form detaches the leaves from their otherwise close connection with the sun's rhythm and they become perennial, thus coming, as only the branches do on the deciduous trees, under the influence of the far planets.

At the same time, the conifers with their vitality penetrate deeply into the dark and cold season. Quite early in spring, organic substances are already formed through assimilation. This goes on into late fall, when the deciduous trees no longer carry any leaves. With the onset of the cold weather, life—like the seed—rests. If the winter is mild, however, as it is occasionally in Central Europe, the spruces, firs and pines take up the light of the low winter sun.

Likewise, the conifers have advanced much farther into the northern latitudes than have the deciduous trees. There, a massive belt of conifer forests, the taiga, stretches across the American, European and Asian continents. The spruce, the characteristic tree of the European taiga, thrives even where the summer vegetative period (mean daytime temperature 10°C) lasts for a mere 30 days. Like the other northern conifers, it must unfold in the sunlight through its needles—those leaves that remain green even under the moon's winter domination—for the duration of at least one moon period, in order to be able to grow.

Like the leaves, the branches also are subject to strong inhibiting factors. The sections of the shoot between the needles generally are so short that, in the spruce, fir and yew, one needle immediately follows another. We notice the extent of this inhibition of the shoot when we hold a spruce twig next to a beech twig. We may count more needles on a ten-centimeter spruce tip than on a one-meter-long branch of a beech. We also notice that in the spruce almost all axillary buds, i.e., the organs which provide for the further development of the shoot system, are suppressed. In the pine, they are entirely limited to the terminal buds. On these, a new whorl of secondary shoots is formed each year, and in their middle the continuation of the center shoot. The branches grow longer year after year in much the same way. In the spruce, fir and yew, forms evolve from which the entire development of the tree becomes visible in one image. Growth is converted into a permanent form. The age of free-standing firs and spruces may be calculated rather accurately by the number of tiers of branches. In short, conifers are completely dominated by forces that inhibit growth processes and harden their forms.

In these forces, Saturn operates intensely. Up to now, we have met Saturn only in the seed, through which the plant maintains its form under conditions of complete inhibition of life forces (*v.* p. *51*). During evolution, the group of gymnosperms, to which the conifers belong, achieved the development of seeds.[40] The forces dominating

40. In the long-gone Paleozoic era (Carbonian and Permian periods), fern-like plants already formed seeds. These seed ferns (pterido-sperms) in their leaf form had reached the level of the ferns as had the seed-forming *Lepidocarpon* species with the club moss. We get the impression that here within the fern family the seed development appears as though in one episode, and then later on, belongs to the type of plant development.

seed development—the obstruction of growth in the germ, the step towards and into permanency through the desiccating effect of warmth, the moving away from the sun's rhythm—permeate the entire coniferous plant. The seeds are created, as it were, out of the inhibited life forces of the conifers; these are vivid images of those forces at work in the seeds.

The form of the conifers displays Saturn's connection to the sun and the near planets. Saturn revolves around the sun, Mercury and Venus every 29½ years—it is significantly slower than Jupiter. This rhythm leads to a higher degree of perennity than that found in the deciduous trees by including the leaves. In the araucarias, the scale-like leaves are directly tied to Saturn's rhythm; they grow to be thirty years old. Free-standing firs and spruces ordinarily grow vegetatively for thirty years, that is, for the duration of one Saturn cycle, before they form cones and bear seeds. As Saturn orbits around the sun in the depth of the universe and the sunlight glimmers with a bluish tint from there, the branches of the conifers reach far out into their surroundings away from the central trunk. And as the slow Saturn is restricted by a strong retrogradation (approximately one-third of Saturn's movement is retrograde), all the organs of the conifers develop under this inhibition—not only the shoots and leaves, but also the cones. The tiny cones are a sort of inflorescence in which the simple male or female gametophytes with their cover scales are even closer to each other than the needles on a twig.

Thus the image of Saturn in the plant kingdom is seen in the entire conifer. Saturn unfolds here an effectiveness similar to Jupiter's in the deciduous trees' life processes, which are largely dominated by desiccating forces of warmth. These lead not only to the development of wood, but also to the needles, in which expansion is inhibited so impressively.

6. The Shrubs

The form of the shrubs is nearly diametrically opposed to that of the conifers. When we see a dog-rose next to a spruce, this becomes obvious. In contrast to the dark, stern, symmetrical spruce with its heavy, drooping branches, the rose bush with its long, bow-shaped shoots springs forcefully out of the ground into the atmosphere. From these shoots, the shorter, flowering shoots expand upward. The blossoms with their broadly expanding crowns and numerous, bright yellow filaments turn towards the midsummer sun. Such a rose bush is a magnificent example of a shrub.

In the system of growth patterns, the shrubs fall between the herbaceous plants and the trees. As in the herbaceous plants, strong shoots crop up continually. They become woody and branch out above ground as do the deciduous trees. After seed germination, a short shoot usually develops during the first year, corresponding to the center shoot of the herbaceous plants. It remains stunted or dies off in the following year. From then on, a strong growth impulse sends shoots into the surrounding space. The effects of both the sun and its sphere are manifest in the shrubs. From the base of the shoot and the root, the "xylopodium" originates in the ground, from which ever-stronger shoots spring forth on some shrubs year after year.

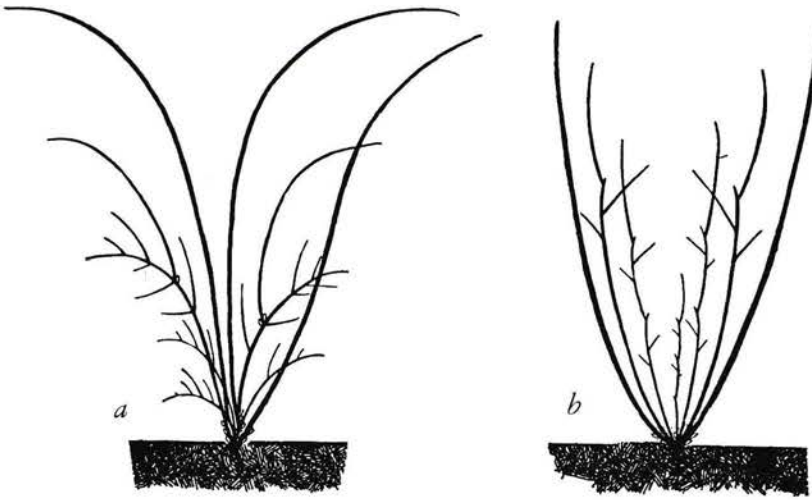


Fig. 37 The two most important growth patterns among shrubs (after Rauh): (a) the secondary shoots of shrubs with characteristic bow-shaped shoots (barberry, rose, black elder, etc.) originate mostly from the middle region of the shoots from the previous year (mesotony). They continue the bow-shaped, upward-rising form, which strives away from the center. These shrubs have a centrifugal development. (b) The opposite gesture is found among shrubs with upward-rising shoots (hazel, spindle tree, etc.). The upward expansion also determines the branching-out: on the shoots of the previous year, mostly the upper lateral (axillary) buds sprout (acrotony).

The flowering shoots usually emerge from the buds of these long shoots during the following year. The blossoms thus originate far up in the sphere of light and warmth. From the long branches of the wild rose, the black elder or the tamarisk, for example, long, bow-shaped shoots emerge. However, these do not flower until the following year. Shrubs develop in a two-year rhythm, alternating vegetative growth with flowering.

We are reminded of the biennial herbaceous plants, which under the influence of Mars develop rosettes one year and flowering shoots the next year. The biennials are form expressions of the Sun-Mercury-Venus-sphere modified by Mars. In the shrubs, Mars also manifests itself directly in the plant's development. After conjunction with the sun, Mars moves farther and farther away *(v. p. 42)*. First moving along a wide-reaching curve that ascends with the sun, Mars then turns against the sun's path towards opposition. Mars, during this movement, has such a forward-pressing, dynamic power that it is directed towards the moon and the earth like no other planet. The bow-shaped shoots so characteristic of many shrubs, which in only a few months grow three to four meters in the rose and the black elder, and even five meters long in the blackberry, directly reflect Mars' urge away from the sun. Like Mars in its relationship to the sun, they press upward from the center and then bend down again.

During the following year, Mars moves away from the earth towards a new conjunction with the sun. In the same manner, the flowering shoots originate from the bow-shaped shoots of the first year; they rise upward and turn towards the sun with their blossoms.

This image of Mars lives in the various shrubs under innumerable modification. The blackberry is characteristically extreme. In it, the two-year rhythm is manifested most purely. Its bow-shaped branches press upward to a lesser degree than in the rose or the black elder, but it expands all the more in diameter. The branches bend back to the ground and they root there, as Mars on its way into opposition approaches the moon and the earth. From the point of rooting, a new bow-shaped shoot develops during the next year. On the bow-shaped branches of the previous year, the flowering shoots with their beautiful white blossoms emerge. After the flowering and fruit stage, the entire shoot dies off in the fall, at the end of the second year. Meanwhile, the new bow-shaped shoot has rooted.

In another group of shrubs, to which the currants and gooseberries belong, the vegetative shoots in particular grow towards the sun—as Mars does after the conjunction with the sun *(v. Fig. 37b)*. During the following year, the flowering shoots emerge and, characteristically, bend to the side and then downward. They grow by turning away from the sun, towards the earth, as Mars does when approaching opposition. The blossoms remain small and often green.

Here, then, both phases of the synodical movement of Mars are expressed in the alternating rhythm of the shrubs: the movement

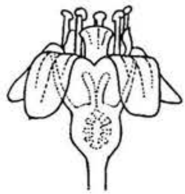


Fig. 38 The two-year-old shoot of a gooseberry bush *(Ribes uva-crispa)*. During the first year, the shoots merely form leaves. From the axillary buds, small bow-shaped shoots emerge during the following year with blossoms and fruits. As with most shrubs, the receptacle of the gooseberry blossom forms a jug. The small petals and stamens are carried upward beyond the level of the receptacle. The growth gesture of the shrub, the intense upward expansion in height and width, also dominates the development of the blossom (after Rauh, modified in part).

towards conjunction in the vegetative shoots and the movement into opposition in the flowering shoots. The spindle tree and the daphne belong to this group of shrubs, too.

In contrast to the trees, almost all shrubs form fully-developed blossoms with corollas, even if these are not always so magnificent and radiant as in the rose, hawthorn, blackthorn, elder, barberry or tamarisk. Even in the developing blossoms, Mars is discernable. The receptacle of the gooseberry, the currant, the alder buckthorn, the buckthorn, the hawthorn, the blackthorn, the spirea and, most importantly, the rose, expands and rises as a flower cup above the receptacle. The petals and stamens no longer originate from the receptacle—the reflection of the sun—but from the space around it. The stamens stand on the edge of the flower cup as Mars' sphere skirts the sun's region. In the elder and the daphne, the corollas form a little jug, which carries the stamens beyond the receptacle into the surrounding atmosphere. Fig. 38

On a remarkable number of shrubs, fleshy fruits, particularly berries, develop. In contrast to the dry fruits characteristic of most herbaceous plants, these fruits collect an excess of nutrients. For the plant, it would suffice to have fruits that dry up and wither during maturation. Many of our native trees have those kinds of fruits, which usually act in typical ways. Often they form wing-like organs for movement in the air: the essence of the tree—its arrangement in the atmosphere—is expressed even in the fruits. Shrubs arrange themselves differently. Their essential growth pattern is expansion in height and breadth. In like manner, the nutrients stream upward and are collected in the plump fruits. During winter, they serve as food for the birds. The shrubs thus blend into the broader frame of nature.

The vegetative shoots, like the flowering shoots with their blossoms and fruits, possess characteristic formations: thorns and spines. On the blackthorn, the hawthorn, the sea buckthorn, the buckthorn and the prickly broom, the thorns are transformed secondary stems. They originate from the axillary buds, which would normally sprout during the following year. The thorn shoots, however, develop during the same year as the shoots from which they emerge. The shoot presses out rather intensely, but length and thickness are inhibited by strong compression and solidification forces. Mars surges forward but also retrogrades sharply (14 degrees of arc) to cause a combination of abundant, overzealous shoot development and compressing inhibition.

The spines of the rose, blackberry and raspberry are not homologous to the thorns. They are not modified secondary stems or leaves (as, e.g., the thorns of the barberry), but derive from the surface layer of the shoots, from the epidermis. Their formative forces act similarly to those in the thorns, in that development presses beyond the boundaries of the shoots to all sides and immediately ends in solidification and obstruction.

7. The Dwarf Shrubs

Between the herbaceous plants, which press upward from their buds into the sphere of light each year, and the woody plants, which maintain their forms there, the dwarf shrubs constitute a distinctive form of growth. Most striking are the Scotch heather, the whortleberry and the lingonberry. They grow in the mountains, coniferous forests and moors, and especially in the poor soils of the heath, covering vast areas. In the northern reaches of the vast western European heathland that stretches along the Atlantic Ocean from Portugal to Scotland, the dwarf shrubs, particularly the Scotch heather, increasingly imprint their character on the land. The dwarf shrubs, like the herbaceous plants, adhere closely to the ground. Many do not become even as tall as some of the larger herbaceous plants.

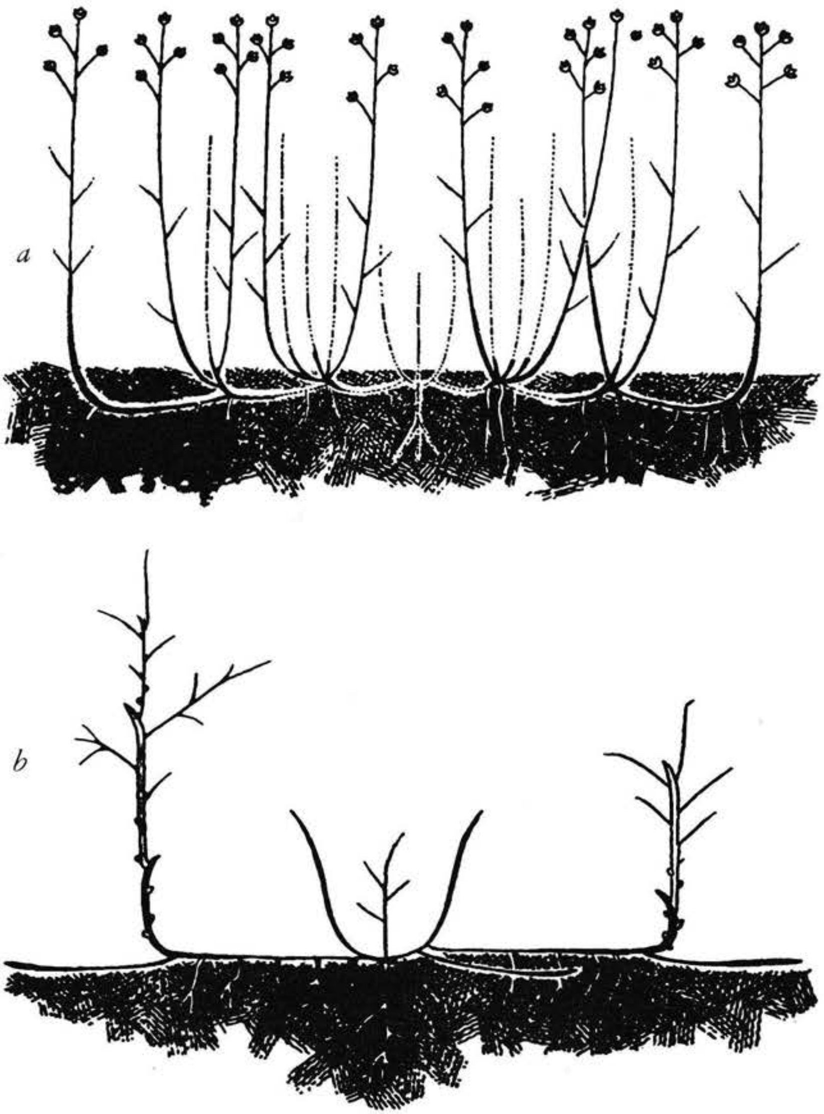


Fig. 39 Growth pattern of a flowering perennial plant during its fourth year (a) and of a dwarf shrub (b) blueberry, (*Vaccinium myrtillus;* after Rauh, modified).The perennial continues to expand with its shoots in the vicinity of the original center shoot. The shoots of the blueberry develop similarly. They are, however, perennial and expand upward sympodially.

The development of the dwarf shrubs is very similar to that of the perennial plants and the shrubs. The primary shoot remains weak, as in the whortleberry. The plant continues to grow, with new shoots filling the area surrounding the center shoot year after year. These shoots become woody and push upward into space. Through the years, a small, branched shoot system develops. From the shoots branching out over the ground, roots break into the soil to tie down the entire plant. The growth of the dwarf shrubs is strongly inhibited and they remain tiny. The leaves are set close together on the branches, as in the conifers. The leaves are small, simple and often tough. In several species, they are so narrow that they approach the form of needles, and like the needles of conifers, they isolate themselves from the annual rhythm of the sun. On only a few species, such as the whortleberry, are they shed in the fall; otherwise, they persist two or more years. The blossoms also are often set close together in the inflorescences. Among the heather species, the corollas often form tightly enclosed interior spaces. Fig. 39

In the dwarf shrubs, the suppression of growth forces at work in connection with the wood-forming processes *(v. p. 87)* is the same that we encountered in the conifers as a manifestation of Saturn. The conifers tower high above the ground, while the dwarf shrubs are bound to the ground, revealing their relationship to the perennial herbaceous plants. Dwarf shrubs are really more developed manifestations of perennial herbaceous plants, in which Saturn's inhibition has led to permanence.

The plants of the Atlantic heathlands have a peculiar relationship to Saturn's rhythm. After a fire, it takes a decade for regeneration. The heath then remains in a mature state for a full ten years, during which the growth of the dwarf shrubs slows down. After a ten-year period of degeneration (or frequently even before the beginning of this period), the heath burns again. Dwarf shrubs are also characteristic of areas where desiccating heat strongly intervenes in the life processes of plants, namely in the desert regions.

The so-called trellis plants are even more closely allied with the ground than are the dwarf shrubs. Their shoots do not expand into the atmosphere at all. Only the blossoms of, for example, the mountain avens, one of the most magnificent Alpine plants, reach up into that sphere.

8. Summary

We arrive at a comprehensive view of the most important growth patterns when we observe how each entire plant form reflects the dominant influence of a planet. Even though we will proceed to explore individual plant families, we can now summarize our previous findings:

Annual Herbaceous Plants:

The formation of the plant falls predominantly under the influence of the sun and Mercury.

Biennial Herbaceous Plants:

With longer development, the Venus influence, which exceeds one year and causes the development of the blossoms in the second year, becomes prominent. The entire development reflects the dynamic Mars modifications in the herbaceous plants.

Perennial Herbaceous Plants:

Under the moon's influence, renewal buds develop as organs of continuance. The perennials appear like undeveloped trees, although their individual forms vary greatly. Jupiter, also, has a moderating influence on these plants.

Dwarf Shrubs:

They resemble perennial herbaceous plants. The shoots become woody, and the entire plant is permeated by Saturn's inhibiting influence.

Shrubs:

While the effect of the sun and Mercury is merely modified by Mars in the biennials, the whole dynamic of Mars is expressed in the shrubs.

Deciduous Trees:

The form of the plant expresses the relationship of Jupiter to the sun.

Conifers:

As the deciduous trees are an expression of Jupiter's character, the conifers are a reflection of Saturn.

Plant Families as Expressions of Dominating Planetary Influences

In the following text, our observations will turn to even more specific details. A number of families of the flowering plants will be examined more closely. We enter a field still largely unexplored in its internal structure. The comparative study of plants has taken great care to uncover the relationships in form between the species and genera and thus has arrived at the various families among all the flowering plants. The families comprise higher systematical units based upon general similarities: for example, the lily family, the narcissus family, the iris family, the agave family and the black bryony family all belong to the order *Liliales*. The question, however, of why such families as *Liliaceae, Ranunculaceae, Rosaceae* or *Umbelliferae* even exist has not yet been tackled seriously. Paleobotany, at best, indicates at what past time imprints of certain plant families are first to be found in the geological record.

In connection with the problem of classifying the multitude of plants, Goethe pointed out that in addition to the idea of metamorphosis, the formative force principle working in all plants, a second opposing principle is at work, the urge for specification. In contrast to the view of metamorphosis, which observes life generally undergoing transformations and therefore leads to seeing things as "formless," the urge for specification is "the inertia of that which has just become a reality."[41] Here lies the basis for the lively, flowing Type to establish definite, solid forms. These two laws act simultaneously. Goethe did point out, however, that in some plant groups, like the gentians, the forms remain stable, just as the rosaceous plants are dominated by change. But he gave no further details concerning form stability.

The process that leads to the multitude of forms cannot be found in the mutations and selections of genetics and phylogenetics. Partic-

41. Goethe, "Probleme und Erwiderung" in *Goethes naturwissenschaftliche Schriften*, vol. 1, p. 121.

ularly in these fields, the development of the comprehensive morphological systems—the classes, the orders, the families—is not wholly satisfactory. The question concerning the inner laws cannot be brought up as long as concepts are still applied that presume that new forms develop merely by chance, with environmental conditions determining survival and progress.

We have to seek the key to an understanding of the individual families of flowering plants in the growth forms of the Type, in the archetypal plant itself. In each plant form, not only its individuality but also the general type may be recognized. Every modification is specific. We may thus focus our attention on the following: the type enters into many particular forms, and shines, as it were, through them. Individualization accords with those principles operative in the type itself.

We will clarify this further with examples of several plant families native to Central Europe. We will not outline the various groups of flowering plants occurring there. Rather, the following chapters will illustrate, exemplified by a few characteristic families, how one can see and understand the laws of formation and the relationship between families.

1. The Grasses

If we follow not the botanical system but the significance of the plants in their natural environment, we must begin with the grasses. Although some plant families have a greater variety of species (for example, *Compositae, Orchidaceae, Leguminosae* and *Rubiaceae*), they do not dominate the image of our vegetation so extensively as do the grasses. These form a green carpet of life over wide areas, on which the other flowering plants appear to be merely sprinkled. In the tropics, where the earth is under the strongest influence from the sun, grass areas are particularly vast. They cover mostly the plains, where the sun dominates from sunrise to sunset through its intense light and heat.

The sun penetrates the grasslands deeply. About halfway up the blades, more than 50 percent of the total light still filters in. In a field of clover, for example, the light is suppressed much more quickly than in a grain field. The grasses grow and live to a greater extent in the sun-permeated atmosphere than do most other plants. Yet the grasses are also strongly attached to the earth. The roots generally do not extend far, but they do penetrate the ground very intensively. A single rye plant that is not crowded by neighboring plants, as it

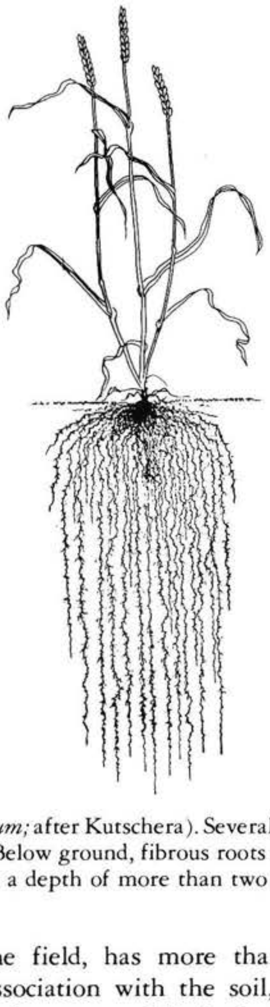


Fig. 40 Wheat *(Triticum aestivum;* after Kutschera). Several blades develop from a single seed through tillering. Below ground, fibrous roots are formed, which penetrate the ground intensely to a depth of more than two meters.

would usually be in the field, has more than 80 km of hair roots. Because of this close association with the soil, the grasses are capable of efficiently absorbing moisture, especially in dry regions.

Thus the grasses are particularly well-adapted to, and harmonize with, the conditions of nature. Living substance is formed everywhere, from the time the plant leaves its connection with the ground and its moisture and yields to the sun with its stems, spikes and panicles. No other group of plants takes up the light forces emanated from the sun into its development of substance to such a degree. Only the trees may stand comparison to the grasses; the trees, however, deposit these substances to a great extent directly as wood. The grasses stand in their entirety in an abundance of light, because their narrow stems and leaves cast little shade. In many of them, the light enters more strongly into the processes of life than in most plants. In general, the utilization of light is 5 to 10 percent; in some grasses this is increased to 24 percent. The extraordinary vegetative force of the grasses is based on this, thus enabling the plants to germinate shortly after a fire or mowing, given good weather conditions. The lives of many animals, such as cattle, antelopes, horses and zebras, are completely dependent on the grass-covered plains. And because human beings succeeded in cultivating wild grasses to produce grain thousands of years ago, the living substance of those grasses also became a basic of human nutrition.

The close relationship of the grasses to the sun is expressed most of all in their form. In no other plant groups is the form determined so much by the center shoot. The long internodes' strong upward-pressing includes the lower leaf, which envelops the stem as a sheath. Therefore, the lower part of each leaf shares the character of the stem. It is particularly amazing to observe this upward-pressing when a broken stem erects itself at one of its nodes against the forces of gravity. On the stems, even the slim upper leaves initially develop in the vertical direction of the shoot. With their elongated, rolled-up form, they appear to be the top part of the stem. When they unfold and gradually bend towards the side, the new "tip" pushes out of the sheath of the lower leaf. The plant continues to develop leaf by leaf out of its center, until the ear with its panicle is finally formed. In wheat, the ears develop in the center of the still bud-like, undeveloped blade. Then the stem, leaves, and finally the ear push rapidly upward. When the grasses harden in their forms, they preserve living tissue capable of growth in their nodes.

This formation can be compared with another case where one organ is enveloped by another: the layered bulb, which reflects the moon's influence. While the shoot and leaves remain in a bud stage in the bulb, they expand upward most strongly in the grass blade. The grass stem appears as a pronounced bulb that has been stretched vertically. Intense solar influence transforms the mucous, moist character of the bulb into its opposite: the dry, air-permeated blade. Whereas the bulb is full of substances, the grass stem is a masterpiece of static engineering in that it carries the spike and panicle up above while using a minimum of matter. In many of our grasses, a layer of woody, fibrous tissue develops close to the surface of the stem, giving particular stability to the stem in its hollow, cylindrical form. Nevertheless, the lower leaves, enveloping the shoot tightly, still resemble the bulb. This connection becomes quite apparent in the rhizomes of various grasses, such as the reed. As in the bulbs, the lower leaves envelop the earth-borne shoot and its shorter internodes.

During drought periods in the tropics, when the above-ground parts of the grasses wither, the many layers of dry leaf blades protect the delicate growing points of the shoots. Here they outlast the long periods of dryness much as the bulbs protect themselves through their dry external bulb layers. Thus there is also a functional correlation between the grass blade and the bulb.

Out of this relationship we may understand the strange structure of the grass stalk, with its close connection of leaf and stem. We are reminded of a form connected to the moon—the bulb—which, however, has been imprinted with the sun's signature in the extraordinary development of the upwardly expanding shoot. The grass blade is the reflection of a peculiar interaction of the moon and the sun in the region of the green plant, in which the sun—like the moon in the bulb—is the dominating force.

The sun's effect is even stronger in the grains. Most grasses are perennial. They undergo a bud-like development period during which it is mainly the moon that affects them. This interference by the moon is eliminated in the grains: all grain species are annuals and undergo their entire development during the one-year course of the sun.

This stronger relationship to the sun is expressed by the substances that are formed in the leaves by the light and which almost entirely flow to the newly developing tillers, leaves and inflorescences. Thus the grains grow much taller than many other grasses. In the perennial grasses, life is strongly concentrated in the underground buds and roots towards the end of the vegetative period, whereas in the grains it is concentrated above ground. Ripening takes hold of the entire plant with its drying, warmth processes, especially in the ears of the grain, where the milk stage proceeds to a mature stage of ripeness. Sometimes the grain (wheat and rye) reaches a dead ripe stage if it is harvested too late. The warm yellow coloring of the mature grain field is the manifestation of this vigorous process of maturation.

The relationship of the grasses to the sun becomes apparent also in the characteristic flowers and inflorescences. They lack almost everything usually expected in blossoms, most importantly the colorful corollas. Their rather dry glumes look like small grass leaves. Like the leaves, they develop on the stems in two rows. The one-half positioning of the leaves, that manifestation of Mercury that resembles its moving away from the sun in alternate opposite directions *(v. p. 29)*,

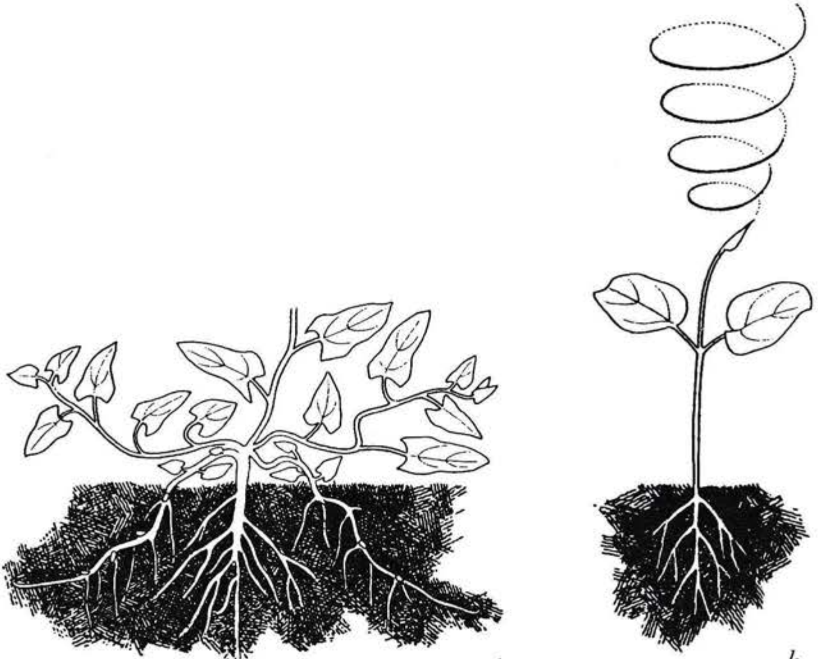
is continued in the blossoms and spikelets, the tightly compressed, tiny inflorescences. Venus is not represented at all here. The grasses are a reflection of the moon, the sun and Mercury, even into their flowering sections. Those two small formations that comparative morphology considers to be underdeveloped, stunted, rudimentary petals, the so-called lodicules, push apart the glumes somewhat during flowering. This active opening up is an indication of the expansion that usually marks the corolla.

How little interior space there is in the blossoms may be seen in the way the two stigmas with their delicate, feather-like division penetrate between the opening glumes and the three anthers, and how these anthers sway in the wind. The flowering process takes place entirely in the light- and warmth-filled atmosphere, as did the development of the stem and the unfolding of the leaves. The fruit develops there, too. The seed coat joins with the pericarp to form the caryopsis characteristic of the grasses, which is a fruit but at the same time looks like a seed. The grasses thus form stamens; these lack, however, the impulse towards height and width so characteristic of Mars. Likewise, the seeds are not surrounded by an individual fruit that would indicate Jupiter's influence.

2. The Bindweed Family

The bindweeds, which unfold their large, white or delicately red-colored, funnel-shaped blossoms during mid or late summer in the fields, pastures and around bushes, are among the most impressive plants in our flora. Of the numerous (more than 1600) species of the family, our three European species are but a small sampling. Nevertheless, important relationships may be studied from them, as they clearly express the type of the bindweed family.

In many aspects, the bindweeds are built exactly contrary to the grasses. The shoots are so weak they need external support to help them rise above the ground. When the support is lacking, they spread along the ground. A hedge bindweed that has climbed up some wire mesh or a bush impresses us with its beautiful, simple leaves. The leaves turn their blades towards the sun and often form an almost closed green cover. Through this cover peek the large, white, funnel-shaped blossoms. The stems or a stem system are hardly visible. When the plant's support is removed, it becomes apparent how weak the internodes are. They are little stronger than petioles or flower stems. The leaves and blossoms are joined with what seem like cords. Whereas the grasses reach a high degree of static perfection, the bindweeds lack firmness and stability. One can hardly speak of a stem; this string-like internode has scarcely any inner relationship to the sun. The leaves and flowers, which would normally be grouped around the stem, stretch away from the internodes towards the light.



a b

Fig. 41 (a) Young hedge bindweed *(Calystegia sepium;* from Hegi). The shoots originating in the axils of the cotyledons penetrate into the ground. There the plant undergoes an essential part of its development. From these underground shoots the winding shoots emerge into the light-sphere. (b) Young germinated morning glory *(Pharbitis purpurea;* after Rawitscher, modified). Already the young shoot completes a regular rising spiral motion around an ideal axis.

On the young seedling plant, it may be observed how the formative impulse from the sun recedes and other forces determine the development of the shoot. The field bindweed, which often runs rampant in the gardens, has a weak center stem, which soon withers. From the buds in the axils of both cotyledons, however, secondary shoots emerge. Most importantly, the root continues to penetrate deeply into the ground. From there, further development begins. During the second year, root buds develop into earth-bound shoots *(v. Fig. 41a)*.

Up to this point, the plant reflects the moon exclusively *(v. p. 83 ff.)*. Out of this dark underground existence those shoots develop that later stretch upward into the sphere of light and air. The seashore glorybind of the East Frisian Islands and the hedge bindweed first undergo this developmental stage far from the sun as underground shoots. The stems of the seashore glorybind remain on the ground when they reach the light. They lack not only firmness and the inner relationship to the sun, as do the other bindweeds, but also the circumnutation of the bindweeds in the light. Other species, such as the beautiful morning glory, a native of the tropical regions of America, develop straight up from the young germinating plant. The center stem soon begins to move in a circling motion. It bends to the side and grows by turning its tips to all sides, spirally upward *(v. Fig. 41b).*

Even later, when the bindweeds have matured, their stem apex still continues this circling motion. The plant develops in upward-rising spirals. After the first developmental stage of the underground shoots influenced by the moon, a second cosmic law manifests itself. Soon development reflects the spiral movement in which Mercury—of course over a much longer period of time—orbits the sun.

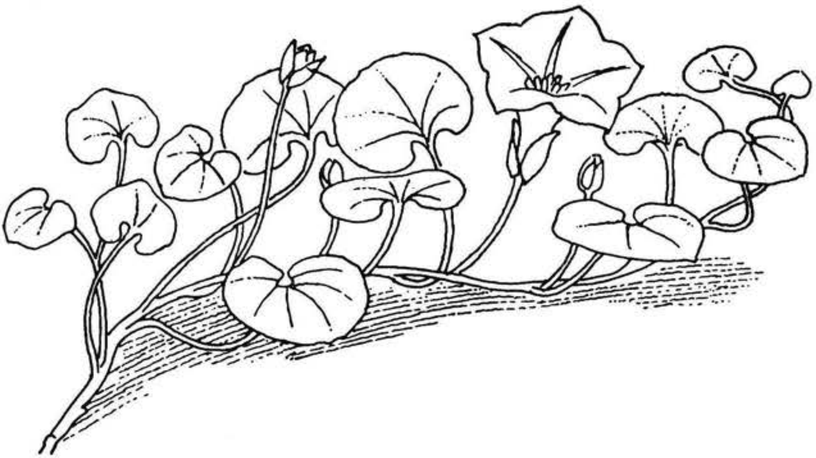


Fig. 42 The beach bindweed *(Convolvulus soldanella;* from Hegi), a plant which grows all over the world. Its shoots penetrate up to 1.5 meters into the ground. From there the shoots spread above ground. The *Convolvulus soldanella* blooms between June and August.

We can observe how field or hedge bindweeds sometimes climb on blades of grass. Here two laws are joined externally that, as a rule, are usually combined within the plant. What we see is a reflection of the sun's movement and Mercury's orbiting the sun. As Mercury moves away from the sun east to west on a cosmic scale, the shoot—in most bindweeds—spirals to the left; it also climbs up the blade of grass counter-clockwise.

Goethe speaks about the winding plant in his essay "Über die Spiraltendenz der Vegetation" (About the Spiral Tendency of Vegetation): it "searches externally for that which it should give to itself but cannot." This is the vertical tendency originated by the sun. Because it is lacking, the form expressions originated by the sun recede *(v. p.16)*. The nodes stretch out, like shoots growing in darkness, much earlier and more intensely than is usual with herbaceous plants. The delicate, underdeveloped leaves come out of the terminal bud prematurely, as tightly fitting scales. When the sun-related form-

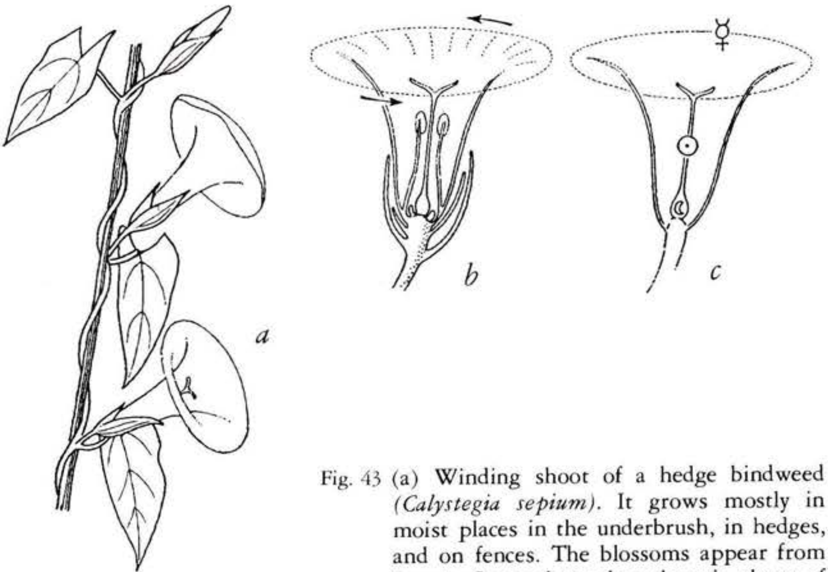


Fig. 43 (a) Winding shoot of a hedge bindweed *(Calystegia sepium)*. It grows mostly in moist places in the underbrush, in hedges, and on fences. The blossoms appear from June to September, when there is plenty of light. The blossoming stage and the form of the blossom show a strong urge toward the sun. In contrast to the field bindweed, the blossoms of the hedge bindweed open even during bright, moonlit nights.
(b) Longitudinal section of a hedge bindweed blossom. The corolla emerges from the sheath of the bracts and the calyx. The arrows indicate the direction in which the developing corolla is turning.
(c) Within the blossom, the style is the reflection of the sun. Surrounding it, the corolla develops in a spiral motion similar to that of Mercury in the sun's sphere.

expressions of the shoot are weak, another law of formation begins to take hold in the development of the leaves. The leaves are the strongest expression of the circling tendency in the plant; they generally develop on the stem in upward-rising spirals. This law of formation now dominates the plant. The terminal bud now also assumes the horizontal position normal for the leaves, and grows upward through the spiral movement in all directions. The leaves, although they emerge from the protective enclosure of the terminal bud prematurely, take longer than usual to develop from their first appearance in the vegetative bud until their final size is reached. This, again, shows how strongly the development of the leaves is emphasized in the bindweeds.

To gain a deeper understanding of the formative processes in the plant, one must distinguish between shoots that resemble the character of the sun (center stem of the herbaceous plants), the moon (underground stems, rhizomes), Mars (bow-shaped stems of the shrubs), Jupiter and Saturn (trunks and branches of trees), and Mercury (the stems of bindweeds). Since Mercury and not the sun affects the bindweed stems, these do not end in inflorescences. The stems continue to grow until external conditions end their development. The flowers originate in the leaf axils, either individually or in groups. The development of the flowers is also dominated by the spiral tendency. Excessive stretching of the internodes also plays a modified part in the development of the flowers. The various organs—for example, the calyx, corolla, stamens and pistil—do not develop simultaneously in their rudimentary form at the vegetative point, but successively. It becomes evident that the characteristic successiveness in leaf development also plays a role in the development of the flower.

In the hedge bindweed, the calyx is enveloped by a pair of tiny leaves. The corollas of the bindweed family in part develop within a double sheath of leaves. They open in a spiral movement and expand into a characteristic funnel shape. At the base, the bindweed blossoms are narrow. The stamens are grouped tightly around the pistil. Just the edge of the corolla turns its depth towards the sun. The gesture of Mercury is also found in the flowers in two ways: first, in the counter-clockwise growth of the corolla, and secondly, in the form. The form indicates that at first the flower continues in the narrow, hollow receptacle and only gradually unfolds its characteristic flowering expression. The winding motion expresses itself in the continuous adjustment of the edge of the corolla towards the surrounding space. The corolla is the gesture of spiralling trasformed into a three-dimensional form.

Not all bindweeds are so intense a manifestation of Mercury as the field bindweed and the hedge bindweed. The dwarf morning glory,

Fig. 44 *Convolvulus tricolor* (from Hegi, modified), an annual from the Western Mediterranean region.

native to the Mediterranean region, develops a vertically stretching center stem. The plant nevertheless retains the character of the bindweed family in its entire form, not just in its blossoms. The shoot initially develops only leaves. The blossoms originate in the axils of the older leaves, just as we have seen in the field bindweed and the hedge bindweed. Again Mercury, together with a stronger influence from the sun, determines the form. In warmer regions, the bindweeds even turn into shrubs with branches winding upward.

According to Julius, all winding plants may be interpreted as a single pattern of growth, which manifests itself within the various plant families. There are winding plants among the following native families: *Aristolochiaceae* (birthwort), *Leguminosae* (bean), *Cannabaceae* (hops), *Polygonaceae* (wild buckwheat), *Caprifoliaceae* (honeysuckle) and *Convolvulaceae*. They all have in common the Mercury-like development of the shoots: the intense growth of the nodes that is related to the winding motion, and the development of the blossoms and inflorescences in the leaf axils. The purest reflection of Mercury, however, can be seen in the bindweed family, particularly in the blossoms. The herbaceous forms, like the field bindweed and the hedge bindweed, reveal the purest form among the bindweed family. They illustrate how the entire plant at first develops under the moon's influence and only from there expands into the higher region of Mercury-related development. In a few species, such as the dwarf morning glory, the plant finds the connection with the sun's formative forces.

From this comprehensive view of the *Convolvulaceae,* a rather vast field can be taken in at a glance. One plant species is even connected to Mercury by name: the mercury plant has been called *Mercurialis* since ancient times. Dog's mercury, which covers vast areas in beech woods and marshy meadows, in springtime grows underground as a rhizome. From below ground, a green shoot with increasingly larger, simple-formed leaves emerges. Inflorescences with small, greenish blossoms are located in their axils. In the bindweeds, as in the mercury, the shoot is strongly influenced by Mercury's character. This is emphasized by the fact that flower formation is only hinted at. Whenever the shoots of herbaceous plants express themselves predominently through the development of the leaves, we are sure to find Mercury's signature.

3. The Umbellifers

Like the grasses, the umbellifers are midsummer plants. The earliest among them, such as the wild parsley and the lady's comb, blossom as early as April; others, like the sea holly and the common sickleweed, continue flowering into October. The main period of flowering, however, occurs in the months of strongest light and warmth: June, July and August. Then the umbellifers unleash their strong vegetative force in the meadows, forests, marshes and mountains.

Almost without exception, they continue to grow anew each year into large herbaceous plants. Their usually white, expansive inflorescences clearly stand out above the other plants on the midsummer meadows. Among the umbellifers of our flora, perhaps not the tallest, but the most impressive, herbaceous plants may include the poison hemlock, the water fennel, the wood angelica and the cow parsnip often found in meadows. Mulleins and thistles may well expand upward more strongly, but they develop mainly in their center shoot. The umbellifers, on the other hand, fill the surrounding space much more because of their branching habit.

When we observe the gradual development of the annual vegetative cycle, starting in early spring, and see how the shoots grow taller and the flowering process becomes more intense, the umbellifers appear

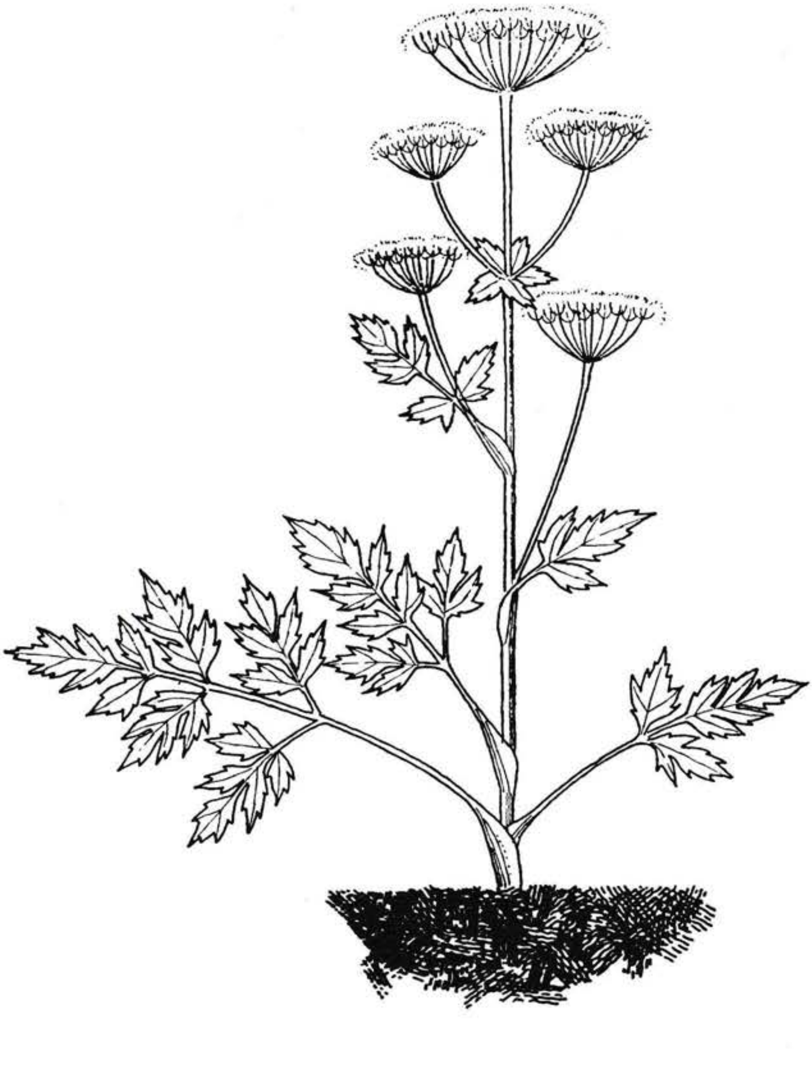


Fig. 45 Meadow parsnip *(Chaerophyllum hirsutum;* after Hegi, modified). This plant exemplies the type of the *Umbelliferae* in its form development. It is most common in moist, mountainous forests. The plant flowers from May to August.

as the climax of this development. Hegi notes that in Persia, Afghanistan and Turkestan, certain umbellifers grow to be five meters high during one growing season.[42]

All the organs of the umbellifers are permeated by this intense growth, which expands out into the surrounding space. It is particularly evident in the inflorescences—the umbels. They develop at the top of the center shoot and its secondary shoots. From there, the umbels radiate upward and outward. From their tips, the tiny umbellules, with their white (occassionally yellow or greenish-yellow) flowers, unfold like miniature reflections of the entire inflorescence. The flowering process extends beyond the mere region of the shoots. With its numerous, small, star-like blossoms, it not only bends upward towards the sun but also to the entire universe.

With this gesture of dispersion, almost all enclosure of the inflorescences, as well as the development of interior spaces within the flowers, is eliminated. At the bases of the umbels and the umbellules, we often find no indication of leaf forms, bracts or bractlets or an involucre. The calyx of the individual flower is hardly developed. The corollas are generally opened wide and the anthers carried beyond the blossoms by long filaments. The petals and stamens are formed on top of the ovary, that is, on the outermost section of the plant.

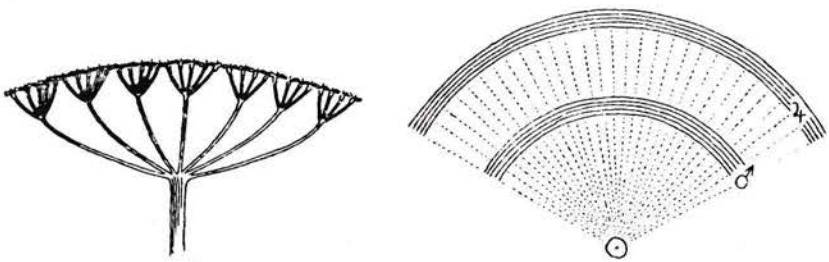


Fig. 46 Inflorescences of the *Umbelliferae* with their double structure in the space above the shoot in its relationship to the spheres of Mars and Jupiter containing the sun.

Seen from above, a fully developed umbel is a small carpet of blossoms spread out in the light and the air. On it, numerous insects congregate, taking up the nectar from the styles of the many small blossoms. Viewed from the side, the double umbels seem to be an image of certain cosmic relationships. The image of the sun is reflected in the shoot. Above this, the umbel expands, as it were, in two tiers,

42. G. Hegi. *Illustrierte Flora von Mitteleuropa,* vol. V, part 2 (Munich) p. 941.

or spheres: first, up to the tip of the umbellate rays, and then from there to the rays and the flowers of the umbellules. The blossoms stand above the shoot much as Jupiter in the region of the far planets is located beyond the sun and Mars. Jupiter's character is also revealed in the total yielding of the blossoms and inflorescences to the universe. As Jupiter radiates the sun's light into cosmic space *(v. p. 44)*, the umbellate flowers radiate above the shoot into the atmosphere.

This radiant expansion also characterizes the development of the shoot system. Strong secondary shoots develop from the center shoot and greatly expand the form of the entire plant. The same tendency permeates the leaves and fruits of the umbellifers. The leaves of most genera are pinnate. The blades of the pinnate leaves separate into a number of leaflets, which distribute themselves in space from the petiole. Often, this distribution process continues, and bi-, tri-, or quadro-pinnate leaves develop. The leaf, like the umbel, dissolves into the surrounding space. Such a leaf often looks like a small branch with numerous leaf-bearing secondary branches; the entire plant correspondingly looks like a small, loose tree on which blossoms form as though in miniature crowns, the umbels. The mature, dry fruits (the schizocarp) even separate, as in the maple, into two partial fruits (mericarps), which at first still hang next to each other on the small "crowns" from a delicate stem.

The similarity of the strongly expanding umbellifer to an open, loose tree is not mere chance. As the deciduous trees are the pure, perfect manifestation of Jupiter in the plant kingdom, the umbellifers with their branching shoot system, their leaves which disperse into the atmosphere, the development of the umbels and the division of the ovary are the image of Jupiter among the herbaceous dicotyledons.

In the middle of the umbellifers, located on the center shoot, formations of an opposite character are present. In many genera and species, the lower leaf is developed as a large blade which generously encompasses the shoot. With its parallel venation, it looks like a hollowed-out monocotyledon leaf, like one of those still scale-like leaves from the newly developed shoots of underground buds. This apparent correspondence is indeed connected with the function of these blades. Like well-rounded, filled buds, the blades envelop the undeveloped part of the umbelliferous plant. When we follow their growth, we see how each successive section of the shoot up to the next leaf develops out of this "bud." The later stages of the shoot are again enclosed in this section, as in a Russian doll. The blades of a fully grown plant remind us of how the entire development of the plant has been permeated by bud-like conditions. Normally these bud-like conditions would appear only at the ends of individual shoots, primarily on trees. There, growth reaches a period of rest, while in the umbellifers it urges onward and the blades often swell tremendously as a result.

The divided upper leaf connects to the leaf blades, with their enveloping character, like a polar opposite. It sits, as it were, on an enlarged petiole or on a monocotyledon leaf. The position of the leaves also corresponds to the mercurial character of the leaf form; in the umbellifers, the one-half position is predominant, particularly in the lower sections of the shoot.

The umbellifer is a rather complicated plant type. The bud stage, from which the herbaceous plants generally emerge in the spring, continues on in the further development of the plant, though in a modified way. Even above ground, where the plant enters the region of strong influences from the sun, it develops out of a lunar isolation, and then it achieves the above-mentioned union with the surrounding space. The character of Jupiter always develops anew out of this lunar isolation.

Despite all the differences, there is a similarity with the grasses. In the umbellifers, just as in the grasses, the center shoot develops powerfully; it pushes upward out of the sheath of blades. While the grasses, through their relationship to the sun, center their entire development in the center shoot, the umbellifers spread out into the environment.

In order to demonstrate the validity and utility of our viewpoint, we will now study the umbelliferous type in its differentiations. The type manifests itself most perfectly in those genera and species where the leaves dissolve into the atmosphere through their multiple pinnation, the secondary shoots strongly penetrate into the space surrounding the center shoot, and numerous radiating umbels create a richly developed inflorescence. The intensely radiant character of these umbels is expressed also in the fact that the subtending bracts and bractlets are developed only slightly, or not at all. The perennity characteristic of Jupiter leads to perennial herbaceous plants. These formations may be found, for example, in the genus *Angelica* and both magnificent Alpine species of laserwort.

Aside from those plants that manifest Jupiter so perfectly, there are those whose form is less developed, on which there are fewer, generally simple, pinnate leaves. On the umbels, the blossoms are enclosed like buds for some time by means of stronger bracts and bractlets. The umbels appear less radiant because a smaller number of umbellate rays develop. The secondary shoots remain relatively short in comparison to the long center shoot, as in the parsnip. Most of these umbellifers are biennial, and they express the dynamic force of Mars. Thus, the shoots of the second year grow especially high, as in the cow parsnip, parsnip, waterdropwort and "Rippensamen" *(Pleurosperum austriacum)*.

As Mars in its movement stretches only so far as the periphery of the sun's sphere and accordingly is more contained in its orbit than Jupiter, the umbellifers are somewhat restricted to the vicinity of the center shoot.

A third group of umbellifers, to which the wild chervil, the lady's comb, the hedge parsley, the wild carrot (two species), and the "Breitsame" *(Orlaya grandiflora)* belong, are quite similar to the preceding two groups in their development. These plants, however, are annual herbaceous plants in harmony with the yearly course of the sun. The umbelliferous type appears to be even a bit more restrained in this group. The plants are a little smaller; the number of umbellate rays is reduced, generally fewer than ten; and there are few flowers in the umbels. The inflorescences of, for example, the "Breitsame" *(Orlaya grandiflora)* and the wild carrot appear to consist of one common blossom produced by the particularly large peripheral petals of the outer umbellate blossoms. The umbels, all in all, express intense solar influence and so relate closely to the center of the plant.

We come across rather different forms in the wood sanicle and the pink masterwort. The compound leaves are palmate instead of pinnate. From the tip of the petiole, the blade expands in all directions, without dissolving completely. Although the leaves are divided, they appear much more centered than the pinnate forms, and their umbels are also less developed. In the pink masterwort, the bracts form a wreath of almost petal-like, white leaflets. The pedicles emerge directly from its center. The sepals of the individual tiny flowers are magnificently developed. Their corollas do not expand like those of the compound umbels. Thus, particularly in the pink masterwort, the radiant character of the umbellifers recedes entirely. The simple umbels, in their white or greenish-white bracts, appear like single flowers, particularly since the outermost of the small individual flowers contain merely stamens. These umbellifers do not grow to be as large as the previously studied species. The secondary shoots are almost non-existent. The type of the umbellifers appears, as it were, to be robed by Venus: the umbels are like blossoms, the leaves form a connected surface with a strong relationship to the surrounding space, and the entire plant expands into a kind of inflorescence in its uppermost parts.

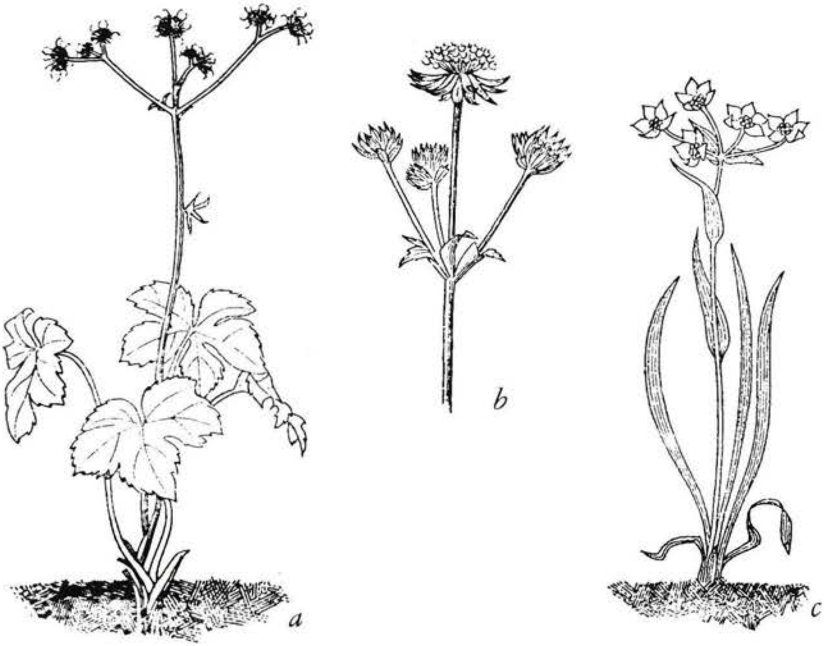


Fig. 47 (a) Wood sanicle *(Sanicula europaea)*. In the tough, palmate leaves, the shoots, and the umbels, the type of the umbellifers is not completely developed. The wood sanicle generally grows in shady beech woods; it blooms in early summer (May, June). (b) Inflorescence of a masterwort *(Astrantia maior)*. The bracts become remarkably large and blossom-like. The leaves, similar to those of the sanicle, are palmate. The type of the umbellifers seems restrained. This plant grows in woodlands, on the edges of forests, and in pastures. Frequently it may be found in mountainous areas. It is in bloom in midsummer (June until August). (c) Hare's-ear *(Bupleurum ranunculoides)*. This plant, which in its entire form is vastly underdeveloped as an umbellifer, grows in mountainous areas on rocks, rock debris, and in rocky pasture, where it is exposed rather strongly to the sun. Its leaf blades emerge directly from the stem and are almost as simple as the leaflets of other umbellifers. Instead of radiance, there is a gesture of envelopment in the inflorescences. The period of blooming is in late summer (July and August).

Mercury's signature among the umbellifers appears in the hare's-ear. The leaves develop in the one-half position of the shoot. The leaves are simple and in almost all species parallel-veined, sometimes even grass-like. A superficial glance reveals no umbels, and they are even less typical than those of the pink masterwort. A relatively small number of flowers stand tightly pressed together, surrounded by radiant yellow bracts, which can hardly be distinguished from a corolla. This umbellifer has the form of a monocotyledon, with umbels at its shoot tips disguised as blossoms. The type is underdeveloped.

The marsh pennywort, a small plant growing in swamps and moors, is even more peculiar. While most umbellifers are natives of the temperate zones of the northern hemisphere, the marsh pennywort belongs to a subfamily of *Umbelliferae* more common to the southern hemisphere, which has larger areas covered by water than does the northern. Its thin shoot develops without any yielding to the sun: it lies on the moist ground; the roots develop from its nodes. The moon thoroughly permeates the development of the shoot. The rather delicate petioles carry the leaf blades above the shoot. The blade expands, like a nasturtium leaf, from the petiole in all directions. It is a self-contained form. The moon's character, which leads plant development into isolation, is thus expressed even in the form of the leaf blade. The small umbels arise as thin stems from the leaf axils. They are a bunch of stunted flowers, hardly more than a bud about to unfold. Under the moon's influence, the umbellifers lose their characteristic affiliation with the surrounding space.

In contrast to the marsh pennywort, which totally clings to moisture, the genus *Eryngo* grows in areas where dryness is prevalent: on the salty dunes of the North Sea and the Baltic Sea (Sea holly), on the dry grassland, which in more continental areas is saturated with the sun's warmth *(Eryngium campestre, Eryngium planum,* flat eryngo), and in the Alps as high-lying patches of perennials *(Eryngium alpinum).* The character of these plants is determined by warmth-related desiccating processes. The shoots become much more woody than in other umbellifers; the leaves harden and even turn into thorns. Nevertheless, plants such as the *Eryngium campestre* become quite large. Much is inhibited, however. The leaves show a tendency towards division, but they remain in a palmately lobed form. Numerous small blossoms develop in the inflorescences; they do not expand into umbels but remain pressed together in compact heads. The petals of the individual blossoms narrow into slim tubal blossoms. This contraction is even expressed in part in the blue coloration of the blossoms, or of the whole inflorescence with its bracts. The characteristic development into the atmosphere of the typical umbellifer can be observed in its beginnings. The entire development of the plant is permeated at the same time by restraining forces and thus has a distinctly Saturnian character. It manifests itself through the peculiarity of certain eryngo species like the *Eryngium campestre*. In the fall, the plants break off close to the ground and, like some other umbellifers of the genera *Falcaria* (sickleweed) and the stone parsley, are blown across the ground as tumbleweeds by the wind. The plant in its entirety serves to spread the seeds. In a dried condition, it is capable, as is usual only for fruits and seeds, of moving through the air. Just as Saturn normally conditions the plant from the seed to sowing, here the entire above ground plant is permeated by the drying-out process characteristic for the development of seeds, and thus becomes the organ of seed development.

The division of the umbellifers into individual genera or groups of similar genera and species thus appears in order. The comprehensive laws of plant development are illustrated by the example of one type. What we have observed in the umbellifers may be applied to the other plant families. Out of the seemingly incidental multitude of forms, standard laws become manifest. A reflection of these all-encompassing laws is known in botany as so-called convergence—that is, the appearance of a similar form within different plant groups, such as the occurrence of parallel venation in the leaves of the hare's-ear as well as in the monocotyledons, in which this leaf form conforms to the type. Convergences have received little attention in botany. They are hardly considered unless they can be interpreted as adaptations to certain conditions of life: an example is the form of the cacti of the American deserts which corresponds to that of African spurges, the swallowworts and some composites of the Old World. These are of greatest interest, however, when the cosmic gestures of formation are discovered in them.

4. The Water Lilies

Water and air are of particular importance for the life processes of the plant. There are various differences between these two elements of life that find their most important interaction in the leaves. Water, despite its intrinsic flexibility, isolates itself from its surroundings. Through surface tension, it creates a clear boundary separating the outside from the inside. This flexible boundary persists, even though moisture may continually condense or air may penetrate into the water. Air, on the other hand, does not remain so isolated. There exists merely an inside, as it were, which expands boundlessly in all directions with very slight mobility and flexibility. With water, the plant can create and maintain living shapes with defined forms; through the air, it is connected to the entire surrounding space and the incoming cosmic light.

Water and air participate in the form-expressions of plants, but with varying intensities. We can imagine, for example, that the air strongly affects the formative processes of certain plants and molds their character through the developing forms. This leads to less self-contained forms, which dissolve and are dispersed into the atmosphere. Naturally, life remains intact, but its form loses its compact unity;

it expands centrifugally—i.e., outwards in all directions. We have already studied this law of formation in the pinnate leaves of the umbellifers, the umbels, and the branching-out of the entire plant. It is also found in various genera of other plant families. In no other family, however, is it so pronounced as in the umbellifers developing in the dry summer atmosphere. Air penetrates into the hollow stems, in part even down into the root-stock. The formation of etheric oils in the stems, leaves and seeds is simply a specific physical expression of the evaporating effect of the air.

Just as the life and formative processes of the umbellifers are strongly allied with the air, the water lilies are connected with the water. Most genera and species of this small family are native to the subtropical and tropical regions. In our native flora, we find only the white water lily, the yellow water lily, and the lesser yellow water lily.

Water lilies grow only in the calm, fresh waters of lakes and ponds. With their leaves, and often their flowers, they live entirely on the surface of the water. Here, at the boundary between water and atmosphere, light is reflected as through a mirror. In this glittering, animated, watery mirror, the water lily appears as an integral part of the scene. The water lilies just barely touch the air sphere with their leaves. As the leaves and flowers are connected with the air at the boundary of the water, the shoots are connected below the boundary to the watery sphere. There, the rhizomes grow and root in the muddy bottom. From here, the long pedicles and petioles climb up like thin, green ropes to the surface. In this way, the water lilies grow in all sections of the water, and from its surface they turn towards the sky. The blossoms of the yellow water lily press, as if from another region of the world, a few centimeters into the air, which directly above the water is still permeated by cool moisture.

Light penetrates through the reflecting surface, and part of it reaches the watery sphere below. If we were to look from under the water directly upward, our glance would go through a large round hole into the atmosphere. To the sides, the surface of the water is an impenetrable, silver-shining mirror because of the total reflection of sunlight. Through this silvery, reflecting boundary, in which sometimes the bottom below may be mirrored, a broad sphere of light becomes isolated from the atmosphere. This sphere of light is the earthly reflection of the moon's sphere: just as the moon forms its own isolated sphere through its reflection of sunlight, this light sphere isolated from the sun comes about through the reflection in the water. The moon, at new moon, becomes invisible for several days. It is located in the sun's

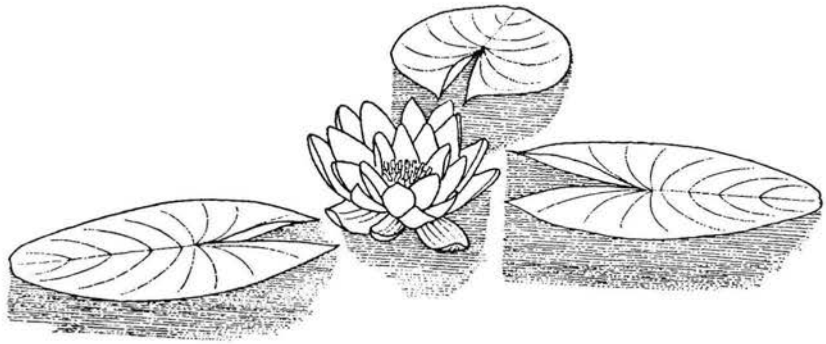


Fig. 48 White water-lily *(Nymphaea alba)*. The blossoms and leaves of this peculiar, beautiful plant grow while floating on the surface of calm, inland waterways. The blossoms—the largest among the flora native to the northern hemisphere—flower between June and August for about one week. Their opening (about 7 am) and closing (about 5 pm) follow the sun's daily course.

light-sphere and for a short time abandons its reflecting function. The light-sphere caused by the moon is open like the light-sphere of the water in that "hole." The atmosphere on earth is directly influenced by the sun; in the watery region below the atmosphere, the influence from the sun is modified by the moon.

The water lilies live in that region. Their shoots are subject to a strong lunar influence; as rhizomes, they are permeated by a root development that ties them to the bottoms of bodies of water. Their pedicles and petioles can hardly be compared to those of other plants. From below, they merely reach the boundary of the atmosphere, that is, the region in which they would normally begin their development. While in most plants these organs are surrounded by air, in the water lilies the air penetrates—in a reversal of conditions—through the long "stems" in certain specialized tissues called aerenchyma, down into the watery sphere. The leaves imitate the slightest movement of the waves. And as they do with water, light and air penetrate from above into the leaves and their life processes; leaves of other plants generally assimilate the air from below. The round form is in sharp contrast to the pinnate leaves of the umbellifers; it is the expression of a self-contained formation expanding in all directions. The peculiarity of the evenly spreading and self-containing character of water is manifest here. In their form and their environment, the leaves have hardly any connection with Mercury; they develop in the moon-affected region of the water, climb up to the boundary and unroll their blades there. They remain tied to this boundary and touch only that region in which the sun and Mercury are manifest in the plant kingdom.

The flower buds also develop mostly in the lighted, cool, watery sphere and float up to the surface. All our native water lilies open their flowers sometime between June and September. They turn towards the intense, midsummer sunlight out of their moist, cool, watery element. The flowers of the water lily open in the morning when the sun has already climbed above the horizon and is reflected in the water. The flowers close before sunset. Such opening of the flowers to the rising sun and closing with the diminishing light is found in a number of plants. The water lilies' so-called photonasty is special in that the outermost sepals, which are green on the underside, seal up the flowers completely during the night. The flowers open anew each morning from the buds and close in the evening. The water lilies, in their entire flower development, retain something of their lunar bud stage. When the flowers open in the morning, the inner petals share little in the motion of unfolding. They turn their surfaces more towards the interior of the blossom than to the sun. Only the outermost petals unfold completely and lie on the water like flat bowls. In the midst of the radiant white petals, yellow anthers sparkle from the depths almost like miniature suns.

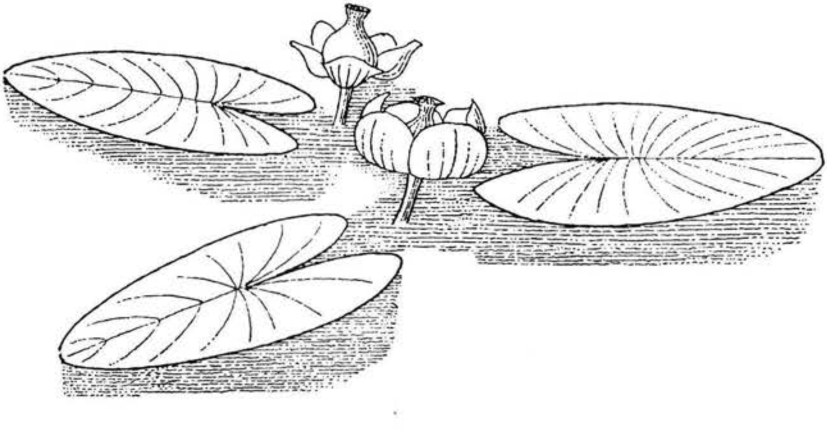


Fig. 49 Yellow water-lily *(Nuphar luteum)*. As in the white water-lily, the leaves and blossoms climb from the bottom 4 to 5 meters upward to the surface. The rhizome is rooted in the murky bottom below. It grows 10 centimeters thick and 2 meters long.

Petals and stamens of the water lily do not originate from the receptacle but emerge from the ovary in spirals. The receptacle has expanded upward and surrounds the numerous carpels like the wall of an ovary. It is subject to the lunar gesture leading to isolation, which is so characteristic of the ovary. The water lilies, then, do not flower from the region of the sun in the plant, but from the region of the moon. An additional peculiarity is the gradual metamorphosis through many intermediate forms from petal to stamen. This slow evolution of the stamens to achieve their full form indicates how this development has to overcome a certain resistance. The lunar influence prevalent in the water lilies inhibits the stamens, which according to their character reach beyond the sun's sphere and with pollination go beyond all moistness.

The yellow water lilies struggle against the predominant influence of the moon in the water. Their radiant yellow flowers not only expand above the water level, but they also unfold into the bowl-shaped flowers which remain open even during the night. Their petals and stamens develop from the receptacle. The flowers of the lotus emerge even farther from the water into the atmosphere. The flowers look like pure, climbing water lilies that lack the crude external petals and the intermediary stages preceding the stamens. The round, shield-like leaves appear as raised water lily leaves that have merged into one unbroken surface. In two genera *(Brasenia* and *Cabomba)* the leaves remain in the water; only the flowers and (in the *Cabomba)* part of the leaves climb up to the sun-air boundary.

The underwater leaves of the *Cabomba* dissolve similarly to those of the water buttercup. Generally those leaves are described, though not quite accurately, as pinnate leaves. Through this designation, the contrast to the true pinnate leaves is hidden. The leaf blade, down to the veins, dissolves in the light-permeated water.

When, after pollination, the plants proceed toward fruit formation, the pedicles bend, pulling the ovary down into the water. Although fruits generally ripen in warmth, these develop in the cool, lunar region of the water in the presence of intense mucus formation. Later, the fruits fall apart. The seeds rise to the surface through the air-filled outer seed coat and float in the water currents for a while. Then the air bladders dissolve and the seeds sink to the bottom and germinate.

Thus the water lilies are a plant type that is dominated by the moon down to the minutest detail. The purest manifestation of the type is found in the white water lilies. When we look at water lilies flowering in a pond and surrender ourselves to the peculiar, dream-like, unearthly mood that rises from the glittering waves, from the floating leaves, and from the blossoms facing upward to the sun, then we experience this most magnificent manifestation of the moon on earth.

Perhaps the superlative example is the royal water lily, which grows in the Amazon region, mainly south of the equator (from 4°N to 15°S latitude). There it develops in connection with the swelling water level and the higher-rising moon, from December to June or July. Then the large flower buds arise from the water between the enormous floating leaves, and blossom one late afternoon into the moon-lit world of night. The flowers close during the early morning hours, and only when the sun begins to set do they open for a second night, but then they are no longer white, but pink.

5. The Buttercups

Basic types are, of course, manifest within other plant families—in the individual genera and species—not just in the grasses, water lilies and umbellifers. When studying the shepherd's purse and the rapeweed closely, we discover the other crucifers among the multitude of flowering plants. All are quite similar in the development of the shoot, inflorescences, blossoms and fruits. We get the impression that one basic form appears in the many varied genera; the form seems to vary most in the relationship of the individual parts of the plant to each other. The basic type in the geraniums, the mints, or the teasels unfolds within relatively narrow limits. The situation is quite the opposite with the buttercups. The type here is of such flexible variability that it is difficult to discover a basic form common to all the different genera. We may find it hard to understand how the prostrate pilewort and the radiating form of the meadow rue or love-in-a-mist may be included with the columbine in one family. Here, even the expert botanist is on shaky ground. He has hardly any solid criteria for classification. Thus there is no consensus as to whether the peony should be counted among the *Ranunculaceae* or should be listed with its related species as a rather distinct family separate from the buttercups. The type of the *Ranunculaceae* is so flexible that, in contrast to the monocotyledons, it easily overcomes the mind's boundaries. The pilewort germinates with a single cotyledon, the leaves of various buttercup species have parallel venation, and the blossoms of many anemones have six petals. All narrow categories of thought must be abandoned in considering the buttercup family, more than any other, if one is to penetrate the relationships of the processes of form-expression.

It is characteristic of the *Ranunculaceae* that, almost without exception, they grow in the moderate and cold latitudes, that is, in those regions in which a regular change of seasons influences the life of the plants. During summer, the sun's power increases; during winter, with its increasingly long nights, that of the moon prevails. This rhythm thoroughly permeates the buttercups. Except for the clematis, which is the only genus that penetrates into the tropics and thus departs from this rhythm, the *Ranunculaceae* are herbaceous plants: in the growth and the withering of their shoots, the sun's rhythm is manifest, while in the withdrawal into the bud stage, the rhythm of the moon is reflected. These relationships may be studied in detail.

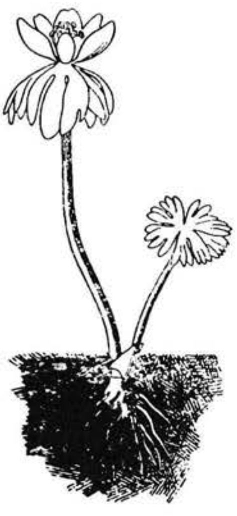


Fig. 50 Winter aconite *(Eranthis hiemalis)*. From the shoot system, only a tuber has developed, which originates from the hypocotyl. From this tuber the shoots grow in February and March up to 15 cm above the ground. The three-leafed, lobed, involucre develops like a calyx, directly below the delicate yellow blossoms. The blossoms open each morning for about one week; in the evening (around 7 pm) they close again. The winter aconite grows in thickets, below hedges, and in forests, mostly in the vicinity of ancient castles, palaces, and monasteries, where it was originally cultivated (by Troll, modified).

The winter aconite is one of the earliest bloomers among the buttercup species. The delicate yellow flowers of this tiny plant are already open in February. They hardly rise above the involucre, which consists of three lobed, divided leaves. The winter aconite disappears before the summer and remains in the ground as a tuber until the following year. It develops during that season when the sun is gaining intensity, but the full moon during the long nights still rises significantly higher than the sun during the short days.

These cosmic relationships are indicated by the lack of a real stem, as a particularly strong influence from the moon inhibits it as soon as germination occurs. The hypocotyl swells up into a tuber *(v. p. 79)*. From it, the small flowering shoots emerge in early spring with the rising position of the sun, and leaf and flower development become strangely interconnected. The leaves form a calyx-like structure, and the corolla with its six petals appears with the characteristic signature of Mercury. Thus, in the winter aconite, the cosmic relationships are mirrored. From the region of plant development influenced by the moon a shoot climbs upward, and here the development tied to the sun's influence is kept in an extremely underdeveloped and internally undifferentiated initial stage.

This leads us to the anemones. The white wood anemone and yellow wood anemone generally are already completely developed by March. The sun's influence is stronger, while the moon's influence has receded somewhat but is still powerful. The shoot of the wood anemone is less restrained than it was in the tuber of the winter aconite; nevertheless, as a rhizome it is still dominated entirely by the moon. From the underground shoots, individual leaves and flowering stems rise to the surface. They are similar to those of the winter aconite, but larger and essentially more developed in all their parts. The yellow wood anemone forms two, sometimes even three, blossoms. It frees itself more from vegetative life during its flowering stage, and so the image of Venus appears in the simple perianth with its five petals. With this, the development of the flower reaches a higher level.

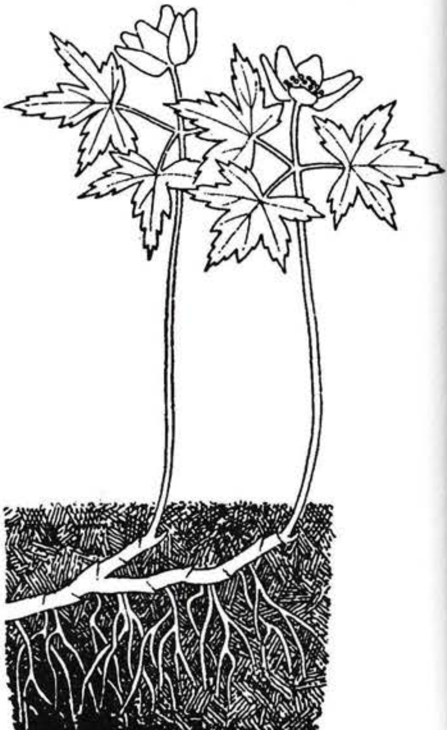


Fig. 51

White wood anemone *(Anemone nemorose)*. In March, April, and May the flowering shoots of this delicate spring plant may be seen in the forests and underbrush. Its shoots grow in the ground as rhizomes. From there the flowering shoots penetrate into the light, which is not deflected by leaves. The white, sometimes pinkish, blossoms close in the evening or in cloudy weather and, as when they are ready to blossom, droop their heads.

A form of mysterious beauty in the buttercup family is the Christmas rose. From the dark, moon-affected rhizome, the flowering shoot emerges as early as midwinter. It is pale and spotted, and carries a few pale-green leaves shaped like bud scales. In morphology, these are often listed as example of hypsophylls; this, however, is based on an inaccurate comparison of forms.[43] In the Christmas rose, and in the other hellebore species, the bud stage persists into the flowering shoot. The large flowers with their five white petals bend sideways and slightly downward. They look, as in a dream, as if they would embrace a vast space. The riddle of the Christmas rose becomes more evident during the following weeks. The petals do not drop as petals and sepals usually do. They turn green and envelop the maturing follicles, taking on some of the hardy character of the leaves of deciduous trees. Their form is simple, their venation parallel. Such green leaves are usually found only as the initial leaf formations of the opening buds within the bud scales. When plants unfold, they generally leave the bud stage rapidly by growing regular leaves and by moving on to the development of the flowers. In the Christmas rose and the other hellebores, the leaves on the flowering stems never really develop. The bud-like character of the leaves continues on into the perianth. The moon, as the underlying law of bud formation *(v. p. 83–84),* penetrates even into the blossom.

During winter, the snow-covered ground takes on some of the moon's reflecting character. It does not, as in summer, take up the sunlight into its life processes, but reflects it. In the midst of this winter landscape, the Christmas rose blooms. This is its peculiar magic; the flowering is permeated by the moon's forces. The Christmas rose, blooming in the midst of ice and snow during the long nights, is the most beautiful and purest manifestation of wintery nature. The tough leaves develop in the late spring, last through fall, and penetrate with their life forces the lunar season of the year. They do not wither until the following year, after new leaves have formed. The entire Christmas rose is tied to the winter and the moon which dominates that season.

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43. In Volume 2 of his work, *Die Infloreszenzen,* Troll writes about the hellebore genus: "All species correspond, in that in the flowering shoot-tip a direct transition from the low to the high leaf formation occurs with a leafing-out of foliage development" (p. 443). During the course of normal growth, the high leaves (hypsophylls) develop from the foliage leaves through metamorphosis, in that the plant is elevated above the vegetative region to the flowering stage. The hypsophylls are the external picture of the proceeding to a higher level of development. Since the hellebore in its flower-bearing shoot does not form leaves, it is not very sensible to differentiate between low and high leaves. Some low leaves at best show the hint of a structuring of a leaf blade in their tips. The low leaves directly go over into "petals" after this short intermediary episode. Low leaves are those leaf structures that first emerge as leaves from the buds and correspond to the bud scales through their parallel-veined structure.

In the other hellebore species, the flowering shoots grow larger. They branch out and usually have many greenish blossoms. The enhanced development corresponds to the increased solar influence in March and April. Yet on all these relatives of the Christmas rose, the tiny leaf formations on the flowering stems have the character of scales.

Not until the marsh marigold radiantly unfolds amidst juicy green leaves in moist pastures and near brooks in March, does the influence of the moon become less pronounced. The shoots often branch out near the ground and they do not expand far upward into the air, so that

Fig. 52 The marsh marigold *(Caltha palustris)*, a plant frequently found in swampy meadows or near brooks and ponds. Its rich yellow blossoms hardly reach beyond the juicy leaves. While they open, the green of the bud stage gives way to the yellow of the developing corolla. The marsh marigold grows on flat land, in low mountains, and in the Alps up to 2500 meters. Time of flowering: March, April.

the plant looks stunted and bushy. The leaves spread their undivided surfaces in all directions. When we try to visualize water, which isolates itself from the surrounding space in a flexible drop, we get the impression that the life in these leaves is predominantly expressed in the moist, watery element. Even the uppermost leaves consistently maintain this character; they are merely smaller and more delicate.

In the marsh marigold a further characteristic of the buttercups becomes evident. The green flower bud rises above the leaves, swells up, and finally unfolds in a radiant yellow. The corolla is five-petaled; it lacks, however, the calyx, as do most buttercup species. The calyx is that formation in which the petals and the rest of the flower organs develop as though in an organ detached from the leaf section. The calyx expresses blossom development becoming independent of vegetative life. Where there is no calyx, the development of the leaves and blossoms is closely connected. With the marsh marigold, the flowering stage only gradually grows beyond the mere vegetative processes. Even though the corolla contains the five-foldness of Venus, characteristic of ideal flower development, vegetative life still has some influence on it. The petals, in contrast to those of the wood anemone or the buttercup, are rather thick and substantial. Most importantly, they vary in their form from one another. The first petal to emerge still appears somewhat unshapely. Only towards the development of the last one does the complete form become apparent. In this manner, vegetative life still affects the flowering stage. In the Christmas rose, winter aconite, and the early anemones, the moon influences the development of the plant intensely. The marsh marigold has largely freed itself from this influence. It is dominated, generally speaking, by vegetative processes in the part of the plant influenced by Mercury. Its flowering shows the blossom becoming liberated from the region of vegetative life.

In the buttercup, the plant expands far up into the sphere of light and air. It develops each year from down below in the moist, earthly region, at times even with the leaves, which are similar to those of the marsh marigold. Then, however, an intense process of unfolding asserts itself. The internodes become longer, the leaves with their palmate, divided blades arrange themselves, and the plant branches out into a loose panicle with radiant yellow blossoms. The entire form makes obvious how the flowering process goes beyond vegetative life.

The palmate leaves so characteristic of the buttercup relate to the surrounding space differently from those of the marsh marigold. Its leaves may well expand into space, but their form is undivided. They reveal the gesture of Mercury pressing out from the center to the periphery. In most buttercup species, the leaves are open to the surrounding space. The sections of their blades combine with the environment by radiating into it. This form of the leaves reveals the character of Venus, which not only moves into the sun's sphere for a brief period but also relates to the sun's vastness.

All buttercup species with palmate leaves are permeated by this urge to expand into the surrounding space. The metamorphosis of the leaves increasingly separates itself from the vegetative processes in the shoots, which are expanding extensively and becoming more delicate. Thus the flowering process reaches its purest form here, in comparison to the marsh marigold.

Among the *Ranunculaceae,* the buttercup is one of the few genera having a complete dicotyledon flower with both a fivefold calyx and a fivefold corolla. Through the calyx, the interior of the flower—with the petals, stamens and carpals—isolates itself from the vegetative region below. The buttercup is a plant form connected with the light world of summer to such a degree that the character of Venus dominates its entire development.

The flower of the buttercup is also based on a simpler flower form. In terms of comparative morphology, there are five yellow petals, which are actually nectaries that have adopted the form of corolla petals. Thus the often yellowish calyx would seem to be the original corolla. This blossom form in particular exemplifies Venus' important role. Venus transforms a blossom, which according to its type has only a simple perianth, in such a way that from its organs a calyx and corolla develop.

A number of buttercup species, such as the rough crowfoot and the globe crowfoot, open their forms less to the environment than do the others. Their leaves remain simple and sometimes even have parallel venation (spearwort, banewort, grass-leaved buttercup, etc.). Like the marsh marigold, they all grow in moist, wet locations. The character of the leaves dominates the entire form. The shoots hardly branch out, and form few blossoms. The shoots of the pilewort even remain on the ground and turn only slightly toward the light. Within the numerous buttercup species, the entire plant form gradually frees itself from the Mercury-related vegetative existence and moves toward the devotion to the light and air characteristic of the flowering stage.

The globeflower is a mediating form between the marsh marigold and the fully developed buttercups. It flowers in early and mid summer on moist, marshy meadows. Its upwardly expanding shoot branches out very little. The palmate leaves are wide-lobed, herbaceous, and less radiant than in most of the buttercup species. The entire form is narrow. This peculiarity dominates the globeflower even in the blossoms, which do not have a calyx and hardly grow beyond the region of the leaves. Their green buds swell up into radiant yellow flower balls. The many petals loosely surround the interior of the flower, which never entirely opens towards the sun. Thus the globeflower does not reach a stage of complete blossoming.

In the marsh marigold, the globeflower, and the buttercup, a continuous process becomes evident. These plants grow and flower when the sun gains full dominance over the moon and climbs up to its highest position in June. During this period, the marsh marigold starts to develop the shoot and leaves. From the marsh marigold to the globeflower to the buttercup, the blossom struggles to achieve its complete form in that the plant allies itself increasingly with the intensifying influence of the sun. In the marsh marigold, the development of the leaves is predominant; that is, the plant develops particularly under the influence of the sun and Mercury. Because of the refinement of the leaves during the metamorphosis in the buttercup, the development of the flower—and with it the influence of Venus—comes into full spring.

This flower development reaches its peak in the columbine in June and July. From the buttercup to the columbine, the entire plant develops one important step further. The palmate leaves of the buttercup dissolve into pinnate leaves, and the flowers are elevated far above the region of vegetative life. There the large blue, purple, red or yellow flowers droop towards the side or downward. Five wide-spread petals surround the interior of the flower, which is formed by the five large nectaries. The external petals are pointed like sepals. The nectaries are similar to those of the other buttercups (such as the Christmas rose, the winter aconite, or the monkshood) but are located as small structures within the blossom. The columbine, like almost all buttercups, presents a flower with a simple perianth. The calyx and nectaries are dominated by an intense flowering impulse and are transformed into a wonderful double corolla. In this metamorphosis, Venus may well reach its most beautiful manifestation. The corolla-like calyx and the deep interior of the flower create a very intimate form together. In the buttercup flower, the nectaries have developed into a radiant yellow corolla, and there is a gesture of yielding. This yielding is further intensified in the columbine in that the external petals open completely and surround the particularly deep interior of the flower.

The antithesis of these flowers is found in the annual herbaceous plants of the family, such as the nutmeg flower and especially the love-in-a-mist. These plants form peculiar, very finely-divided, pinnate leaves. Pinnate leaves, like those in the columbine, usually unite very strongly with the atmosphere. In the nutmeg flower, the leaves push

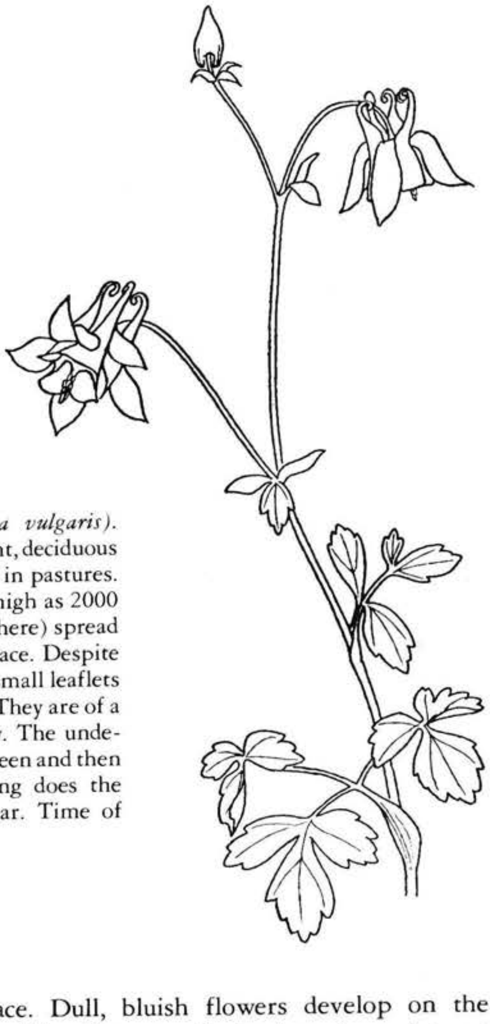

Fig. 53 Common columbine *(Aquilegia vulgaris)*. This beautiful plant grows in light, deciduous woods, in loose underbrush and in pastures. In the Alps it may be found as high as 2000 m. Its lower leaves (not shown here) spread out far into the surrounding space. Despite the bold threefold division, the small leaflets have strikingly rounded forms. They are of a particularly delicate consistency. The undeveloped flower bud is initially green and then colorless. Only during flowering does the intense blue-violet color appear. Time of flowering: June to August.

out into the surrounding space. Dull, bluish flowers develop on the center and secondary shoots. The flowers of the love-in-a-mist are surrounded by a group of pinnate leaves, so that they are hardly noticeable. Their petals are pointed as though in an intermediate form between the simple leaf and the sepal; they are like an early stage of the metamorphosis ending in the perfect petal—far below the level achieved in the marsh marigold. The development of the flowers is deeply rooted in the vegetative processes. Even the green stamens remind us of vegetative life. Only the ovary has a comparatively normal form, though for the buttercup family it is rather unusual. Generally, in the *Ranunculaceae*, the individual carpels develop follicles, as in the Christmas

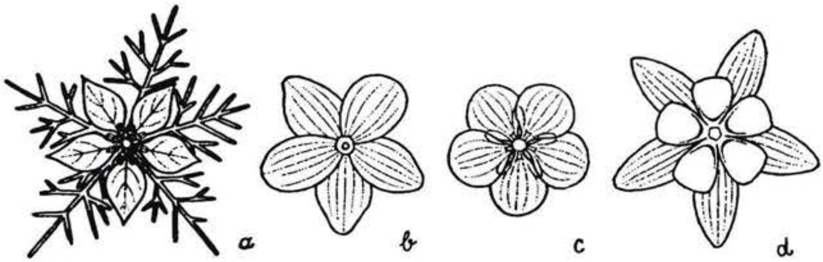

Fig. 54 The four steps in the development of the corolla. (a) In the love-in-a-mist *(Nigella damascaena)*, the dull-bluish petals have the form of simple deciduous leaves. The "calyx" is formed from pinnate leaves as they occur on the entire shoot. (b) In the marsh marigold *(Caltha palustris)*, a metamorphosis takes place within the corolla. Only gradually does the perfect form of the petals emerge. (c) The corolla of the rough crowfoot *(Ranunculus acer)* develops out of the nectaries. In precise botanical terms, only the calyx is the perianth. (d) The form of the blossom increases with the intensity of blossom-like development in the columbine *(Aquilegia vulgaris)*.

rose, the globeflower, the columbine, the larkspur, and the monkshood, or many small indehiscent fruits, as in the anemones, the buttercup, and the pheasant's eye. Even in the carpels the plant relates to the surrounding space; this may be seen quite vividly in the pasque-flower and the clematis. In the nutmeg flower, even more so in the love-in-a-mist, the carpels grow together into one common ovary. A very strong influence from the moon manifests itself in this organ, which isolates itself uniformly from its surroundings and dominates the entire flower.

As annual herbaceous plants, the nutmeg flower species do not have a complete connection with those cosmic regions in which the development of the blossoms is initiated *(v. p. 75)*. The development of the blossoms is influenced more strongly by Mercury and the moon: by Mercury, in that the blossoms do not really push up and out of the region of the leaves, and by the moon, in the development of the ovary.

Whereas the columbine grows beyond the usual level of development in the flowers, the love-in-a-mist remains far below that level. The pheasant's eye is the only buttercup species that forms a genuine calyx, from which a radiant corolla emerges. Unlike the buttercup, it has real petals, which in the annual species that flower in summer—*Adonis flammeus* and *Adonis aestrivalis*—form a five-parted corolla and thus manifest Venus in their perfect form.

We are thus looking at a uniform process that penetrates all previously studied genera of *Ranunculaceae* as a "spiritual link."

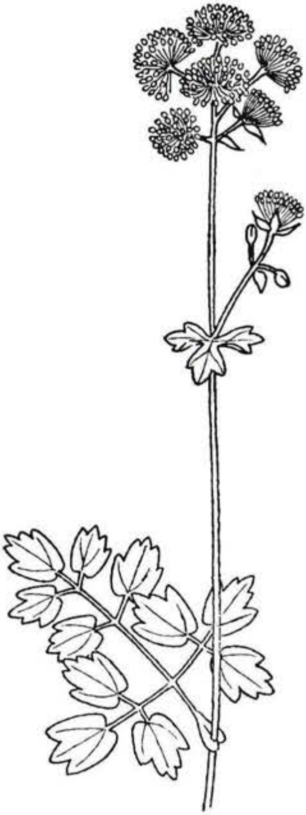

Fig. 55 The columbine-leaved meadow rue *(Thalictrum aquilegifolium)* grows in the moist ground of marsh and forest pasture, in light underbrush, and in meadows. It reaches a height of up to 1 meter. The leaves are spread out, pinnate, and threefold. Above the lower shoot region (not pictured here), the loose inflorescences expand with their radiant pale-violet blossoms. They bloom between May and July and prefer mountainous areas.

Nearly all botanists who have described the *Ranunculaceae* have pointed out the manifold flower forms as a specific element of style in this plant family. These numerous forms of the flowers show their peculiarity when they develop in various ways out of the life processes of the plant at different times of the year. They are not an unsolvable mystery but rather the complete, manifold image of the plant elevated to the flowering stage. When we study the annual successive forms of the Christmas rose as compared to the pheasant's eye, the many forms of the plants and their flowers appear as a metamorphosis throughout the various genera and species. This metamorphosis stretches from the bud-like, moon-affected flowering of the Christmas rose, to the undeveloped, Mercury-like flower buds of the winter aconite and the anemones in numerous stages, up to the complete liberation of flower development from vegetative life in the buttercup and the pheasant's eye. And in the columbine, the plant pushes one step further, beyond these limitations of the flowering process.

The meadow rue follows the columbine in a certain sense. Its leaves are similarly pinnate. The division of the blade into numerous small individual leaflets goes farther, however. The leaves look like a continuously dividing system of stems whose ends have tiny pinnate leaves. They are divided to such a degree that their blades seem to dissolve into the atmosphere. The loose inflorescences expand beyond this centrifugal leaf development in a striking manner. The individual corollas are tiny and drop off prematurely. The blossoms form no interior. On the contrary, the numerous stamens radiate directly into space. The filaments are partially colored and so create the image of radiant flowering. In the columbine-leaved meadow rue, even the many small ovaries are dominated by this formative process in that they are elevated over the receptacle on small stems. The flowering process leaves the region of the enveloping corolla beneath it, as it were, and lives on in the radiating gesture of the filaments. This law of formation penetrates the meadow rue even into the form of its leaves. In our entire vegetation, there is no other plant in which the Mars character of the development of the filaments determines the entire form in this manner. In the lesser meadow-rue, this process of dissolving even reaches a stage where the plant becomes wind-pollinated.

This flowering process from summer until fall is most magnificent in the larkspur and the monkshood. In the buttercup, the columbine and the meadow rue, the whole plant in its transition to flowering, seen in connection with the metamorphosis of the leaves, becomes looser, more delicate, and less substantial. The flowers are merely the last, purest stage of the refined life processes. In the larkspur and monkshood, the vegetative green region and the region of the flower have a different relationship to each other. On the intensely expanding shoot, a vast leaf region develops at first. The leaves of most species crowd the shoot rather closely and change their form but little. Only directly below the inflorescence do they become simpler. A tremendous, upwardly expanding, flowering stem with an abundance of flowers rises above the richly developed leaf region. Here, unlike the process in most buttercup genera, the metamorphosis does not lead toward the development of individual flowers. The flowering shoot rises beyond vegetative plant life as an independent sphere.

The other *Ranunculaceae* are characterized by closed inflorescences, in which the center shoot ends in a terminal bud. Plant growth comes to an end there. The larkspur and the monkshood have open inflorescences, which are not limited by a terminal bud. The development of the flowers unfolds with much greater force, in that it breaks through the boundaries set by such terminal buds.

Fig. 56 Blue monkshood *(Aconitum napellus)*. This plant, which in all its parts is poisonous, grows in low mountains and in the Alps (up to 300 m), particularly in the nutrient-rich soils of cattle pasture. From the lower shoot region, beet-like roots spring forth, on which buds begin to form. Dense groups develop, which appear sinister in the dark color of the leaves and inflorescences. The form of the blossoms is strongly self-centered. It corresponds to their blue or blue-violet color. The common monkshood flowers in late summer (July, August).

The shoot has a different character from that of the other buttercup genera. In the anemones, the marsh marigolds, the buttercup and the columbine, the shoot is the sun's reflection of the near planets, Mercury and Venus. Expanding beyond the region of the closed inflorescences, the shoot becomes the sun's reflection of the far planets, Jupiter and Saturn. This is expressed in the peculiar blossom form of the larkspur and the monkshood. With their bilaterally symmetrical form, they are strangely situated in space. When radial blossoms, like those of the racemes of the crucifers, emerge from a shoot, the individual flowers expand into the atmosphere. This is not the case with the larkspur and the monkshood. Their blossoms, particularly those of the monkshood, seem to rest within themselves. They do not push out into the atmosphere but stay close to the shoot as independent forms. In the larkspur's flowers, the upper petals are recessed into a hollow spur, deeply penetrated by the two nectaries. The flowers expand in all directions on the often heavy racemes. In the flowers of the monkshood, the upper petals are also curved to create a high interior space within the blossom. The two petals on the sides also stretch their surfaces toward the top of the flower; the two lower petals remain narrow. The flowers turn sternly from the high interior sphere to the outside, impelled upward even more than in the larkspur. Not only the entire inflorescence but also the individual flowers expand into the sphere influenced by the far planets, as gestures of form-expression upward and to the sides.

The impressive, centralized expression of the monkshood flowers and their inflorescences is an intensification of the processes active in the shoot and the leaves. Because of the generally dense leaf cover, the plant appears self-contained. In addition, the palmate, deeply divided leaves are usually quite dark, their individual lobes long and narrow. Only the wolfsbane (which starts to develop its yellow blossoms as early as June), with its loosely standing, lighter and wider leaves, has a less severe character. Its form is similar to that of the larkspur, which is more flexible and open in its formation.

The flowers of the monkshood and the larkspur also lack a calyx. We may observe how the small green buds on the flowering racemes gradually develop into colorful blossoms. The flowering process comes forth from a predominantly vegetative condition, but here the process takes place above the region of the leaves, and under Jupiter's and Saturn's influence it is almost overpowering.

In all the *Ranunculaceae,* the same phenomenon — the immediate elevation of the flowering process out of vegetative life — occurs in many forms. In this close connection between the lower and higher sections of plant life, and in the immediate emergence of the flowers out of vegetative formations, lies the spiritual center of the *Ranunculaceae.* When we grasp how this specific metamorphosis — the emergence of the flower form from the shoot and leaves — takes place in all the different plant forms, we recognize the type of the buttercup family in all its multiplicity. It is a many-sided expression of Venus and its relationship with Mercury. We now are able to understand through the type that the *Ranunculaceae* are almost without exception herbaceous plants; their formative processes are influenced by the relationships originating in the region of the near planets.

It has become quite clear how the form of the buttercup type is associated with the cosmic relationships of the annual cycle, that is, with the position of the earth in the universe. From winter till spring, the type receives its specific form through the moon's influence and its gradual receding in favor of the increased solar influence (Christmas rose, winter aconite, early anemones); then the increasing domination by the sun and the sun-related planets, Mercury and Venus, becomes manifest in the forms the type adopts (marsh marigold, globeflower, buttercup); and during midsummer, the sun (nutmeg flower) and Venus (pheasant's eye, columbine) leave their visible mark. Particularly from midsummer on, the buttercup type is penetrated by the formative laws initiated by the far planets (meadow rue, larkspur, monkshood).

The buttercup genus, above all others, develops the greatest multitude of species. It also brings to perfection the type—the form expression of the dicotyledon flower—which derives from the region of the shoot and leaves. In a plant such as the rough crowfoot or the globe crowfoot, we are particularly close to the idea of the type.

From this perspective, the peony might be included among the *Ranunculaceae*. No other plant genus forms a calyx on which the metamorphosis of the leaf into the sepal may be studied quite so vividly. From the intensely swollen flower buds emerge the large petals, as the shoot with its incredible leaf formations emerges from the underground buds. With this calyx and bud development, the peony points to a higher stage of plant development, in which the flowers do not merely expand beyond the vegetative stage but in which the calyx has reached complete independence from previous stages of development.

6. The Rose Family

In the rose family, the blossoms develop independently of the more substance-related processes in the leaves and shoots. All blossoms have a calyx, which indicates a second, higher budding stage. In the calyx, isolated and separated from the preceding vegetative stages, the corolla and the other organs of the flower develop. Particularly in the budding rose we may observe the degree of perfection the flower already achieves in the bud. The calyx is the organ through which the plant rises to a higher level of development, the blossom.

In contrast to the buttercup family, whose flower forms are closely related to the development of the rest of the plant, the blossoms of the *Rosaceae* are distinctly uniform. The five-parted blossom characteristic of the dicotyledons is expressed here most purely. The unadulterated manifestation of Venus is part of the type of the rose family. The development of the blossoms has an exceptional power. A flowering cherry tree or apple tree is the highest expression of abundance and beauty in the flowering process. The previously stern form of the tree is totally submerged in a cloak of light, delicately yielding to the spring sun.

The future flower announces its arrival on the green shoots of the herbaceous plants, shrubs and trees. The leaves, in a two-fifths position, expand upwardly in spirals, through which the principle of the development of the flowers, as is the case in numerous dicotyledons, is already revealed during the vegetative stage. Yet the development of the leaves, too, is remarkable in comparison to most other plant families. At the base of the plant, where the leaves are attached to the shoot, we find stipules. They correspond to the lower leaf, which generally appears modest in contrast to the upper leaf, that is, the petiole and the leaf blade. As is characteristic of only a few other plant families, the rosaceous plant develops the leaves so completely that the lower leaf is clearly recognized in the various forms of the stipule.

Most importantly, however, the rose family, like no other plant group, strives beyond the flowering stage to the last step of plant development, the fruit stage. Usually the mature fruits are only dry seed pods. But particularly in the rosaceous trees, in addition to the seeds, substances are formed in the fruit in which the ripening does not only lead to dehydration but also to further refinement. In the apples, pears, cherries, plums, etc., the fruit forms an unusual range of substances.

The plant attains a high degree of perfection on all levels of development in the rose family. Its shoot system is diversified into herbaceous plants, shrubs and trees. Unlike the previously studied plant families, the rose family does not limit itself to one particular area of development or pattern of growth, but instead it develops comprehensively. It is a universal plant type.

The botanical system distinguishes between four groups (subfamilies) according to the form of the fruits. Like many buttercup species, the *Spiraeaoideae* (of which several species of spirea are cultivated in our climate, and of which the goatsbeard with its pinnate leaves and divided, white flower-spikes grows in moist, shady forests and mountain ravines) form only dry follicles with numerous seeds. The type of the rose family is manifest particularly in the abundance of flowers that covers the twigs of the spiraea almost entirely, and in

Fig. 57 Marsh cinquefoil *(Comarum palustre)*. This plant, growing in wet locations, may indeed develop beautiful flower buds, but the metamorphosis towards a corolla is incomplete. The petals have the form of small sepals. They stand between the much larger sepals. The red-brown color tells us that the marsh cinquefoil never quite reaches a full stage of flowering. These peculiar flowers may be found during June and July.

the woody shoots. With the process of lignification, warmth-related drying permeates almost all rose genera, the herbaceous plants included. Usually such warmth-related processes are associated with the transition from vegetative growth to the development of flowers and, in particular, to the development of fruits. In the rose family, unlike the buttercup family, these processes permeate the plant's development from the very beginning. The plant thus relates to the later stages of development while in a stage of vegetative growth.

Thus there are no water plant species among the rose family as there are among the buttercup family. Only the marsh cinquefoil grows on marshland and peat pastures. Its creeping, rhizome-like shoot develops in the water-saturated subsoil. On the upwardly expanding shoots, a few dark red, dull blossoms develop above the digitate, divided leaves. The perianth consists essentially of the calyx only. The petals are extremely small. The moistness and the moon-related form of the shoot allow the full development of the flower bud up to the calyx only. The metamorphosis into the perianth and the other organs of the flower is hardly able to overcome these influences. Here the type expresses itself in a partial manner, mainly in the vegetative processes.

The marsh cinquefoil is a member of the second group of the *Rosaceae,* the extraordinarily multiform *Rosoideae*. Only one seed develops in the individual carpels of this group. Frequently a number of these carpels, however, join together in a higher form of fruit formation, such as in the raspberries, blackberries, and roses. Almost all the herbaceous plants in this group form only small, dry fruits. The various species of lady's mantle, with their beautiful, round or digitate, divided leaves, belong among them. On the edge of their leaves a string of clear pearls of dew often appears when the morning sunlight reflects radiantly off them. Numerous blossoms develop in the mostly loose inflorescences; they remain small and have no corollas. Their green color makes them hardly distinguishable from the leaves. They do, however, exude a strong, sweet smell. The fact that the leaves do not undergo a metamorphosis towards the inflorescences, but even become smaller, shows how the lady's mantle is a member of the rose family that carries Mercury's signature quite clearly.

In the cinquefoils, the strawberries, and the various avens species, Venus is manifest in the generally bright yellow or white blossoms. In the stoloniferous species, the flowers remain hidden among the green leaves. In the others, particularly in the avens and strawberry, the individual flowers and panicle-like inflorescences climb above the vegetative region. The strawberries are the first to form fleshy fruits. In exact botanical terminology, the red strawberries cannot be called fruits, because only the tiny achenes on the surface of the fleshy receptacle develop from the carpels. But this points to the extraordinary fruit development of the rose family. After pollination, the receptacle increases tremendously in size. The continuation of the shoot that reaches into the blossom *(v. p. 32),* and is the image of the sun in the blossom, develops further into a fruit. The small, dried-out fruit seeds, the true fruits, are thus carried out into all directions of the surrounding space. Here the development of the fruits interacts much more deeply than usual with the plant, even in the region that is otherwise merely the base of the fruit's development.

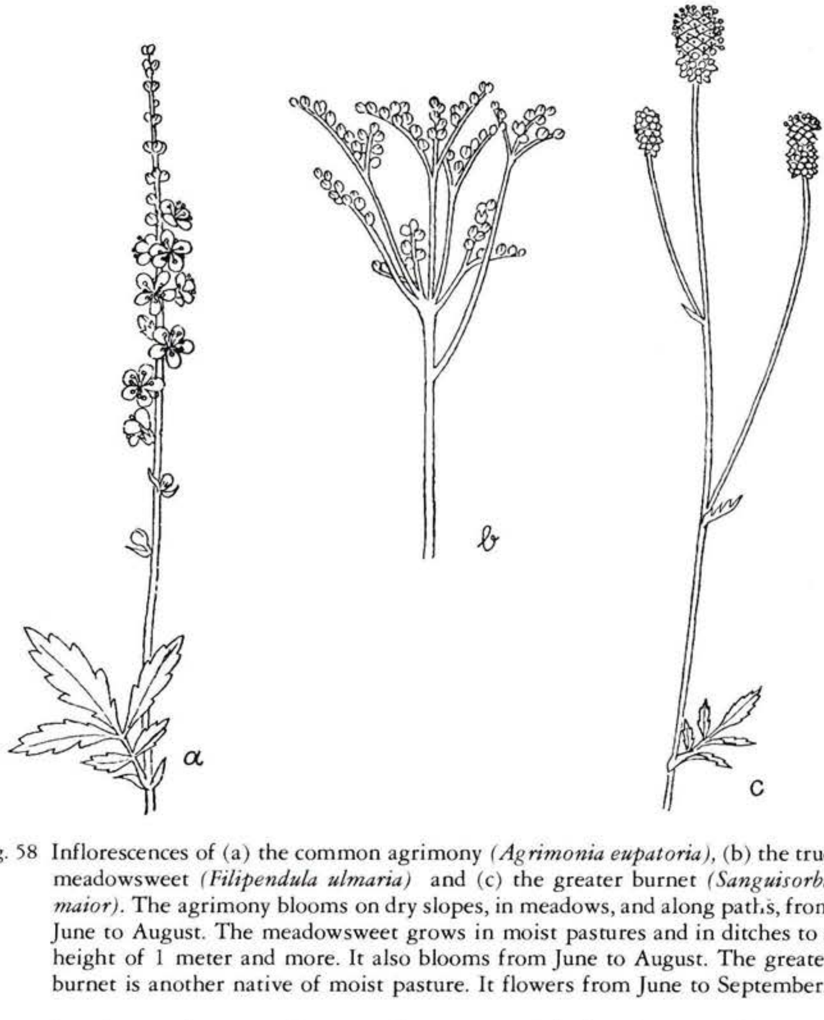

Fig. 58 Inflorescences of (a) the common agrimony *(Agrimonia eupatoria)*, (b) the true meadowsweet *(Filipendula ulmaria)* and (c) the greater burnet *(Sanguisorba maior)*. The agrimony blooms on dry slopes, in meadows, and along paths, from June to August. The meadowsweet grows in moist pastures and in ditches to a height of 1 meter and more. It also blooms from June to August. The greater burnet is another native of moist pasture. It flowers from June to September.

In the agrimony, the meadowsweet and the burnet, the type reaches a higher degree of manifestation than in the cinquefoils and the various avens species. Here the flowering process is expanded in the far-reaching inflorescences above the leaf region. The agrimony develops a strongly upward-stretching spike with many radiant yellow flowers—like a small mullein. In the meadowsweet, the inflorescences expand high above the rather large pinnate leaves, like umbels with numerous whitish blossoms. The rays of the umbel, however, do not originate from one common point as do the true umbels, but one over the other along the stem. Towards the periphery they increasingly stretch upward.

The form of the branched structure resembles the crowns of the deciduous trees, with their decreased development of the secondary shoots. In the burnet, even more than in the agrimony and meadowsweet, the individual flowers do not stretch out so far. They form tightly crowded, round flower heads, which are elevated above the vegetative region by means of long internodes. In the midsummer meadows, we often see the brownish-red heads of the greater burnet standing above the other plants. The tiny flowers turn in all directions. There are but few plants in which the flowering process turns towards the atmosphere so perfectly. These flower heads are like a higher stage of the flowering process. Usually flowers and inflorescences relate to one or another region of the surrounding space; here they relate to the entire environment. The individual flowers therefore no longer form corollas. They recede in favor of the flower head. Thus the development of the flowers distributes itself in the warmth and light-permeated atmosphere.

Through its stamens and the rudimentary forms for the development of fruits and seeds, the plant in its flowers has already established an association with the region of the far planets, which may, however, influence the plant's development even more. In the rose family, this begins in the region of the flower itself, namely in the form-expression of the inflorescences. The center shoot of the agrimony develops far beyond the normal size into a flowering shoot, like in the biennials under the influence of Mars. In the meadowsweet, the inflorescence in the vicinity of the center shoot is a reflection of Jupiter, similar to the inflorescences of the umbellifers. In strange combination with a strong inhibition or contraction into one center, this turning to the surrounding space escalates in the burnet as the expression of Saturn in the region of the flower. In the herbaceous plants of the *Rosoideae,* the type thus develops in a nearly archetypal way, according to planetary images.

The type achieves more impressive form-expressions in the many shrubs, that is, in the growth pattern in which Mars influences the entire development of the plant. The raspberry has a peculiar form among the shrubs. Its shoots emerge vertically from the ground, the tips bending slightly to the sides. During the second year the short flower- and fruit-bearing stems develop from the lateral buds. When the raspberries are ripe, the shoot dies back. It is dominated by the biennial rhythm of Mars. In the meantime, however, new shoots have come up from the crown. They originate from the underground rhizomes. The raspberry shoots are merely parts of a moon-related plant, growing in the moist soil, which later climbs up into the light. The closely related blackberry *(v. p. 98)* develops above the ground. At the tips of the long, bow-shaped running shoots, the plant roots in the ground again. From the highest middle sections of these canes, inflorescences develop during the following spring. Only in the roses does the shrub free itself from its ties to the ground, that is, from the remaining lunar influence, and then it expands far out into the atmosphere.

In these shrubs, the flowering shoots develop from the very beginning on a higher level than in the herbaceous plants. Their buds already develop above ground, that is, in that region into which the herbaceous plants have to struggle time and again. Through lignification, the shrubs appear to be permeated more intensely by warming, drying processes. The development of the flowers begins where plant life is less dependent on moisture from the ground. This applies least of all to the raspberry. The process of lignification is rather weak here; the blossoms are insignificant. The shoots of the blackberry are much stronger and harder. Blackberry bushes may also grow in dry, warm locations. On beautifully formed panicles, numerous blossoms with reddish-white petals develop. Total lignification, however, is achieved only in the rose. Its shoots grow stronger each year and become branches. And there, where all softness and moisture has been conquered by the woody tissues, the development of the flower reaches its ultimate beauty and abundance.

Everything about the rose blossom is extraordinary. Few other flower buds swell up more in the course of their development, that is, develop more intensely within the bud. The sepals are strikingly thick, generally furry on the inside, and thus create a strong enclosure. The tips are reminiscent of the rose leaves. The calyx thus vividly reveals the fact that it originates from the leaves through contraction. In the sequence of the leaves' development, a second metamorphosis takes place on the level of the calyx. The law of metamorphosis and development becomes intensely apparent in the rose blossom as in no other plant.

A second bud stage follows, that of the still unopened corolla. Even as a bud, the rose blossom is one of perfect beauty. The petals of the dogrose unfold into wide, delicate, reddish crowns that bend toward the sun in a gesture of purest devotion. From the center of these blossoms radiates the yellow color of the many filaments dispersing toward the sky. Everything that is known about the development of the flower, the bud stage, metamorphosis, unfolding and expansion, reaches a stage of such perfection in the rose that much of what can usually be grasped only abstractly reaches external manifestation. In order for this to happen, Venus has to manifest itself where the plant, through the dynamic force of Mars, develops particularly forcefully.

The actual fruit development in the rose family begins with the shrubs. The herbaceous strawberry is merely a forerunner. The development of the fruits, even more than the flowers, is connected with the processes of lignification. While the fruits grow and mature, the plant is freed by means of warmth from its dependence on nature's processes, and it goes into a state of permanence *(v. p. 49)*. A similar process occurs during the stage of lignification previous to flowering. In the shoot system, which is still dominated by forces of gravity and mineralization coming from the ground, hard, dense, woody tissue develops through warmth. When the forces active during lignification dissociate themselves from the merely earthly influences during the flowering stage, they lead directly into the ripening processes of the fruit. More exactly, there is a twofold maturation process: one leads to the formation of woody tissues, the other to the ripening of the fruit.

We may now better understand that raspberries and blackberries have fruits different from those of the rose. The shoot system in the raspberry or the blackberry is more similar to that of the strawberry than is the rose's; the same goes for their flowers and fruits. In contrast to that of the strawberry, however, the receptacle here swells up but little after pollination. The numerous carpels develop into small, red or deep-blue stone fruits, which join together to form an aggregate fruit, a round, cone-shaped receptacle. Fruits are always a manifestation of Jupiter. In the aggregate fruits of the raspberry or blackberry, Mars, too, establishes a peculiar expression of its character. The aggregate fruit surround the receptacle, the sun's reflection, just as Mars with its sphere contains the sun's sphere to a large extent.

The stronger shoot system of the rose affects the development of the flowers and fruits. The shoot, in the form of a small jug, grows upward and around the original center of the flower. The carpels are located at the jug's bottom; calyx, corolla, and stamens originate from its upper edge. Through this metamorphosis, the blossom receives an imprint of Mars' character *(v. p.99)*. This hollowed-out section of the shoot, attached to the flower, develops into the fruit pulp of the rose-hip. The receptacle of the shoot, that is, part of the vegetative plant, becomes the fruit. The differentiating, refining force of fruit formation is essentially greater here than in the raspberry and blackberry, or even in the strawberry.

The remaining shrubs among the *Rosaceae,* that is, those not belonging to the *Rubus* and *Rosa* genera, have a form different from those already described. The hawthorn, shadbush, medlar, mountain ash, and blackthorn do not form bow-shaped shoots, but rather strong trunks from which secondary shoots originate at the base. They reach a height of only a few meters but are quite similar in shape to the trees. The fruits are structured similarly to those of the rosaceous trees: the apple, pear, quince, rowan, cherry, sour cherry, bird cherry, and plum trees, and other fruit trees not native to our climate.

In these trees the rose family reaches its highest level of development. They grow high above the ground and go through their entire development, from the bud stage to fruiting, in the sphere of light and warmth in closest connection with the universe. Within the many variations of the type, Jupiter achieves perfect manifestation. Those forces that lead the plant towards the final and highest stage of its development, the fruit *(v. p. 48)*, here permeate the entire formative process, and fruit development reaches its peak of richness and power.

In the *Pomoidae* (apple, pear, quince, rowan, hawthorn, medlar, shadbush) the fruit reaches a climax of development, in comparison to the roses. The shoot completely encloses the carpels. The perianth and stamens develop above the carpels resting in the shoot. They are taken up by the shoot formation dominated by Jupiter, which develops like an intensely expanding sphere into the fruit. In the many species of the genus *Prunus,* the *Prunoideae* (apricot, cherry, almond, peach, plum, blackthorn, bird cherry), there develops in the center of each blossom only one ovary, which later becomes the stone fruit.

There is a correlation between fruits with an abundance of pulp and the entire tree form. It is a well-known fact that on, for example, the apple tree, the entire vegetative growth recedes during fruit development, particularly underground. A tree like the rowan, which forms only small fruits, has a different vegetative development from that of the apple tree. The rowan forms longer shoots in its loose crown each year, with pinnate leaves and loose, umbel-like inflorescences. On these, the rowan berries with their meager fruit pulp develop. In contrast to the rowan, the apple tree, despite its broad crown, seems narrow and dense. Its beautiful blossoms emerge directly from the buds. They are formed under the moon's influence during the preceding year and have only to unfold in the spring sun. The leaves are simple on the generally short, stunted shoots, whose growth leads quickly to the development of buds. In all fruit trees, the outward-striving vegetative development is restrained in this manner. In its place, we find the higher stage of this transformed vegetative growth in the fruits. In pomaceous fruits (apple, pear, quince) this powerful expansion, to which is supplied most of the substance assimilated in the leaves, even extends to the inner region of the carpels. Thus, the relatively broad core is created.

These pomaceous fruit trees may be understood only when we see that Jupiter manifests in them in a manner different from that in other trees. By being restrained, vegetative life is transformed in the fruits into its highest stage. The tree reaches the peak of its development. Of course, nature has achieved this only through man's intervention, through grafting. Man, however, could only further that for which certain propensities already existed. The stone fruits have the opposite character. They develop solely out of the ovary, the tightly contracted image of the moon *(v. p. 41)*. The outer layers (exocarp and mesocarp) become the skin and fruit pulp; the inner layer (endocarp) hardens into the pits of cherries, plums, etc. They are connected with the tightly enclosed seed and form a kind of second seed coat. Thus the contrast between core fruit and stone fruit is based on the general character of the plant.

In the core fruit, the fruit reaches its peak in the processes of expansion and differentiation. Here the most intensive manifestation of Jupiter becomes apparent. In the stone fruits, the contraction and isolation connected with seed development spreads to the fruits. The moon and Saturn *(v. p. 51)* are particularly clearly manifest.

7. Sympetalous Blossom Development and the *Compositae*

In various places within the plant and animal kingdoms, a higher organ comes into being through the combination of several structures that previously appeared successively or in juxtaposition. They become parts of a new organ in which a higher degree of organization is expressed. This principle is visible in each flowering plant when it progresses from the leaf-bearing shoot to the corollas, where detailed progression of form-development may be observed.

There are four levels of corolla development in the flowering plants. The first level merely suggests the fully developed corolla. Here the perianth, as in the water lily or magnolia, is formed from the numerous petals, which are tightly crowded in spirals around the receptacle. The upward-climbing leaf development characteristic of the shoot still affects the flower. At the second level, in the simple, generally sixfold perianths of the monocotyledons, flower development is still closely connected to the shoots and leaves. The successive development of the leaves is overcome in the strict, orderly forms. The corolla as a whole, however, struggles beyond the initial green, vegetative stage. At the third level, the plant reaches complete independence in the flowers from the preceding vegetative stage through the calyx. Only in the five, or rarely four, petals of the dicotyledons is the individuality characteristic of the leaves on the shoot maintained, but in a modified way. The petals with their expanding surfaces join more intensely than in the monocotyledons into one common corolla. There are certain dicotyledons, such as the bindweeds, mulleins, bluebells, gentians and bedstraws, where this higher unity manifests itself even more perfectly. The corollas become one unit even in their external form. At this fourth level, the individual petals are more or less absorbed by this higher structure. These flowers are called sympetalous. This term is not quite suitable, because the corolla is generally one unit from the beginning; only rarely are initially separate petals fused together, as in the thorn apple and the periwinkle. In all cases, however, the corolla tube is derived from fused petals.

All we have learned about the laws of plant development makes it understandable that this highest form of corolla originates in those dicotyledons in which the flower develops clearly beyond the vegetative stage by means of the calyx. In the sympetalous corollas, more so than in the choripetalous (separate-petalled) flowers, the plant stretches upward into the region above the flowering shoot. In dicotyledons that do not form a calyx, like the buttercups, the corollas are always choripetalous.

The sympetalous flowers indicate their relationship with the choripetalous blossoms not only through their color and delicateness, but also through their form. Even where their flowers reach out far beyond the receptacle and are completely fused together, as in the bluebells, the blue and violet gentian species, or the foxglove, the fivepartedness is found—either in the entire form, or at least in the periphery. The radially symmetrical corollas in particular have this signature of Venus, although not quite so vividly as the choripetalous flowers. In addition to Venus, there are other principles at work, in that the corolla develops as a cohesive structure from the entire region of the receptacle and generally climbs above it as a uniform blossom. If, however, we bring to mind how Venus with its rhythmical movement out into the sun's sphere imprints itself in the five petals of the choripetalous blossoms, we see in the sympetalous blossoms formative forces that, in contrast to those of Venus, continually affect the sun's sphere and enclose it entirely. The sympetalous corollas thus point to the region of the far planets, which encloses the sun's sphere, including Venus. From the sun's sphere Venus relates to the far planets. With its synodical rhythm, it already goes beyond the one-year rhythm of the sun. The spheres of both the far and near planets become visible in the sympetalous corollas. The forces from the near planets (in this case, Venus) radiating from the center reach over into the region where the forces from the far planets are active and imprint their character on them so that the corollas, as an enclosing sphere, surround the receptacle and the sphere above it.

Here the universe influences plant development more profoundly than usual. During the course of regular development the far planets do not become manifest until the stage of development following the corollas. Now, however, they permeate the preceding stages, in many cases even the calyx. In several sympetalous species the calyx is already fused.

Sometimes, all the *life processes* are changed. In the roots and leaves, the plant is immersed in the outer world of nature. The flower frees itself from this direct connection. It can develop only because the activity of root and leaf in absorbing and transforming substance recedes. For this reason, the flower is "rooted" in the life of the plant, as the plant is rooted in the soil, the atmosphere, and the light. Only in this way is the plant capable of being permeated by the laws of the far planets in pollination and in fruit and seed development. When, however, in the sympetalous plants the processes important for the flower penetrate deeper down into the plant, the life processes of absorption and formation may even, in extreme cases, be weakened. In these cases, the entire plant must root in the life of other plants in order to obtain what it cannot assimilate and form on its own. It becomes parasitic. Particularly among the sympetalous plants do the conditions normal for the development of the flowers reach down into the region of the shoot and the roots in such a way. Certain *Scrophulariaceae*—the eyebright, yellow rattle, lousewort and cow-wheat—are semi-parasitic plants. They are no longer able to take up water and salts from the soil. They absorb these substances from the tissues of other plants through haustoria. The toothwort (another scrophulariaceous species), the broomrape family, the pinesap, and the most extreme among our native parasitic plants, the likewise sympetalous silkweed, are unable to form organic substances even with the aid of light. Their leaves become at best pale scales. All substances necessary for the development of the shoots and flowers are taken from the host plant.

In other plants, the *principles of formation* leading to the development of sympetalous plants deeply penetrate plant growth. Not only do the petals of the individual flowers fuse, but the flowers of inflores-

Fig. 59 Flower head of a scabious (a) (after Weberling-Schwants) and (b) flower head of a composite flower. Both formations find their origin in an obstruction of the sun-affected flowering shoot. This obstruction corresponds to the formation of a rosette in the biennials. At the base of the scabious head we find a rosette-like wreath of simple leaflets. In addition to this obstruction, there is also an expression of the shoot in the composite flowers.

cences also join together into one higher unit. In this way, the flower heads of the globe daisy family, the teasel family and the composites develop. The far planets are even more pronouncedly manifest here. The flowering impulse takes hold of the plant with such intensity that the stems and leaves that usually stretch far up into the region of the flowers are stunted. In the teasel family, particularly in the scabious and the mournful widow, the individual blossoms of one flower head are tightly crowded in a bowl-shaped "calyx" of simple leaves. During blossoming, the flower head is carried far above the region of leaves into the midsummer world of light and warmth. There the blue or purple blossoms turn to all directions of the sky. In the flower heads of the scabious, the lowest blossoms with their tubes and petal-like edges become rather large. They enclose the numerous individual blossoms into one uniform structure.

This, however, is merely a suggestion of the higher blossom form present in the *Compositae*. In the daisy, the calendula and the arnica, a higher level of inflorescence develops, the so-called pseudanthia. The shoot expands to form the bottom of a basket-shaped head of fused receptacles. It is surrounded, as if by a calyx, by numerous small leaves, the so-called involucre. The tubular blossoms along the periphery widen to form a wreath of petals. This "corolla" of ray flowers surrounds a small sea of disc flowers that gradually bloom from the periphery towards the center. The flower buds of the disc flowers turn toward the sky in tightly clustered, uniform spirals. Only when the last flowers in the center fade do the ray flowers on the edge wither also. The plant reaches the highest level of blossoming in that the many flowers together form these higher "blossoms." In the rose the individual plant reaches utmost perfection; in the *Compositae* an

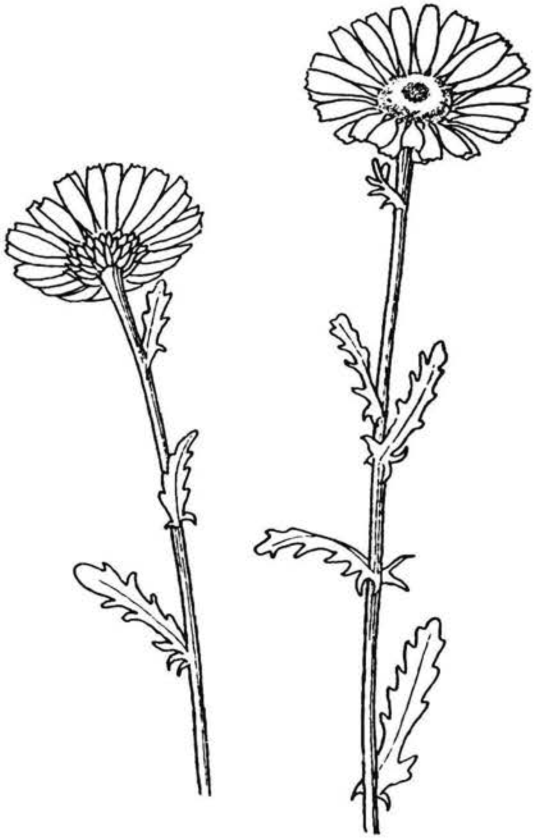

Fig. 60 Daisy *(Chrysanthemum leucanthemum)*. The type of the *Compositae* is particularly beautifully manifest in this plant common to our summery meadows and mountainous pastures. The numerous leaflets which form the involucre (a) reveal that an undeveloped, tightly contracted shoot is at the basis of the composite flower. The leaves of the shoot, after undergoing several intermediary stages, go over into the contraction of these small leaflets. The radiant, white ray flowers, surrounding the yellow center with its numerous disc flowers, appear like one single blossom. During the course of several days, they begin to bloom from the periphery to the center. The daisies flower from May until October.

overyly rich flower region generally develops into a few blossom forms or even into a single one.

This gesture is sometimes continued in the fruit. It is particularly evident in the delicate, ball-shaped fruit clusters of the common dandelion and the goatsbeard. The numerous small, dry, almost seed-like fruits (achenes) together form a sphere permeated by air and filled

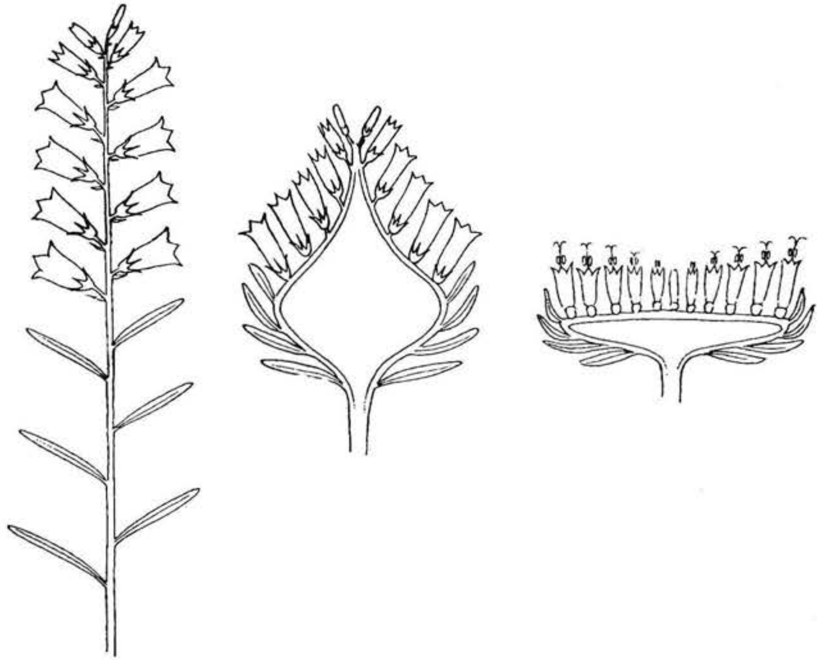

Fig. 61 Relationship between a raceme (bluebell) and a composite flower. In the raceme, the blossoms arrange themselves along the shoot. The shoot, as the sun's reflection, becomes a flower head through a double transformation—through obstruction and expansion. The obstruction corresponds to that caused by Mars, which in the biennials leads to a rosette formation in the lower region of the vegetative shoot. In the expansion, the formative forces connected with Jupiter are active and stretch the shoot horizontally. To this is added the contraction of the bell-shaped blossoms into disc flowers.

with light before they are dispersed into the atmosphere. Usually the small fruits rise into the air by means of the fine rays of the so-called pappus and are taken up by the gentlest breeze. Even in the fruits, the *Compositae* climb beyond the normal level of plant development. In the rose family, the transformation of substances reaches a peak during maturation; in the composites, the evelvation of the plant beyond the vegetative growth processes becomes a visible phenomenon in the fruits, which are enveloped by the warmth-filled atmosphere.

A common law is expressed here: the activity of those formative forces goes beyond the usual, where normally they are active only in the blossom in conjunction with the corolla. These formative forces, the manifestation of the far planets, increasingly permeate the preceding stages of plant growth. At first they bring the corolla together into one uniform sympetalous form. They reach much more deeply

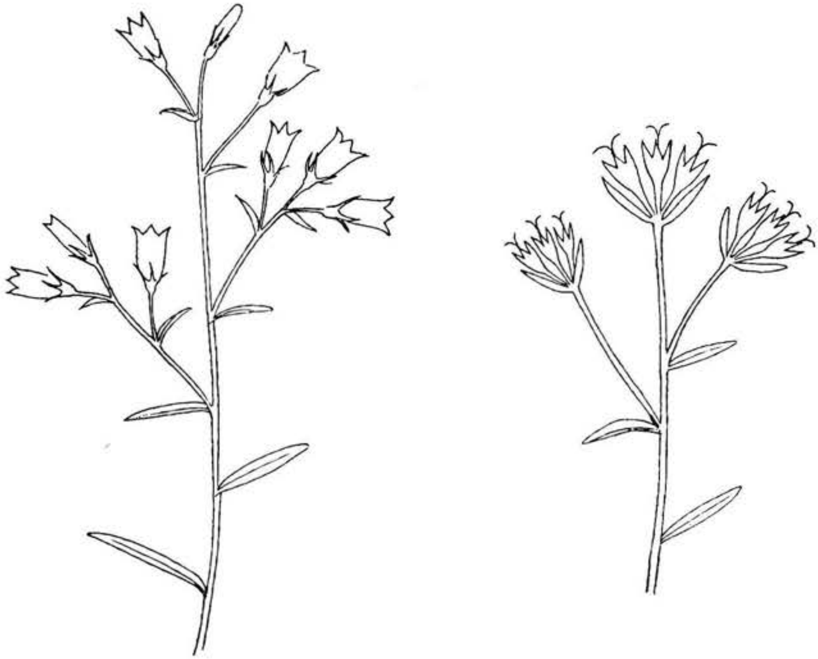

Fig. 62 Bluebells and composite flowers are closely related. The tubular disc flowers in the flower heads look like strongly contracted bluebells. The gesture of contraction is also apparent since no pedicle and no calyx develop and the florets are concentrated into one head. The heads may, as shown here, contain a small number of flowers. Such a formation may be found in the simple flower heads of the *Adenostyles glabra* (v. p. 159)

into the formative processes so that the sympetalous blossoms join together to form the blossom forms of the globe daisies, teasels, and most of all the composites. The formative forces active during vegetative growth are inhibited here. The often numerous small leaves, which crowd tightly together to form the involucre, point to the fact that at the base of the flower head is an unexpanded shoot which, in its rudimentary form, may be quite strong. In the type of the composite family, it is not only the regularly progressing metamorphosis—the ascent of the plant towards ever higher stages, to the development of the fruits and seeds—that is active. This ascending development dominates only in a shoot structure influenced by the sun and Mercury. The following stages are influenced by the opposite formative gesture, the reaching down of the formative forces of the far planets into the entire flower and even into the region of the shoot. In the carline

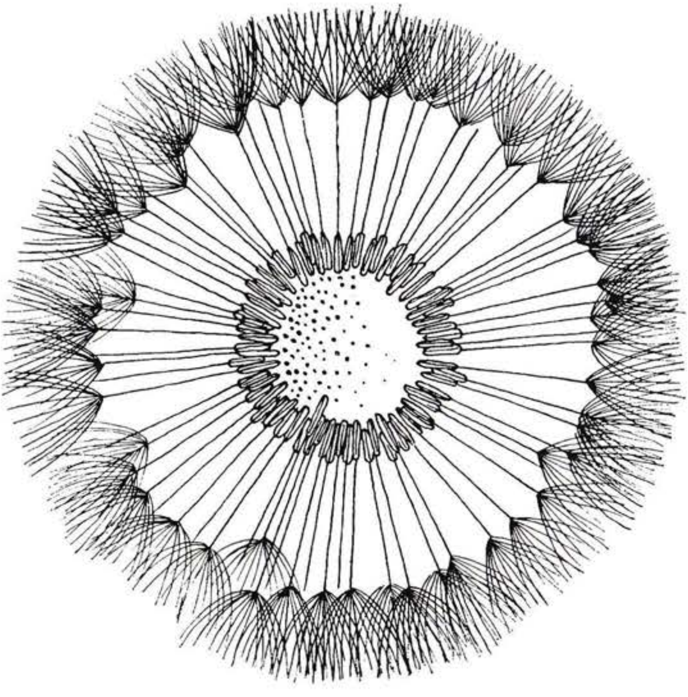

Fig. 63 Fruit cluster of a dandelion *(Taraxacum officinale)*. The wind has already carried off some of the delicate windblown fruits. Around the receptacle, the fruits with their delicate pedicles and feathery crowns (pappus) form a sphere permeated by light and air. In all *Liguliflorae* the receptacle expands only a little above the shoot. The inhibition connected with Mars appears most obviously in the vertical development of the shoot. It arches up uniformly as the base of the fruit cluster. The fruits in a delicate, radiating sphere surround the upper part of the shoot and the arched base, as Jupiter's sphere surrounds Mars' sphere in the universe.

thistle, the entire plant appears to be a blossom lying on the ground. The tightly positioned, thistle-like leaves appear in a calyx-like border around the "blossom." The dry sepals of the enveloping calyx expand like a silver-gold corolla. Formative forces that normally are awakened later here permeate the plant during the earlier stages. Thus we have a massing together within the plant and an intensified development of the blossom and the fruit. The type of the *Compositae* is formed from the joint influence of the normal, ascending formative laws and the formative laws reaching down from above—i.e., from the cooperation between the form-giving tendencies of both the near and far planets. The plant thus reaches a connection with the region of the far planets which goes far beyond the normal.

From this perspective, we may now, at least roughly, survey the abundance of forms in the composite family. The botanical system divides the *Compositae* into two sub-families (or into two families, if the composites are considered as an order, instead of a family). The numerous genera of *Tubuliflorae* include the basket-shaped flower heads of the tansy. In the smaller group of *Liguliflorae,* there are only ray flowers in the flower head, as in the dandelion or the chicory. This classification pays particular attention to the flower region. To comprehend the various composite species in their entire form within their type, we must observe within the whole plant the manifold interrelationship of the formative forces influenced by the near and far

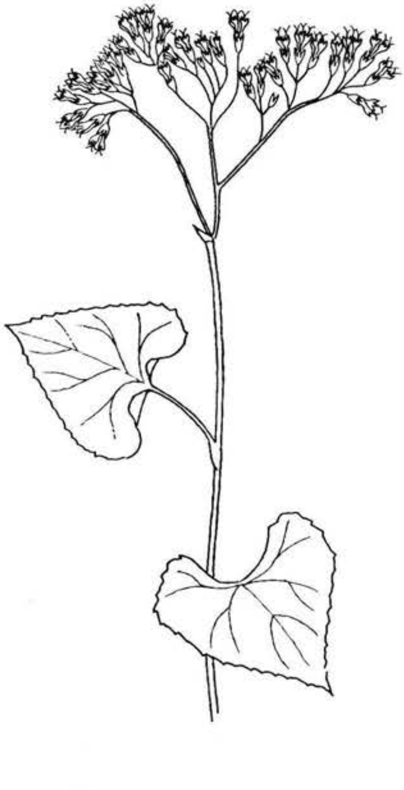

Fig. 64

Adenostyles glabra. This plant grows in Alpine forests in calcareous soil. The lower leaves are large. Above this vegetative region, which is strongly marked by the influences of moistness, the inflorescences climb to a height of almost 1 meter. The individual flowers seem insignificant. Together they form a muted, reddish inflorescence stretching gingerly into the atmosphere. Time of blossoming: July and August.

planets. This interrelationship illustrates the most important law permeating the many forms of the *Compositae*. There are either species with few or just one large "blossom" in which numerous small flowers are contained (carline thistle, sunflower, daisy), or many small flower heads develop, each composed of few individual flowers standing in loose "inflorescences" (yarrow, purple rattlesnake-root, various mugwort species). Here the upward-striving, vegetative development plays a strong role in the region of the flowers. Between these two extreme groups a multitude of various form exists.

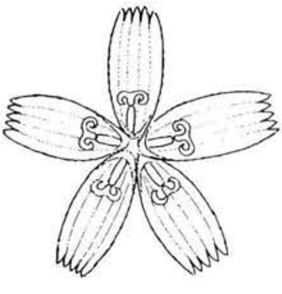

Fig. 65 Flower head of a wall lettuce *(Mycelis muralis;* after Schad). The composite flower here develops a form that corresponds to the five-fold dicotyledon blossoms. In the latter, the corolla originates from five petals; the loose inflorescences of the wall lettuce each contain five yellow ray flowers.

In the hemp agrimony and the *Adenostyles glabra,* for example, the shoots and leaves develop particularly strongly. Both plants grow to over one meter in height in the somewhat subdued atmosphere of forests and bushes. The top of the shoot is divided into a loose, pale-red "inflorescence" consisting of many small, thin flower heads, which contain only three to six tubular flowers. Thus the flowering process appears to be contained, as though in a beginning stage. The composite plant has not yet reached its final form. The shoot with its leaves dominates the whole plant. In contrast to the stong sun and Mercury effect, the influence of the far planets is minor.

In species like the wall lettuce, the purple rattlesnake-root and the tansy, similarities may be found. The flower heads, however, are not suspended above the shoot; they are more integrated with it. Most importantly, the flowering process, despite its delicateness, becomes

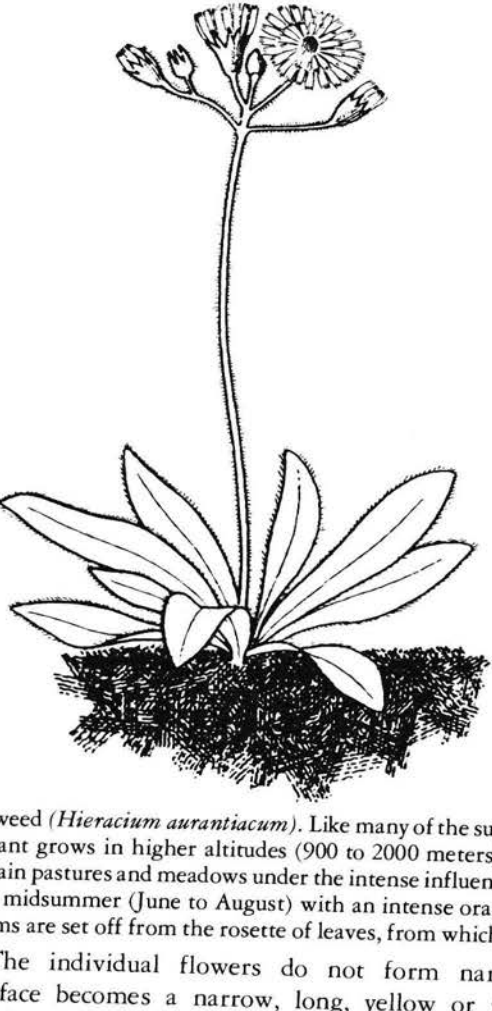

Fig. 66 Hawkweed *(Hieracium aurantiacum)*. Like many of the sun-affected composites, this plant grows in higher altitudes (900 to 2000 meters) where it develops in mountain pastures and meadows under the intense influence of the sun. It blooms during midsummer (June to August) with an intense orange and red color. The blossoms are set off from the rosette of leaves, from which runners originate.

stronger. The individual flowers do not form narrow tubes. Their interior surface becomes a narrow, long, yellow or red tongue, which radiates far beyond the head and yields entirely to the sun, or, in the upside-down flowers of the purple rattlesnake-root, yields to the light-filled space of the woods. Here forces are suggested that lead to the typical composite flowers. In contrast, Venus' signature often shines through in the "blossoms," as each group of five-ray flowers forms a regular five-pointed star. In other composites, the flower head is also five-parted. As in the typical dicotyledon flower, five ray flowers surround the few disc flowers in head of the buttonweed, the yarrow, and some of their relatives.

The moon's influence remains very strong on the earliest of our composite plants, like the coltsfoot, which flowers in February, and the various winter heliotrope species flowering in March. The shoots grow in the moist, often somewhat loamy soil as rhizomes. In the coltsfoot, the pale shoots with yellow heads emerge in clusters. In the winter heliotrope, the heads are crowded tightly together. On neither of these plants do perfect individual flowers develop. In the heads of the coltsfoot, numerous ray flowers, containing only a stigma, style, and ovary, surround the relatively few disc flowers with their stamens. The heads of the winter heliotrope are even monoecious. The leaves unfold after the flowers; they grow from the ground and often expand into strong, tough blades.

The dandelion, the goatsbeard, the hawkweed and hawk's-beard species, and other genera of the *Liguliflorae,* clearly express the forces of light and the sun. The subdued flowering process we found in the wall lettuce, tansy, and purple rattlesnake-root now develops in a more beautiful, radiant manner. The flower heads are still relatively small; however, they do contain many flowers. With their radiant yellow or reddish-orange rays, they bloom in circles from the edge towards the middle. Over several days, the effect of light intensifies. Since the ray flowers are not single petals but the interior part of the flower turning towards the light, there is a most intimate connection of the plant with the sun. On a meadow or mountain pasture with flowering dandelions or hawkweed, we may experience how the sun and plant life melt into one unit. In the morning the heads open; in the evening, and also during rain, they close until the sun shines again. Thus sunrise and sunset are reflected a thousandfold in a meadow.

All these plants are substantially smaller than the hemp agrimony, the *Adenostyles glabra,* and the purple rattlesnake-root. Almost all belong on open land and in mountainous areas where the sun's radiation, not moisture, dominates. The vegetative growth clearly recedes and the flowering process dominates. The chicory is a close relative of the dandelion, the hawkweeds, and the hawk's-beard species. Its bluish flowers develop on slim branches in which the life processes are maintained by drying warmth. They lack somwhat the radiant character. The ray flowers form a bowl-shaped circle, which turns its light-blue face toward the light.

In these plants the flower heads are still rather narrow. Thus we have the impression that the shoot itself is opening up towards the sun through this radiating, blossoming gesture. In most plants, however, the shoot clearly expands at the base of the head. A living ground develops from which the numerous small flowers emerge. Such a composite flower resembles a flower garden which unfolds above the green leaves like a more highly developed plant species. It develops in the various forms in which the region of the far planets is reflected.

To begin with, this expansion is connected with an intense contraction of the tubular flowers within the ball-shaped flower heads of, for example, the thistles, the horse thistles, and the cotton thistles. A significant number of these species are biennials. Almost all show Mars' influence. They either push upward with extraordinary intensity, or else the shoot is completely suppressed, as in the stemless horse thistle. A clear contraction is often connected with the upward urge. In various species, the leaves initially grow upward along the stem before they spread into the surrounding space. This combination of the upward-urging expansion and the narrowing contraction so characteristic of Mars is encountered everywhere. In the leaves this leads to a contraction in the thorny tips, in the flower heads to the prickly form of the bracts. The flower heads are very compact. From the center, the reddish disc flowers break forth as if freed from an obstruction. Finally the fruits with their long hairs burst out of the enclosure in a dense white cloud and are blown far out into the atmosphere. Few plants reflect Mars as vividly as do the thistles. The burdocks, centauries, and most of all the carline thistles are closely related to the thistles.

The perfect form of the composites is revealed in the leopardbane, the Roman camomile, the German camomile, the oxeye, the asters, the daisies, and the sunflower. On the receptacle, numerous disc flowers develop and turn as a blossom-sphere towards the sky; the shoot expands far beyond the stem diameter into the receptacle. So one may observe how the sun-related shoot attains a position which reaches beyond the stem in the same way as Jupiter reaches beyond the sun's sphere in the cosmos. All open composite heads, in a way different from that of the umbels of the umbelliferous plants, are a reflection of Jupiter. In the umbellifers, the flowering process transcends the shoot; in the composites, it penetrates deep down into the region of the shoot and transforms it into a flower head. The sun unites with the sphere of the far planets into one entity, in which the sun dominates in plants such as the hawkweed, Mars dominates in the thistle-like plants, and Jupiter dominates in the above-mentioned species.

The ray flowers, which in the sun-affected genera fill the entire flower head, here crowd along the periphery. The ray flowers of the camomile or calendula, however, are of a slightly different character from those of the hawkweed. They are somewhat tougher, and have only three crenations in their tips instead of five. The ray flowers do not develop so completely as in the sun-affected composites. They are often sterile, and thus are almost like petals. In the cosmos and dahlias of the autumn garden, they expand in wide, radiant "corollas." In many strawflowers (Cat's-foot, everlasting), which are strongly characterized by the desiccating warmth of their locations in sand, heath, or mountains, the bracts of the involucre become dry and colored. In this way, particularly beautiful, delicate "blossoms" develop.

An even higher stage of the composite flower is reached by the edelweiss, a relative of the strawflower. In a cloak of white, felty hypsophylls, several composite inflorescences are united. This is only the beginning stage of a new unity, however. Only the globe thistle achieves complete unity. When we first come across this higher plant species with its dry, pale, steel-blue flower balls, we assume that the receptacle is not only arched upward as in the German Camomile, but is even curved into a small ball. The flowers spread uniformly in all directions. The ray flowers, however, are surrounded at the base by a small involucre. They are, in fact, composite inflorescences, each with a single flower. We have to imagine that many composite flower heads, corresponding to those of the daisies or sunflowers, arrange themselves spherically around one center. With the simplification of the flower heads, a new unity develops, even more comprehensive than all previous structures. What is one unity in the composite inflorescence joins together under an even higher law. If the expansion of the shoot into the receptacle in the other composites is seen as the formative work of Jupiter, the blossom form of the globe thistle becomes clearer. In the globe thistle, the development of the plant enters into direct association with the sphere surrounding Jupiter, namely Saturn's sphere. Saturn's effect, which is to inhibit all development, manifests itself in the narrow, blue or bluish-white flower heads. The fact that Saturn surrounds Jupiter's sphere is reflected in the flower heads' orientation to the surrounding space. The globe thistle is the most impressive manifestation of Saturn in relation to Jupiter and the sun.

Thus the type of the *Compositae* already finds numerous expressions of its form in our native flora, some of which we have mentioned. This abundance of forms is to be understood directly from the type. Here the formative forces originating from the sphere of the far planets may penetrate down into the lower regions of the plant, the inflorescences, and the shoot, in various ways. These forces sometimes transform the inflorescences by only a small measure, as, for example, in the hemp agrimony and the *Adenostyles glabra*. Their effect, however, can be as intense as in the development of the larger, disc-shaped or arched composite heads, or even the globe thistle. Herein lies the reason that the *Compositae* are the family or order with the most species among the

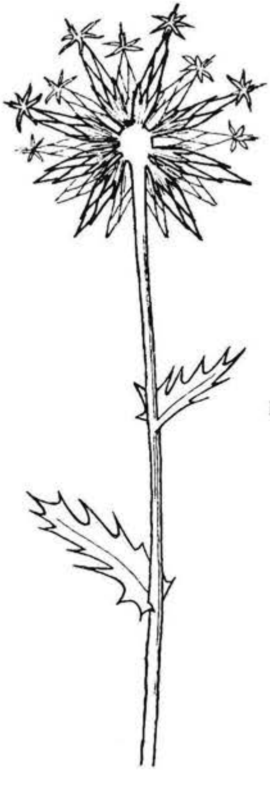

Fig. 67 Globe thistle *(Echinops sphaerocephalus.)* This simply-sketched cross-section through the inflorescence shows how the many narrowly contracted heads turn toward the entire surrounding space. Initially the flowering starts on top and gradually spreads down into the inflorescence with its pale blue coloration. This inflorescence, which is exceptional in color and form, is carried up to a height of 2 meters by its sparsely-leafed shoot. This plant is often found around castles and monasteries on dry, rocky slopes, because it was originally cultivated there. It has survived in those locations where warmth has always been present.

dicotyledons. The flowering plant reaches its highest stage of development in the *Compositae,* because here, as in no other plant group, the plant is dominated by the flowering process.

The composites are also quite widely distributed. The flowering process always demands that the plant during its development elevate itself above the broader effects of moisture. Where the flowering process permeates the plant's development as intensely as in the composite family, it is understandable that there are no water plants and only a small number of species growing in the wet soils of the marshlands. Numerous composite species may be found in all other regions of earthly vegetation. Plant cover is dominated most significantly by the *Com-*

positae where the cosmic influence is especially strong, as in high altitudes. The abundance of *Compositae* in mountainous areas strongly points to the intimate connection of these plants with the universe. A significant number of *Compositae* are also present in the open landscapes of the tropical and subtropical regions, where the sun with its light and warmth dominates plant life.

Retrospect and Summary

It would easily be possible for us to go on studying further plant families, even the domain of the lower plants. Our purpose, however, is to show with some characteristic plant groups how one may penetrate into the orderliness of nature when one observes plants from a cosmological viewpoint. The paths we have to enter are still quite unfamiliar today. The modern researcher in his investigations concentrates on the individual plant species, yet he is convinced that he uncovers general laws through this method. Our procedures do not correspond to the general notion of inductive natural science. We first developed an image of the general laws of formation expressed in the flowering plant. This archetypal image is not a schema or an abstract concept; it is vividly concrete and emerges from the activity of the human mind in the observation of plants. Human thinking cannot simply rely on external perception in the cognition of life as it does in the discovery of physical laws. "Our spirit must . . . work much more intensely in comprehending the type than it does in discovering the laws of nature. It must take up a function that in the inorganic natural sciences is done by the senses, and which we call intuition. On this higher level, the spirit itself must be intuitive. Our judgment must perceive thoughtfully and think intuitively."[44]

The approach toward cognition appropriate for life, described here by Rudolf Steiner, does not, like the inductive methods, lead from the objective and specific to the abstract and general—it grasps the general itself in a concrete, intuitive fashion. This is done in the way that Goethe, in his argument with K. P. Wolff, describes as the contrast to mere sense-perception: " . . . that the eyes of the spirit and the eyes of the body must continuously work together lest there be a danger of looking and yet overlooking."[45]

With appropriate preparation and exercises, i.e., if we allow our imagination and thoughts to be penetrated by the rhythms and orderliness of the planetary world, something is revealed in the formative

44. R. Steiner, *Grundlinien einer Erkenntnistheorie der Goetheschen Weltanschauung,* GA 2 (Dornach: 1960), p. 110.

45. *Goethes naturwissenschaftliche Schriften,* vol. 1, p. 107.

processes of the plants that hitherto has been "overlooked" because our view has been clouded: the living reflection of the universe.

In the archetypal image we have found the principles through which the subtypes emerge from the general type. Here, also, we are not dealing with deduction in the usual sense. The specific is not deduced from the general. The near planets, as well as the sun with the far planets, come into play more intensely in the archetypal image; the monocotyledons and dicotyledons arrange themselves according to the former, and the growth patterns according to the latter.

This generally corresponds to the path that our cognition must follow if we wish to penetrate the realm of life. We must develop our

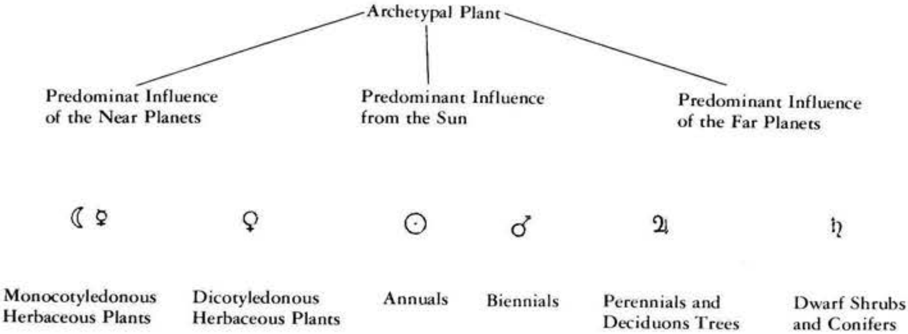

Fig. 68

particular case "from the archetypal form (here the archetypal plant). We must not compare the type to the individual plant to see how it determines the plant. We must allow the plant to come forth from it . . . the type flows into the individual living entity; it identifies with it."[46]

In the cosmic realm, the near planets are tied to the sun's sphere and are surrounded by the far planets. The spheres of the far planets permeate those of the near planets. The influences from Saturn, Jupiter, and Mars permeate those from Mercury and Venus. A vivid image of this is encountered in the plant kingdom; the monocotyledons and dicotyledons always develop in certain growth patterns, although in various ways. Figure 68 is misleading insofar as it shows what should be depicted as the right side enclosing and penetrating the left. Most importantly, however, this model should not mislead you into thinking that the archetypal plant exists above or next to the individual plant

46. R. Steiner, *Grundlinien einer Erkenntnistheorie der Goetheschen Weltanschauung*, p. 106.

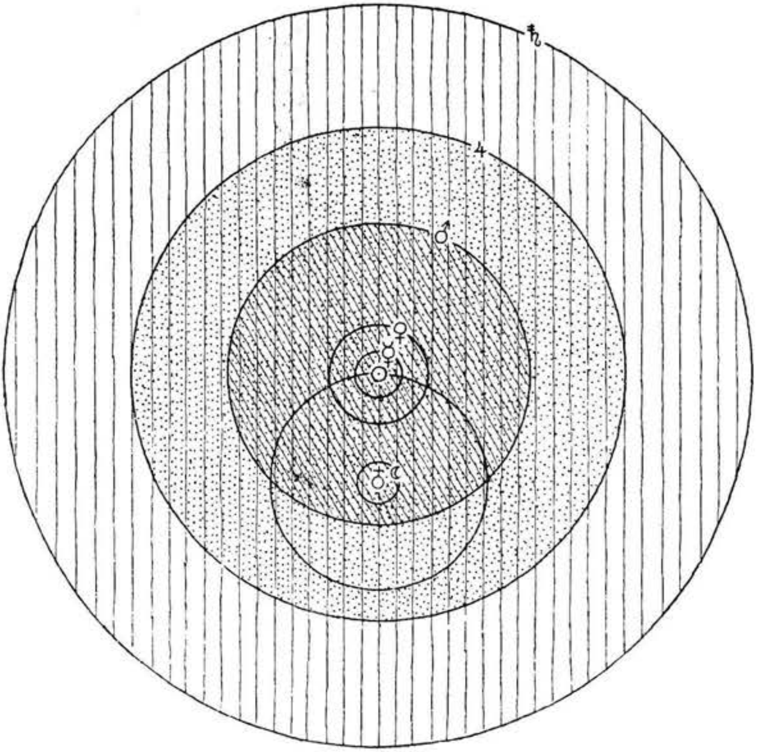

Fig. 69 Saturn's, Jupiter's and Mars' spheres permeate the sphere of the near planets, which is reflected in the monocotyledonous and dicotyledonous herbaceous plants. Form expression is thus manifest in certain growth patterns. This illustration exemplifies in a factual manner the content of the preceding model.

forms. The archetypal plant expresses different forms in that it activates the formative forces in the individual plant with varying intensity.

When studying the monocotyledons and dicotyledons, we envision that those principles leading to the various growth patterns are also active in them. As explained in the preceding chapters, we observe how from the subtypes of the monocotyledons and dicotyledons specific forms emerge. They develop because they are permeated anew by certain planetary regions with their rhythms and laws of formation. For the families of flowering plants the following over-view results:

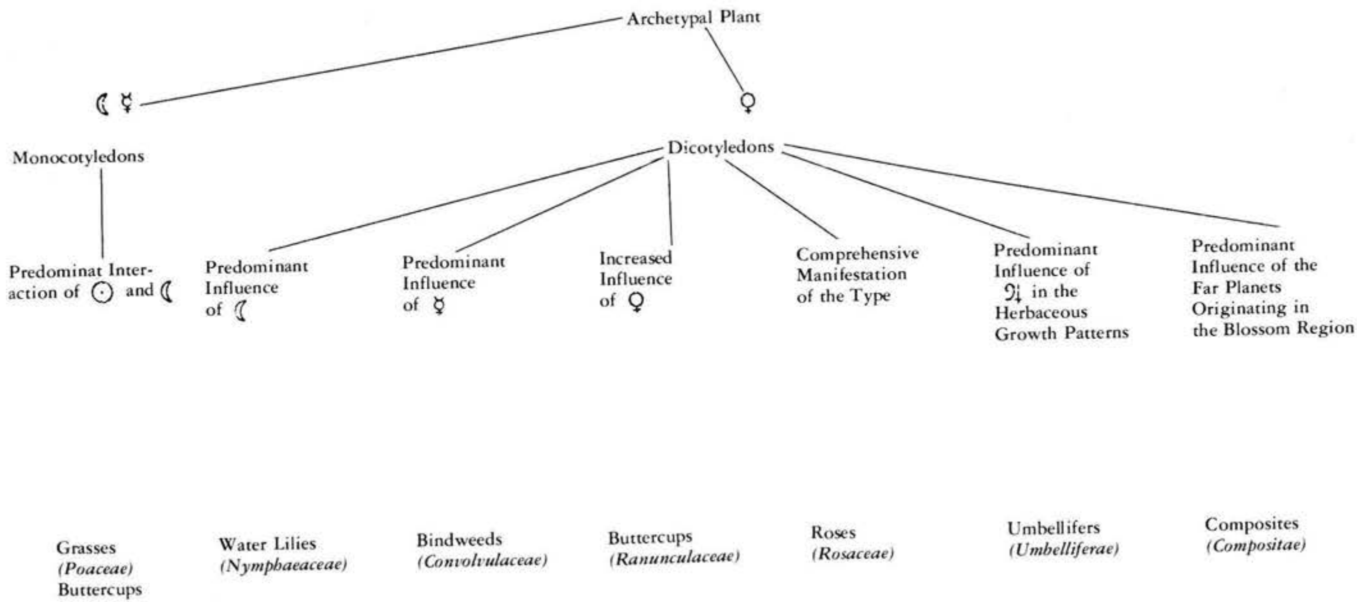
Archetypal Plant
☾ ☿
♀
Monocotyledons
Dicotyledons
Predominat Interaction of ☉ and ☾
Predominant Influence of ☾
Predominant Influence of ☿
Increased Influence of ♀
Comprehensive Manifestation of the Type
Predominant Influence of ♃ in the Herbaceous Growth Patterns
Predominant Influence of the Far Planets Originating in the Blossom Region
Grasses (Poaceae) Buttercups
Water Lilies (Nymphaeaceae)
Bindweeds (Convolvulaceae)
Buttercups (Ranunculaceae)
Roses (Rosaceae)
Umbellifers (Umbelliferae)
Composites (Compositae)

Fig. 70

Only when we see how each plant family is a type in which the archetypal image is realized in a particular form do we reach an understanding of the individual genera and species. Within them the respective type again expresses itself in various ways according to the universal laws, namely within the four elements and substances. Organic life is a living mirror in which the multifaceted interplay of the moon, the sun, and the planets is manifest.

To comprehend with our spirit an individual plant genus in its connection with nature, we must penetrate into the development of external forms, from the type of the family, to the more comprehensive types, and finally to the archetypal image.

Frequently we encounter the opinion today that it is easy to gain cognition of the specific; when proceeding from the specific to the general, however, the cognitive process is said to be more troublesome and complicated. As soon as we enter the realm of life, though, this opinion proves to be an illusion. If we want to understand the plants in their interwovenness with nature, i.e., in their reality, it is no more difficult to understand the archetypal plant than the water lily or the blackberry. We become increasingly aware that the entire planetary system manifests itself in each individual plant genus, and this is a manner whereby the rhythms and spheres interpenetrate each other with varying intensity. We experience the individual plant as a mighty musical chord in which the individual notes resound in changing rhythms and intensities.

Epilogue: The Educational Purpose

The expansion of our perception of nature as we have introduced it in rough outlines is not only of theoretical interest. The views people gain from school, college, and individual research on the subject of nature profoundly affect their entire perception of the world and their view of life. Our concepts of matter, life and evolution determine how we consciously relate to the great questions and mysteries of existence and how we perceive ourselves as human beings.

Modern natural science leads us into a dilemma. Its concepts of the causes of plant and animal life limit human comprehension of what is experienced in the plant and animal kingdoms. Even the scientist forgets the concept of molecular biology at the sight of a flowering rosebush or a ripening field of grain. Nature and theories about nature are two different worlds sometimes. Nature speaks to people not only by relating to their minds but also to their feelings and moral sense. We surmise, when relying on our perceptions, something essential that eludes rational interpretation. The concepts which supposedly explain nature convey little of that which is experienced as nature. People within themselves become divided between relatively abstract structural and causal thinking and experiences that mold their characters through their feelings and moral sense.

During the past decades more and more natural scientists have pointed to this gap, especially the Swiss zoologist A. Portmann. His research and works are significant because they direct the perception of nature back to the phenomena of living nature.[47] A few years ago, Portmann also focused attention on the effect of the terminology and concepts of natural science on education. In his essay about "Biology in Aesthetic Education" he writes that " . . . the predominance of theoretical function . . . inhibits cultural development tremendously and . . . has brought about in particular a little-noticed atrophy of the feelings and emotions."[48] Therefore he advises that lessons in natural history for children and juveniles also foster an aesthetic appreciation of nature.

47. In this connection, we would like to mention particularly the paper on *Entlässt die Natur den Menschen* (Munich: 1970).

48. *Biologie und Geist* (Freiburg: 1963), p. 251.

We see the task not only as attending to the "theoretical function" and the "aesthetic function" but as bridging the gap that leads to the creation of these contrasts. How does this gap come about?

The plant kingdom as it is encountered by the inquisitive person awakens a multitude of questions. They relate to form, origin, life processes, etc. There are two ways to approach these questions. Nowadays we are convinced that the cause for a phenomenon can be found only within the phenomenon itself, and so we dissect it. Through analysis the interconnectedness of the phenomenon is dissolved, and we arrive at various structures: for example, the genetic code. In the molecular structures—the minute parts of the whole—the cause of the whole is found. The terminology here turns to the causal connections, which, however, are really not established yet. Vague, theoretical, unsubstantiated assumption is passed off as fact. What is a mere *prerequisite* for the occurence of certain phenomena is escalated into being a *cause*. We may speak of cause only when we can prove that from it with strict, elucidative necessity a certain phenomenon occurs. This is not the case with deductions in the field of molecular biology, for example. Beliefs are established thus, not knowledge. The mysterious phenomenon is not explained, and explanation is merely postulated. In this manner, mysteries remain veiled for children and young adults. Significant facts are joined with insufficent concepts and, in part, create an unreal perceptual world. Because it is investigated in parts, the phenomenon as a whole moves into the background.

The second way leads in the opposite direction. Here, for example, we learn how the plant is connected with the atmosphere through its leaves. In the expanding leaf blade, we comprehend how the entire plant with its processes of growth and life yields to the air and light. When we perceive only the leaf, we deal with an abstraction; that seemingly complete entity does not exist on its own. Only when we imagine the penetration into the sphere of light and air through which the leaf becomes a part of the atmosphere do we arrive at a view of reality. Likewise, we have to perceive how the plant roots in the ground's moisture and how at the same time gravity determines the development of the plant. The root by itself is no more a reality than are the leaves, shoots, flowers, etc. Imagination must free us from abstractions based on sense perceptions. The analysis of our sensory perception is in conflict with our integration with nature.

According to Rudolf Steiner, this is the first step we have to take with children in their botanical lessons.[49] The children should develop

49. R. Steiner, *Erziehungskunst, Seminarbesprechungen und Lehrplanvorträge*, GA 295 (Dornach: 1969), Seminarbesprechung from 30 August 1919.

innate, vivid imaginative powers and through them comprehend how the plant is actively formed under the cosmic and earthly forces, in the substances of nature. What capabilities the young person develops do not lead away from nature, but, on the contrary, lead from the observed plant towards nature. When we approach the plant in nature this way, we arrive at the next question. It relates to those intrinsic laws active in the processes of form expression. We have investigated those laws. In the beginning of botanical studies, around the fifth grade, the children should at first learn only about the simple basic gestures: how, in everything that expands in the plant's development, the sun is evident, and how, in all that undergoes contraction, the moon can be seen.[50]

From such lessons in school, significant influences reach over into a person's development. When a child understands and experiences how the sun is active wherever the shoots develop their leaves and blossoms in the light, and how the moon is active where the plant in the ovary, buds, and seeds isolates itself, his or her relationship to the world is changed. Children do not merely stand in front of nature when their imagination helps them to comprehend how many spring bulbs and, to a lesser degree, developing shoots reflect the still-powerful moon and the slowly increasing sun. With this kind of cognition, people sense their interrelatedness with nature. The experience of the self is distinct from the objects and more or less self-contained. Through the understanding of nature we envision here, the human being not only relates to nature through the imagination, but makes spiritual connections, even in the experience of the self, with the vastness of the cosmic relationship. By seeing the universe reflected in the plant kingdom, one experiences the greatness of nature. One is filled by this greatness through cognition and is led beyond the narrow boundaries of the ego.

The curriculum of the upper grades of the Waldorf School must continue along this path, as Steiner clearly indicates.[51] There are hardly any alternatives if we do not wish to push the young person into the region of "scientific dogma." Around the eleventh grade, the pupils should be thoroughly knowledgeable about the various systems of the world, not only the Copernican but also those of Ptolemy and Tycho Brahe. From there they may penetrate into the laws of life and growth

50. R. Steiner, *Die Methodik des Lehrens und die Lebensbedingungen des Erziehens*, GA 308 (Dornach: 1974), evening lecture from 10 April 1924; and *Gegenwärtiges Geistesleben und Erziehung*, GA 307 (Dornach: 1973), lecture from 13 August, 1923.

51. R. Steiner, *Menschenerkenntnis und Unterrichtsgestaltung*, GA 302 (Dornach: 1971), p. 111.

in the plant and animal kingdoms. This touches upon the main task we have set before ourselves with this book: to lay the foundation for this kind of curriculum. Nowadays scientific education is required for all grade levels. In many aspects, however, science must be developed further if it is to contain the conditions for human development. Young people today are searching for an understanding of the world through which they may comprehend their own selves. This calls for more than a materialistic interpretation of the universe and of life. The lessons must give guidance. Understanding will be achieved if, for example, young people make the rhythms and orders of the planetary system part of their thinking and then approach the phenomena of the plant kingdom with this in mind. For then they may recognize, with their own intuitive judgment, the universal orders prevalent in nature, and through this cognition they may relate to them spiritually. To these observations may be added in a meaningful way those facts that causal, analytical investigations have uncovered through another path. They describe the material life processes, which are a reflection of the universe.

INDEX

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