Natural Alchemy of Religious Opinion
Progress of Invertebrate Life
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Part III. Progress of Invertebrate Life
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Only by learning as much as possible about other forms of life can we determine, with any degree of accuracy, man's place in nature. And only when man's place in nature has rightly been determined can rules of conduct wisely he laid down. Men adopt, it is true, such rules as arbitrarily have been handed down from times when almost nothing was known of nature. And because of this, there is hardly an accepted code of life that will not repay critical examination in the light of present day knowledge. Some of these commonly accepted notions I will discuss later, and most persons will be surprised to find how few are truly sound. But before this can be done we must have a good general idea of the processes that have led life to its present estate.

Now living matter, as I have said, is always associated with protoplasm. Protoplasm is an essential ingredient both of animals and of vegetables. What, then, is the line of demarcation between animals and vegetables, and what were the incentives that produced the first animal?

As a matter of fact, there is no clear cut line between them; some animals, such as the protozoon, Luglena, being provided with chlorophyll, and others, such as the ascidians, possessing cellulose; both of which are commonly considered strictly plant features. Animals live upon organic matter, and in some stage of life possess the power of locomotion. Yet among plants the fungi live upon organic matter; and many algae, such as the diatoms; and the spores of the cryptogams; have the power of locomotion. To be sure, the male sexual element of most plants has the power of locomotion well developed.

In general, the source of food supply and the power of locomotion tend to distinguish animals from plants. Plants, with the exception of those that feed upon material already organized, possess the green coloring matter, chlorophyll, by which, in the presence of sunlight, they are able to capture carbon, their chief food supply, from the atmosphere. Animals, on the other hand, are not capable of living upon inorganic matter. Their chief food supply is the organic matter stored up by plants. Animals also feed upon other animals. In fact, sea creatures form a chain from the smallest to the largest, the smaller in its turn being devoured by the larger. But the original food supply sustaining the smallest, and hence the whole chain, is vegetable or bacterial in origin.

To obtain a vegetable food supply, either the plants must be brought to the animal or the animal must go to the plants. Water serves to bring the food supply of certain creatures, such as the sponges, yet even those usually have developed the power of producing the current of water which brings their food. But more often, to get an adequate food supply, the animal must go to its food. This necessitates locomotion.

We can hardly conceive of animals living before plants or bacteria, but as soon as these came into existence there was an available food supply, and it is probable that it was not long before there were animals developed to take advantage of it. In fact, it is even possible that animals developed before plants, as many of the protozoa feed freely upon bacteria, and today thus exert a limiting influence upon bacterial activity.

The urge to secure a food supply resides in the astral counterpart of both plants and animals. It is a fundamental impulse common to all life. And this intense desire-- a subconscious desire that may also be termed instinct, but that is nevertheless intelligent in its expression-- ever tends to adapt the structure to the end of better securing its food. Intelligence is not confined to certain favored organisms, but is inherent in every living form. In fact, I believe the form is but the expression of the intelligence temporarily using it.

When a new condition arises this subjective intelligence, dimly aware of its plight, feels the desire to meet the new condition successfully. There is a blind groping to find a tray. Subjective intelligence makes many mistakes. It is not reason. It is but the memory of its previous experiences, which may have been largely astral, stored in the astral form. But desire changes the astral form, and this in turn tends to change the form and attributes of the physical structure. So we may conceive of a single primitive cell of living matter, accentuated by the desire for food, departing from the custom of seeking nourishment from inorganic matter and appropriating the food supply already secured by its neighbor. This then proved so successful an expedient that the cell adopted it, and when it divided to form two cells, each new cell continued the trait. But this method, to prove permanently successful, requires that the cell be able to move from place to place in search of other cells to devour. This desire to actively seek a food supply caused a change in the astral counterpart, and this in turn brought about a change in the physical structure that gave greater mobility, and finally resulted in a cell having the power to move about ingesting less favored forms of life. Such was the primitive protozoon. The protozoa not only were the first animals on earth, but persist today as the most abundant aquatic animals. Millions of them swarm in almost every drop of water. Not all of them are so small, however, for they range in size from the one supposed to be the cause of yellow fever-- so minute it has never been seen-- up to a gigantic species two thirds of an inch in length found as a parasite in the intestines of lobsters. They are all single celled creatures.

Animal life is divided by naturalists into twelve great groups, or phyla. Unfortunately, knowledge of animal life is so strictly confined to the few that there are no vernacular names for most of the great groups of animals living today. This is true with even greater force of extinct animals, of which I shall speak in treating of mammals. Consequently, while I desire to avoid technical names, I must be pardoned for occasionally using them in these lessons, because there are no other terms by which a great number of interesting creatures may be designated.

Phylum I, the lowest, embraces the Protozoa, which are infinite in the variety of their forms. The typical protozoa is the amoeba, which is abundant at the bottom of fresh water ponds and among decaying water vegetation. It is a. microscopic mass of jelly-like protoplasm containing a nucleus. It moves by changing the outline of its body, pushing out and withdrawing portions of the jelly-like mass to produce a flowing effect. Its food consists of minute animals or plants or other bits of organic matter. When it touches such a morsel it gradually flows around and over it until the latter is quite surrounded. The protoplasm surrounding the food particle then secretes an acid which kills the prey and forms the soluble peptones or digestive ferment necessary for digestion. When the digestible portion of the food has been assimilated, the undigested particles are left behind as the amoeba flows on.

Such a simple organism is removed from certain primitive single celled plants only by a slight modification, for we must remember that some of these plants have the power of locomotion. Certain plants also feed upon organic matter. The protozoa, therefore, but utilizes in a somewhat greater degree of coordination, two principles that are also used by plant forms. We may assume that the frothy chemical compound called protoplasm found it more expedient in the case of the protozoa to flow slowly about feeding on particles of life that had been already organized than to remain in one place and endeavor to transform inorganic elements into food values.

Yet because of its minuteness and simplicity of structure we should not hastily scorn the simple cell. The single celled protozoa have an infinite variety of modifications, and the cells that make up the body of both plants and animals are not widely dissimilar to these. Were it not, for instance, for the amoeba like cells in the human blood, man would soon succumb to infectious diseases. The white corpuscles of the human blood are often called amoeboid corpuscles, because to all intents and purposes they are amoeba cells belonging to the human organism that are fostered by it as soldiers to guard it against invading germs. These amoeboid corpuscles, when minute organisms of various kinds invade the human system, act toward them as the ordinary amoeba act toward their prey. They pursue them and flow over them, engulfing them in their protoplasm. They are then digested and portions not assimilated are carried by the blood stream to portions of the body where they may easily be expelled. It is only when microbes multiply to such an extent that they so outnumber the amoeboid blood cells that these can not kill and devour them, that such diseases prove fatal.

I have already mentioned in the last lesson that certain algae devised the expedient of secreting lime. Other early plants-- such as the microscopic ones called diatoms, closely related to the algae, and supposed to be the source of the oil in the Southern California oil fields-- adopted the expedient of secreting a skeleton of silica. So we need not be surprised that early one-celled animals also should secrete hard parts to protect themselves from other predatory one-celled animals. Certain of the protozoa, called foraminifera, secrete a shell, or external skeletons of lime. There are foraminifera also that secrete a covering of chitin. Chitin is the horny substance forming the outer coat of insects and the crayfish group. Others of the protozoa secrete an external skeleton of silica. We see, therefore, that among the very primitive single celled organisms of both plants and animals there existed not merely the power of nutrition and reproduction, but also the power to secrete substances that were not protoplasm.

This is very important to us, for man's body, like all organic forms, is built up by cells. The skin and viscera, in fact, consist of cells. But the bones and muscles are chiefly the secretory products of cell activity, and this continues to renew and nourish them.

To a single celled animal living in the water a better mode of locomotion than mere oozing along would prove exceedingly valuable. So in those protozoa called flagellates we find the cell secreting one or two hair-like lashes which carry the animal along swiftly by beating the eater. And in this group is a problem naturalist have had much difficulty in solving, for some of the flagellates, including Luglena, already mentioned, possess distinct plant characteristics, such as the possession of chlorophyll and cellulose membrane. Instead of classifying them as plants, however, as was formerly done, it is now generally believed they are on the borderline between plants and animals, the two forms associating in a mutually beneficial close partnership.

A certain amount of protection is afforded by a thin membrane inclosing a cell. Consequently, in a somewhat more developed form of protozoa, called the ciliated infusoria, such a membrane is secreted and the hair-like lashes which are used somewhat similar to oars become numerous. Also, as the containing membrane does not permit food to enter, there is an aperture in it, and in some forms, such as the sedentary vorticella, there are long lashes around this aperture that cause a whirlpool in the water and so brings the food down into the animal.

I have now mentioned members of three classes of protozoa. The phylum consists of four classes, each containing innumerable species. The fourth class developed more recently. Its members are parasitic, and unlike more ancient protozoa, they reproduce by means of spores. Each spore contains one or more minute germs. These germs and the animals that they produce are the scourges of humanity, causing malaria sleeping sickness, and a multitude of other dread diseases.

The ordinary protozoa and the cells of higher animals multiply by simple division. The particle of protoplasm contracts from two opposite sides, getting thinner and thinner in the middle until at last the connection is severed. In this process of division the nucleus of the cell always is divided, half of it going to form the nucleus of each new cell. When the two halves of the cell exist separately they gather food until both nucleus and its surrounding protoplasm in each attain to normal size. The cells of the higher animals, including man, multiply in the same way as primitive protozoonï¿½by the mother cell dividing into two daughter cells-- except that the cells of the protozoa go separate ways, and the cells of higher animals remain united.

Always, to explain the processes of higher animal life, we are compelled to return to the primitive protozoon, the first animal on earth; for in it we can perceive all the attributes and functions, in their simplest form, that we witness in the highest animal. But for the moment let us leave the protozoon and his single cell of living protoplasm and observe the formation of the first animal of more numerous cells.

A certain flagellate protozoon, on reproducing, instead of sending the daughter cells to some distant place, held them attached to the mother until there was a tiny plate-like colony of sixteen cells. Those sixteen cells, each like a single celled animal, also each discharges all the vital functions. Yet because such an aggregation has certain advantages it was continued, and it came about whenever any one of the colonial cells reproduced by simply dividing, that the new cell went by itself, but divided still further until it also produced a colony of sixteen cells. Such a sixteen celled colonial animal is the Gonium, and another whose colony tends to spherical form instead of being flat is the Pandorina. Both at the present day are common in fresh waters.

Colonial life affording certain advantages, as time passed there came into being not merely sixteen celled colonies, but colonies composed of a great number of cells. With the enlargement of the colony it became increasingly difficult for every individual cell in it to perform all the functions of life. Already in certain protozoa, where the front end differs in shape from the rear end, when it divides to form two, each half was compelled to reproduce features that it did not possess. This ability, therefore, was at hand in the development of colonial organisms.

Now in addition to the desire to express itself more fully, the two great primitive desires of all life are the desire for food and the desire for reproduction. In a colonial organism both functions will be performed more successfully if certain members of the colony specialize in securing and assimilating food, and certain other members specialize in bringing into the world offspring. Such a division of labor for the first time, in so far as present living forms are concerned, takes place in the Volvox. It is a hollow spherical colony, of several thousand cells in a single external layer held together by gelatinous material and fine protoplasmic threads.

In the Volvox there are two kinds of cells. The one kind, called the somatic cells, perform the functions of nutrition and locomotion. The other kind, called germ-cells, perform the function of reproduction. The germ-cells, through division, are able to form not only other germ-cells, but also somatic cells, and thus when separated from their parent, build up a new organism. This primitive division of labor also holds in the higher animals and in man. The ovum, which is a germ-cell, always consists of a single cell. This divides into two daughter cells, these into four, those into eight, sixteen, and finally into a cluster which arrange themselves into two strata forming a sack. From this stage, which has already progressed further than the Volvox, the forming organism passes through those stages of development parallel to still higher forms of life to be considered later, some of the cells secreting muscular tissue, some secreting the skeleton, some the nerve tissue, etc., until the complete animal is present.

But in the Volvox there is still another division of labor, for the germ-cells provide two kinds of sex cells, one male and one female. In the union of cells for the purpose of reproduction two things are essential; that the cells shall find each other, and that the resulting offspring shall be supplied with nourishment. To insure their union the male cells are very numerous, and as economy of material is advantageous, they are very small. In order that they may find the female cell they have the power of locomotion well developed. This locomotion, even in the higher animals, including man, is provided for by lashes similar to those of the flagellate protozoa. In fact, the sperm of higher animals has many points in common with the Flagellates.

That the offspring may be provided with nutriment, the female germ-cell specializes, not in movement, but in storing food. Consequently it is much larger than the male germ-cell, as is markedly the case in the domestic fowl; for the yolk of a hen's egg, while still inside the hen and before fertilization sets up cell division, is but a single cell.

Contrary to popular conception, the sexual union of cells is not primarily to enable reproduction to take place, and originally had nothing to do with reproduction Naturalists hold that its purpose is to enable the qualities of both parents to be inherited by the offspring, and Hermetic Initiates believe it further serves the purpose revitalization.

Two protozoa, for instance-- the simplest of all animals-- although of the same size and appearance come together and coalesce into a single mass, then separate as two individuals and go their way. There were two to commence with and two at finish. On the other hand, without such prepatory union, a protozoon may divide and become two, thus reproducing itself.

In this fusion of cells, however, something important takes place. Within the nucleus of each cell are small particles of definite number called. chromosomes. These chromosomes, following Weismann's theory, are supposed to be the seat of heredity. Hermetic students also believe them to be the carriers of hereditary traits; not in the Weismann sense that every organ in the body is represented by a particular chromosome, or that a chromosome is a rudimentary group of organs; but in the sense that the astral substance associated with them is the carrier of those vibrations that are imparted from the parent's astral body to the astral body of the offspring.

During, the sexual fusion of two protozoa there is an exchange of chromosomes. When they separate the nucleus of each animal contains half of the chromosomes of the other and half of its own. This insures, then, when each cell divides in future, that the offspring shall, like the parents after fusion, contain the qualities of both. It also provides for another important attribute; for protozoa that from time to time enter into union continue to live and reproduce, or at least live and thus have the opportunity of reproducing, while those that fail to do so die. Unless they meet with violent ends, protozoa that have the opportunity for union do not grow old and die. It might be well, therefore, for certain ascetic cults who herald from the housetops that union save for the rare purpose of reproduction is a crime, to pause and consider the biological fact, as stated by our best scientists, that the only animals on earth that are physically immortal can and do reproduce without union, but that union is absolutely essential to their physical immortality.

In Phylum II, the Porifera, which embraces the sponges, the cells are usually arranged in the form of a hollow attached vase through the walls of which are many canals, or pores. This small vase, instead of being composed of a single layer of cells like the Volvox, is composed of three layers held together. Division of labor has here progressed further, with compensating advantages; for the cells of the inner layer have little hair-like lashes. In fact they greatly resemble the flagellate protozoa. They lash the water, causing a current to flow through the canals, and also take in and digest the food thus brought to them. The middle layer of cells helps with digestion, and also secretes the hard framework. And even as some protozoa secrete lime, some silica, and some chitin; so there are sponges whose framework consists of each of these substances. The sponge of commerce is the chitin skeleton secreted by a whole colony of sponges. Such a colony held firmly together by a framework has the advantage of protecting them from enemies that would readily swallow and digest unattached individuals.

Phylum III, the Coelentera, embraces the hydroids, the jellyfishes, and the corals. The individuals are commonly called polyps. The body is a sack, in the center of which is another sack, an arrangement that facilitates digestion. Around this sack other members radiate. These radial members are usually tentacles, which assist in procuring food, and often assist in protection. The Sea-anemones, so common on rocky beaches near Los Angeles, are stationary polyps. Reef-corals have the ability to secrete a skeleton of lime, which is securely fastened to the skeletons of their ancestors, making it difficult for their enemies, to dislodge them. They are minute in size, but almost infinite in number. The reef, which is largely composed of their skeletons, rises at the rate of half an inch in ten years. The red, or pink, coral-- ruled by the planet Venus-- thought by the ancients to be a sure protection against evil influences when worn, is secreted by a coral called, Corallina rubrum. The Jellyfishes, which are colonial organisms, have developed the power of locomotion which is an obvious advantage, and also in addition to feeding tentacles have others armed with stinging cells, such as are present in the Portuguese man-of-war, so common in southern waters. In both digestion and defense the Coelentera have made a distinct advance over the sponges.

Phylum IV, the Platyhelminthes, embraces the flat-worms. The flat-worms are numerous on the land and in both fresh and sea water, many kinds being parasitic. They are the first animals. to have a right and left side and the first to have a front end, which, although possessing no head, is carried forward. They have developed sense-organs that enable them both to see and hear somewhat, which is a great advance over lower forms, both in securing food and in escaping enemies.

Phylum V, the Nemathelminthes, embraces the round-worms. These worms are cylindrical in shapes and have a decided advantage over the flat-worms in possessing a body cavity, which is a great aid in the digestion and assimilation of food. This valuable feature of an intestinal canal, however, is often lost when a species becomes a parasite.

VI, the Trochelminthes, embraces the wheel-worms. These are the Rotifers, or Wheel-anamalcules, of minute size and various shapes. Some swim by means of hair-like bands which resemble revolving wheels. They are rather more complex in structure, and in this respect have made an advance over, the animals so far mentioned. Yet, their general features were not of sufficient value to be adopted by life as it developed still further.

Phylum VII, the Molluscoidea, embraces the Bryozoa, Lamp shells, etc. These animals live in the water, the Bryozoa being a colonial form greatly resembling plants, common on our rocky beaches. They have various ingenious adaptations, and possess a well developed digestive canal. Typical of this group is the Lamp shell, abundant off the coast of Maine. The animal secretes a shell of two valves which it opens and closes by muscular action. There is a mouth, and a groove bounded by little tentacles to guide the food to it. There is an oesophagus and a stomach and a stomach gland for performing digestion. The blood is colorless, and although there is no heart contains corpuscles. It seems to be the precursor of the true molluscs and has made an advance over lower forms in the matter of digestion and in circulation

Phylum VIII, the Echinodermata, embraces the Star-fishes, Sea-urchins, Sea-cucumbers, etc. They all live in the sea and are built on a symmetrical radiate plan, such as gives the Star-fish its name. They have an outside skeleton, usually protected by numerous spines. They also have a great number of tube-like feet ending in suckers, by which they move, and in the case of the Star-fish, by which they open the shells of their prey. There is a blood system, a nervous system, and also a water-vascular system peculiar to themselves. This group is exceedingly well adapted for the environment in which it lives. They have not developed from any of the four groups of worms, but undoubtedly are superior modifications from Phylum III, the Coelentera. Their chief advance over lower forms is the possession of a superior stomach and digestive system, and a superior circulatory system.

Phylum IX, the Annulata, embraces the segmented worms. There are a great many species of these, and they have made unusually important advances over any forms previously considered. Their bodies are elongated, and composed of ring-like divisions, each segment containing a separate and similar set of internal organs. There is also a blood system. Our common earth-worm is a typical example. The sense organs of sight and hearing are more developed than in lower forms, and more important still, there is a nervous system having distinct ganglia, the first and largest ganglion being a part of the head. This, of course, foreshadows a brain, and is the most important advance over lower forms. The nerve chain is supported by a bundle of fibres which runs along with it, and both are enclosed in a common sheath of connective tissue. The highly developed nervous system is advantageous in enabling a ready response to be made to environment, and some naturalists believe the sheathed nerve chain, which lies in relation to the other organs as does the vertebra, which is also segmented, in higher animals, is the ancestor of the true vertebrate structure.

Phylum X, the Arthropoda, embraces the Crayfish group, the Thousand-legged worms, the Spiders, and the Insects. They are animals possessing an elongate and transversely segmented body, with muscles attached to the inside of an external skeleton. This is quite the reverse from still higher animals, which have an internal skeleton about which the muscles are attached. Some of the body segments bear appendages, such as legs or wings, which are moved by muscles. The external skeleton is composed of chitin, a substance which certain protozoa also secrete. This hard outside skeleton prevents increase in size, hence growth occurs through the shedding, or moulting, of the chitin. There is a heart in most species, and a well developed circulatory system, as well as suitable breathing apparatus. There is a mouth, intestinal canal, a brain, and a nervous system. The heart and brain are notable advances over lower life forms.

Phylum XI, the Mollusca, embraces the molluscs, such as the Clam, Oyster, Muscle, Snail, and Octopus. In fact, it includes all the sea-shells commonly found along the ocean beach, as well as the slugs and snails found crawling in our gardens. The bodies are bilaterally symmetrical, unsegmented, and inclosed in a sack-like fold or mantle, which usually secretes the external skeleton, or shell. They are mostly able to crawl, swim, and burrow. They have a head, possessing a mouth and other appendages, with organs of special sense. Respiration is by moans of gills. Quite interesting has been the recent discovery, through the study of embryology, that the young greatly resemble the segmented worms, and in their growth show the steps by which the molluscs developed from such annulata. There is a good digestive system with a liver, which is an important advance. But as marking a still more important advance over previously mentioned forms is the development of a three-chambered heart and blood which in some species is red. This gives vigor of movement, which is a great advantage.

Phylum XII, the Chordata, embraces the vertebrate animals-- those possessing a backbone and those that show the presence of a primitive backbone at some stage of development. The main advance of this group, which includes all the higher animals lies in the development of a second body cavity, which houses a central nervous system-- the spinal cord and brain. I shall have more to say about these vertebrate animals, to which man belongs, in following lessons.

Now reverting to Phylum X, the Arthropoda, this includes the crustaceans, such as the shrimp, crayfish and crab, which live in the water and breathe by means of gills. It is probable that as soon as plants moved out of the water that such animals as followed them found gills insufficient to supply them with the oxygen necessary for life. No doubt numerous experiments were tried before the expedient was devised of having a system of tubes, called trachea, that with their microscopic branches permeate the whole body, air entering these tubes by external openings called spiracles. This system of breathing, because air reaches all organs and parts of the body, is in many respects superior to the lung breathing of vertebrate animals. It conduces to great activity, and is the system used by spiders and insects.

Insects have been unusually successful, 250,000 forms now being known and the tropics largely to be explored. They have made use of every available position in nature, have developed colors to protect themselves by concealment, have developed offensive weapons such as the sting of the hornet, and of still greater importance, because facilitating locomotion, is the common feature of wings. The most primitive insects, such as the spring-tails, have no wings. Instead, at the end of the body are two elongated prongs which are bent under the abdomen and when pressed down form a lever by which the insect makes long jumps. Such leaps, still further amplified in the flea and grasshopper, were undoubtedly steps leading to the development of true flight.

As but a single instance of the wonderful subconscious intelligence displayed by insects let us consider the wasp. The various digger wasps, in need of a food supply for their young, capture other insects with which they fill their burrows and on which they lay their eggs. Meat after being killed does not keep indefinitely, so these wasps, anticipating cold storage, devised a method by which their young might be provided with fresh meat as soon as hatched. They sting their prey in such a way as to reach the main nerve and paralyze the insect without killing it. The wasp of the genus Ammophila has even gone beyond this and has arrived at the tool-using stage of progress. After the burrow has been completed the female wasp fills it with paralyzed caterpillars and then packs earth over the opening, using a stone as a tamping iron (See The Insect Book, by Dr. Leland O. Howard, p.21) to pack this earth down. Later she visits the spot occasionally to see if all is well and to place disguising objects where they will conceal it,. Such provision is taken for the young, even though in many cases the parents die before the young hatch out.

Instances of insect intelligence could be multiplied indefinitely. Ants, for example, keep slaves. They also keep the equivalent of cows, which they manage with great sagacity. These are aphides-- and in California the scale-- from which by stroking they get a sweet secretion. Some ants are excellent farmers, not only keeping plants not desired, for their seeds from growing, but as in the case of the leaf cutting ants, actually cultivating in prepared beds a species of fungi which is their sole food supply, and which must have been cultivated by them for an immense period of time, as it has never been found in the wild uncultivated state.

But of the various wonders of insect life, none is more difficult to understand than the metamorphosis. Primitive insects do not experience this change but hatch as miniatures of the adults. More advanced insects show only a partial metamorphosis, the change from the larval stage being made by a series of moults that do not prevent feeding. But in the higher forms the insect hatches from the egg as a larvae, which feeds vociferously and grows rapidly. Then comes the pupal stage in which there is no external activity, the insect being in a trance or comatose condition. While in this trance state the tissues are broken down and forms a homogenious fluid underneath the external skeleton of the insect. It thus precisely resembles the "ectoplasm" which emanates from a medium during spirit materialization. This ectoplasm has been proven to be composed of organic substance drawn from the medium and sitters. At first it is plastic and without structure, but may materialize into a form of actual flesh blood.

The caterpillar in its trance condition not only dissolves to a structureless plastic fluid, but this fluid is again reconstructed along entirely different lines into a creature having almost no resemblance to its former self. Undoubtedly the "ectoplasm" from a human medium is organized by an intelligent agent acting through the medium's astral body. And it is quite as reasonable to suppose that the unconscious intelligence of the insect works along lines not entirely dissimilar. No special organ of intelligence need be present in the plastic mass of cells. The intelligent power which reconstructs this mass into a beautiful butterfly resides, as states of consciousness part of which it has gained through previous experiences and part of which it has inherited, in the astral form of the insect.

Plants also, in response to their desire to live and find an adequate food supply, have made many remarkable and apparently intelligent variations. Our stonecrops for instance, finding competition unusually strenuous on fertile ground, gradually moved into rocky regions where other plants did not grow. In such ground moisture is retained but a short time. Therefore, to meet this condition the stonecrop greatly thickened its leaves, so as to make a reservoir for holding moisture and thus tiding it over dry weather. The various species of cacti, finding a desert environment developing around them, likewise thickened their leaves as water reservoirs. In addition they had to combat a scorching sun and numerous herbivorous animals, made voracious because other vegetation, always scanty, failed to grow during the long dry seasons. To meet the scorching rays of the sun they caused the outer cells of their leaves to harden, thus coating each leafy reservoir with a horn-like insulation against the evaporation of its. water. To protect itself from greedy animals many of its leaf-parts were made slender and hard, so that it was covered with thorns.

Botanists recognize the leaf as the basic form of all the organs of higher plants. However diverse in form and function a plant organ may be-- bud, thorn, flower part, bulb or fruit-- it is but a modification of leaves. In the calyx of the peony, for instance, the sepals, while largely green like any other leaf, have a fringe of color: indicating the process of transformation. This change of leaf into petal has not been completed in the snowflake; for here we find the petal of the flower white, except the very tip, which is yet green like the leaf. In the begonia, also, certain of the stamens often revert to their original leaf form; and in the water lily the stamens and petals grade into each other with such slight variations that it is easy to trace all the steps of enlargement, broadening and coloring, by which the leaf-like stamen becomes the beautiful petal. Thorns, and the stings of nettles are also mere modifications of leaf structure in answer to the intense subconscious desire of the plan to be protected from its numerous enemies. And even as the most delicate rose, or the most gorgeous orchid, results from modifications of leaves, so every animal on the face of the earth is but the result of modifications of simple single-celled protozoa.

Plants growing like the water lily, where there is little competition for sunlight developed broad leaves. Those growing where there was much competition for sunlight- like our grasses, developed narrow leaves that were able to profit by whatever gleam of light filtered through the surrounding vegetation. We find, in fact, much the same tactics employed by plants that are employed by animals for the same purpose. Plants produce poisonous and evil-smelling secretions to ward off enemies, much as does the skunk among animals. Some plants also are carnivorous. The sun-dews, the butterworts, the bladderworts, the Venus fly-trap, and the pitcher plants-- one of which grows in the mountains of California-- all trap and assimilate insects.

In the Venus fly-trap there is a rounded blade. On the upper surface of each half of this blade arc three prominent bristles, and around the margin a row of stiff thorn-like teeth. When an insect touched one of the bristles there is an electrical change in the plant similar to that taking place in an animal when it contracts a muscle, and the two halves of the blade clap together, the marginal thorns interlocking like the teeth of a rat-trap. Then a digestive fluid is secreted and the insect so caught is digested and assimilated, after which the blade opens for another capture. It may be cheated by using a little piece of moist paper to take the place of an insect, but after twice closing on worthless material in rapid succession it usually will refuse to be duped a third time. In other words, it modifies its actions because there is memory of previous experience.

One might easily write a large volume citing the marvelous methods plants use to overcome the difficulties that have confronted them. It must suffice here, however, to say that every plant form and method of life holds the story of its endeavors to overcome certain limitations placed upon it by environment. The deciphering of those plant romances and adventures, as well as those of the insects and other animals, is intensely interesting, but can not be related in this place.

Undoubtedly all physical life on the earth has ascended from single-celled ancestors. One may observe closely the steps by which all present day plant structures are but the result of leaf modifications. From a mere inspection of the chief characteristics of the twelve great groups of animals, as given in this lesson, it is not quite so obvious that they all developed from the simple single-celled protozoa. But the more detailed and thorough the study of all the functions of various animals, the more the conviction is forced that this is the case. And from the standpoint of religion this is an important finding, one replete with hope and assurance.

If man is a special creation, put here by an arbitrary deity, there may be a hell to be dreaded, and a heaven, which as usually described would be so monotonous that extinction would be preferable.

But, as all the evidence procurable goes to show, if the lowly single-celled protozoa, actuated by the desire to secure food, by the desire to reproduce, and by the desire to express itself more amply, has so modified and developed itself that the higher animals and even man has been brought forth, the possibilities of further development and modifications certainly are infinite.

If the physical body of man has developed from the lowly protozoon, mind can conceive of no barriers, either on the physical plane or beyond it that may not be overcome. Not that the protozoon is so wonderful in its form. It is the spark of intelligent life manifesting through it that is wonderful. This spark has unlimited potentiality-- has unlimited possibilities. It has within itself the possibility of eternal progression, the form of man being merely the present link between a self conscious life on earth and a self conscious life expressing through a finer form of substance. The desire of the protozoa-- the intelligence expressing through the protozoa-- for fuller, expression evolves man, and the desire of man for richer expression evolves a Self-Conscious Immortal Soul. As a Master once said-- "Every immortal soul is the seed of a universe".

GEOLOGICAL TIME TABLE

Based on a Complete Period of Erosion of 500 Million Years

Archeozoic Age, commenced	500,000,000	years ago
Archeozoic Age, lasted	125,000,000	years
Proterozoic Age, commenced	375,000,000	years ago
Proterozoic Age, lasted	150,000,000	years
Paleozoic Age, commenced	225,000,000	years ago
Cambrian Period commenced	225,000,000	years ago
Cambrian Period lasted	25,000,000	years
Ordovician Period commenced	200,000,000	years ago
Ordovician Period lasted	23,000,000	years
Silurian Period commenced	177,000,000	years ago
Silurian Period lastednced	20,000,000	years
Devonian Period commenced	157,000,000	years ago
Devonian Period lasted	20,000,000	years
Mississippian Period commenced	137,000,000	years ago
Mississippian Period lasted	20,000,000	years
Pennsylvanian Period commenced	117,000,000	years ago
Pennsylvanian Period lasted	20,000,000	years
Permian Period commenced	97,000,000	years ago
Permian Period lasted	12,000,000	years
Paleozoic Age, lasted	140,000,000	years
Mesozoic Age, commenced	85,000,000	years ago
Triassic Period commenced	85,000,000	years ago
Triassic Period lasted	13,000,000	years
Jurassic Period commenced	72,000,000	years ago
Jurassic Period lasted	16,000,000	years
Comanchian Period commenced	56,000,000	years ago
Comanchian Period lasted	11,000,000	years
Cretaceous Period commenced	45,000,000	years ago
Cretaceous Period lasted	20,000,000	years ago
Mesozoic Age, lasted	60,000,000	years
Cenozoic Age, commenced	25,000,000	years ago
Eocene Period commenced	25,000,000	years ago
Eocene Period lasted	12,000,000	years
Oligocene Period commenced	13,000,000	years ago
Oligocene Period lasted	5,000,000	years
Miocene Period commenced	8,000,000	years ago

Miocene Period lasted	4,000,000	years
Pliocene Period commenced	4,000,000	years ago
Pliocene Period lasted	2,970,000	years
Plistocene Period commenced	1,030,000	years ago
Plistocene Period lasted	1,000,000	years
1st. Glacial Advance commenced	1,030,000	years ago
1st. Glacial Advance lasted	50,000	years
1st. Interglacial Interval commenced	980,000	years ago
1st. Interglacial Interval lasted	175,000	years
2nd. Glacial Advance commenced	805,000	years ago
2nd. Glacial Advance lasted	50,000	years
2nd. Interglacial Interval commenced	755,000	years ago
2nd. Interglacial Interval lasted	425,000	years
3rd. Glacial Advance commenced	330,000	years ago
3rd. Glacial Advance lasted	50,000	years
3rd. Interglacial Interval commenced	280,000	years ago
3rd. Interglacial Interval lasted	200,000	years
4th. Glacial Advance commenced	80,000	years ago
4th. Glacial Advance lasted	50,000	years
Recent Period(Psychozoic Age) commenced	30,000	years ago
Recent Period lasted to date	30,000	years
Present time, February 1925	000	years