Chapter 3

Progress of Invertebrate Life

WHEN the environment radically changes, most life-forms must also radically alter either their structure or their habits or perish. It will be indicated in subsequent lessons how marked weather changes brought the extinction of numberless forms, and the kind of radical changes some made in order to adapt themselves sufficiently to the new condition to be able to survive. When previously arid regions became deluged with rain, their vegetation had to acquire new characteristics to prosper, and when previously well watered regions became arid, not only did plants have to change their structure to gain and preserve the scant moisture, but creatures whose young were hatched in the water and developed through the tadpole period had to so change that their young reached a land-inhabiting stage without living their youth in the water.

In a previously calm region, when climatic changes developed powerful winds, both plants and animals, to survive, had to develop protection against such gales. When glaciers came down from the north and the previously warm weather became intensely cold, some animal forms developed feathers from scales, and others developed fur; and the young, to protect them from such inclemencies were either not born in the previously immature condition, or the eggs and young were protected by nests until the offspring had matured enough to be able to adapt themselves to the food and temperature conditions brought about by the severe weather.

Wind and falling water and the cold which causes the moisture in its capillaries and crevices to freeze and crack open or flake off pieces of rock, have cut canyons thousands of feet deep in the earth's crust and have leveled giant mountain chains.

These facts are familiar to all. But there is now good evidence that the inner-plane weather, consisting of astrological energies, is fully as powerful to inaugurate changes in the rocks, and in life-forms, as is the outer-plane weather. Even though they are not aware it is influencing them, Church of Light research has proved that inanimate objects and other life-forms as well as man are powerfully thus influenced. A machine built at one time will not last as long as a machine built at a more favorable astrological time. Crops, as many farmers have learned through experience, even though planted when the outer-plane weather is favorable, will not thrive and produce so well if planted when the inner-plane weather is adverse as when planted while inner-plane weather is more suitable.

So far as our research has gone we have found that progressed aspects affect animals in the same manner they affect men, due allowance being made for the normal level of the animal. It is not to be expected that an insect whose normal life span is only a few days will respond other than to progressed positions within those few days. And just how they so respond is yet to be ascertained by timing their births and calculating the aspects which subsequently form. But we have had ample opportunity to observe in cats, horses and dogs that on their level progressed aspects influence their lives as they do human beings.

A lady in San Francisco who raised show dogs kept a record of each puppy born, erected its birthchart and observed its progressed aspects. These charts were sent to us for our opinion. If one of her dogs had a good tenth house it had a good chance of winning a prize at the dog shows, and she found that this was almost certain to occur if it had a harmonious progressed aspect to the ruler of the tenth at the time of the show. The same kind of chart and progressions that belonging to a politician would insure he would win an election, if it belonged to one of her dogs would equally insure he would get a prize at the dog show.

Another gentleman in Montana used astrology in raising and training race horses. He learned to tell when the colt was first born what its prospects were, whether it would be subject to accident, and if it were worth training as a racer. And he could tell by its progressed aspects at the time of a given race whether the horse would get a good break, or whether he would have to overcome fortuitous obstacles in order to win.

The writer has watched the response of both cats and dogs to progressed aspects. The chart of his present dog with the dates of all important events that have entered his life during more than ten years is given on page 31 of chapter 2, together with the significant major progressed aspects coincident with them. Due to lack of space the minor progressed aspects and transit progressed aspects are not there given; but anyone who wishes to calculate them will find that exactly as in a human horoscope, each of these major progressed aspects is reinforced by a minor progressed aspect, and released by a transit progressed aspect, within one degree of perfect at the time the event occurred.

Life must adapt itself to both inner-plane and outer-plane weather or perish. And the survival of the fittest is a factor in organic evolution. But as subsequently will be indicated, such progress is not in some haphazard direction. Every outdoor naturalist I have ever met has been convinced there is a Super-Intelligence permeating and broadly directing all the processes of nature. Such direction is not that of whim or prejudice, but always according to well defined laws. And one of the outstanding laws is that the pressure of the inner-plane weather and the outer-plane weather is such that the overall progress made by life—even though innumerable forms do move up blind alleys and become extinct, and others finding satisfactory adaptation stagnate—is toward filling in the universal plan formulated in the mind of Deity.

Plants as well as animals and men have, in some degree extrasensory perception, and psychokinetic power (Chapter 2, Course 1, *Laws of Occultism*). And in response to their desire to live and find an adequate food supply they have made many remarkable and 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 the 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 horn-like insulation against the evaporation of its water. To protect themselves from greedy animals many of their leaf-parts were made slender and hard, so that their leaves were 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 desire of the soul of the plant 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 modification of simple single-celled protozoa.

Plants growing like the water lily, where there was 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 do certain ants and beetles among insects, and as does the skunk among mammals. Some plants also are carnivorous. The sundews, 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 are three prominent bristles, and around the margin a row of stiff thorn-like teeth. When an insect touches one of the bristles there is an electrical charge 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. It modifies its actions because there is *memory of a previous experience*.

It would be interesting to 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 endeavor to overcome certain limitations placed upon it by environment. The deciphering of these plant romances and adventures, as well as those of insects and other animals, has been my chief and pleasantest avocation for more than half a century, but they cannot be related here.

Early Animals

Living matter is always associated with protoplasm. Protoplasm is an essential ingredient both of animals and of vegetables. Where, then, is the line of demarcation between them, and what were the incentives that produced the first animal?

As I have pointed out in chapter 2 there is no clear cut line between them; some animals, such as the protozoan Luglena, are provided with chlorophyll, and others, such as the ascidians, possess cellulose; both of which commonly are 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 cryptograms, 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 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 tends to bring the food supply of certain creatures, such as the sponges, yet even these 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 so 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—the drive for nutrition—is a fundamental impulse common to all life. And this intense desire ever tends through psychokinesis to adapt the structure to the end of better securing its food. When a new condition arises the soul through extrasensory perception is dimly aware of its plight and feels the desire successfully to meet the new condition. Psychokinesis endeavors to provide the way, but subjective intelligence makes many mistakes. It is not reason, but the primitive working of psychokinesis based on imperfect perception and the memory of previous experiences, which may have been largely astral, stored in the astral form.

But desire changes the astral form and this in turn through psychokinesis changes the form and attributes of the physical structure. Thus we may conceive of a single primitive cell of living matter, stimulated by desire for food, departing from the custom of seeking nourishment from the inorganic matter and appropriating the food 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 actively to seek a food supply, through psychokinesis 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 protozoan.

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 from those microscopic forms just mentioned 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 greatly confined to the very 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 Protozoa: These are infinite in the variety of their forms. The typical protozoa is the amoebae (page 32 of chapter 2), 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 amoebae 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 utilize in a somewhat greater degree of coordination, two principles that also are 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 feedings on particles of life that had been already organized than to remain in one place and endeavor to transform inorganic elements into food value.

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 amoebae-like cells in the human blood, man would soon succumb to infectious diseases. The white corpuscles of the human blood often are called amoeboid corpuscles, because to all intents and purposes they are amoebae cells belonging to the human organism that are fostered by it as soldiers to guard it against invading germs. The amoeboid corpuscles, when minute organisms of various kinds invade the human system, act toward them as the ordinary amoebae 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 parts 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 cannot kill and devour them that such diseases prove fatal.

I have mentioned in chapter 2 that certain algae devised the expedient of secreting lime. Other early plants—such as the microscopic ones called diatoms, closely related to algae and supposed to be the source of the oil in 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 skeleton, 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 which 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 called flagellates, mentioned in chapter 2, which are on the border-line between plants and animals, we find the cell secreting one or two hair-like lashes which carry them along swiftly by beating the water.

A certain amount of protection is afforded by a thin membrane enclosing 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 are numerous. Also, as the containing membrane does not permit food to enter, there is an aperture in it, and in some forms, such as sedentary verticella, there are long lashes around this aperture that cause a whirlpool in the water and so bring 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 germ. These germs and the animals 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 cytoplasm in each attain to normal size. The cells of the higher animals, including man, multiply in the same way as a primitive protozoan—by the mother cell dividing into two daughter cells—except that the cells of the protozoan 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 protozoan, 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 protozoan and his single cell of living protoplasm and observe the formation of the first animal of more numerous cells.

Colonial Life

Some of the flagellates are considered the ancestors of brown algae, which are plants, and some are classified as protozoa. It is believed that a certain flagellate protozoan, 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. These sixteen cells, each like a single-celled animal, also each discharged 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 dividing 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 water.

Colonial life affording certain advantages, as time passed there came into being, in response to psychokinetic power, 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 differed in shape from the rear, when it divided to form two, each half was compelled to reproduce features that it did not possess. This ability of the soul thus had been acquired before the development of colonial organisms.

As pointed out in chapter 2, in addition to the drive 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 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 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, and these into four, these 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 Volvo-x, 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, 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 of revitalization.

During the sexual union of two protozoa there is an exchange of chromosomes (Chapter 4, Course 17, *Cosmic Alchemy*). 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 opportunity for 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 that 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.

PHYLUM II, the Porifera: They embrace the sponges. The cells usually are 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 protection from enemies that would readily swallow and digest unattached individuals.

PHYLUM III, the Coelenterata: These embrace the hydroids, the jellyfishes, and the corals. The individuals commonly are called polyps. The body is a sack, in the center of which is another sack, an arrangement that facilitates digestion. Around this sack other membranes 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 skeleton 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 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, common in southern waters. In both digestion and defense the Coelenterata have made a distinct advance over the sponges.

PHYLUM IV, the Platyhelminthes: These embrace the flat-worms. The flat-worms are numerous on the land and in both fresh water 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: These embrace the round-worms. These worms are cylindrical in shape, 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, often is lost when the species become a parasite.

PHYLUM VI, the Trochelminthes: These embrace the wheel-worms, the rotifers or wheel animacules, of minute 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 further.

PHYLUM VII, the Molluscoidea: These embrace the Bryozoa, lamp shells and sea mosses. Such 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, and to be found near Los Angeles. 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 esophagus 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 mollusks, and has made an advance over lower forms in the matter of digestion and circulation.

PHYLUM VIII, the Echinodermata: These embrace the star-fishes, the 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 to 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 Coelenterata. 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: These embrace the 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 earthworm 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 run 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 other organs as does the vertebrae in higher animals, which is also segmented, is the ancestor of the true vertebrate structure.

PHYLUM X, the Arthropoda: These embrace the crayfish group, the thousand legged worms, the spiders and the insects. They are animals possessing an elongated 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 shedding, or moulting, the chitin. There is a heart in most species, and a well developed circulatory system, as well as a 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.

The crustaceans, such as the shrimp, crayfish and crab, which live in the water and breathe by means of gills are included in this group. It is probable as soon as plants moved out of the water in the Middle Ordovician period—although the earliest so far found is the Psilophyton, a little plant about a foot high without leaves from the Devonian period which commenced about 350 million years ago—that such animals as quickly followed this food supply found gills insufficient to supply them with the necessary oxygen for life. No doubt numerous experiments were tried through psychokinesis before this inner-plane power devised the expedient 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 with the tropics yet 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 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 extrasensory 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 creature without killing it. The wasps of the genus Ammophilia have even gone beyond this and have arrived at the toolmaking 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 (p. 21, *The Insect Book*, by Dr. Leland O. Howard) 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 ant, actually cultivating in prepared beds a species of fungus 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. Certainly the ability of the soul to live in and function through an inner-plane form after the dissolution of the physical is no more amazing. Primitive insects do not experience this change but hatch as miniature 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 larva, which feeds voraciously 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 form a homogeneous fluid underneath the external skeleton of the insect. It thus precisely resembles the ectoplasm (Chapter 7, Course 1, *Laws of Occultism*) which emanates from a medium during materialization. This ectoplasm has been proved 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 and blood.

The caterpillar in its trance condition not only dissolves to a structureless plastic fluid, but this fluid is 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 employing the medium's astral body through which to exercise psychokinetic power. And it is equally certain that the soul of the insect acts through its astral form, in which its own and inherited experiences reside, in a similar manner.

PHYLUM XI, the Mollusca: These embrace the mollusks such as the clam, oyster, mussel, 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 enclose 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 means of gills. Quite interesting has been the discovery, through the study of embryology, that the young greatly resemble segmented worms, and in their growth show the steps by which the mollusks developed from such annulata. There is a good digestive system and 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: These embrace 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.

Physical life has ascended from a single-celled ancestor. One may observe closely the steps by which all present-day plant structures are but the result of leaf- modification. And a detailed study of the functions of present-day animals is convincing that the animals now on earth developed from a single primitive cell. From the standpoint of religion this is an important finding, one replete with hope and assurance.

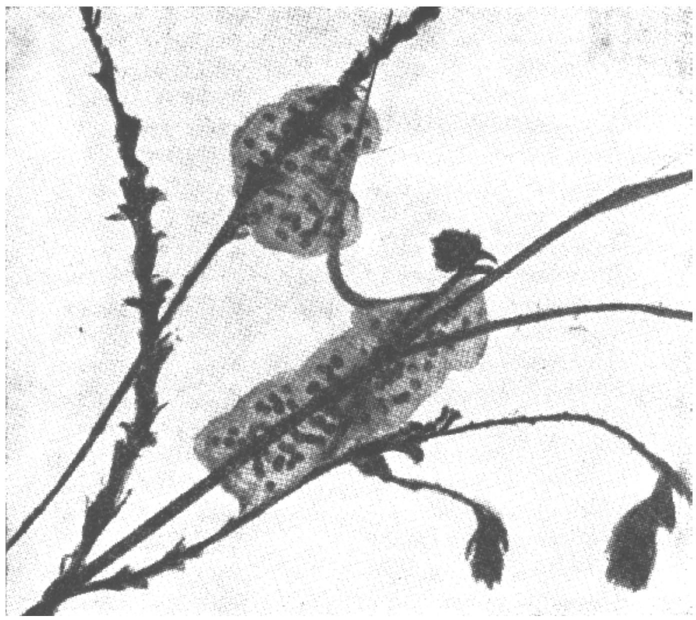
If man is a special creation, put here by an arbitrary Deity, there may be a hell to be dreaded, and a heaven which as usually described would be so monotonous that extinction would be preferable. But as all evidence goes to show that the soul actuated by the drive for sustenance, the drive for reproduction, and the drive for more ample expression, has developed a lowly single cell into higher animals and man, the possibilities of still further progress on the inner plane seem infinite.

Approximate Geologic Time Scale

Recent period has lasted to date	30,000 years
Recent period commenced	30,000 years ago
Pleistocene period lasted	970,000 years
Fourth glacial advance lasted	50,000 years
Fourth advance commenced	80,000 years ago
Third interval lasted	200,000 years
Third interval commenced	280,000 years ago
Third glacial advance lasted	50,000 years
Third advance commenced	330,000 years ago
Second interval lasted	425,000 years
Second interval commenced	755,000 years ago
Second glacial advance lasted	40,000 years
Second advance commenced	795,000 years ago
First interval lasted	175,000 years
First interval commenced	970,000 years ago
First advance lasted	30,000 years
First advance commenced	1,000,000 years ago
Pleistocene period commenced	1,000,000 years ago
Pliocene period lasted	6,000,000 years
Pliocene period commenced	7,000,000 years ago
Miocene period lasted	12,000,000 years
Miocene period commenced	19,000,000 years ago
Oligocene period lasted	16,000,000 years
Oligocene period commenced	35,000,000 years ago
Eocene period lasted	20,000,000 years
Eocene period commenced	55,000,000 years ago
Cenozoic era commenced	55,000,000 years ago

Approximate Geologic Time Scale

Cenozoic era commenced	55,000,000 years ago
Mesozoic era lasted	135,000,000 years
Cretaceous period lasted	40,000,000 years
Cretaceous period commenced	95,000,000 years ago
Comanchean period lasted	25,000,000 years
Comanchean period commenced	120,000,000 years ago
Jurassic period lasted	35,000,000 years
Jurassic period commenced	155,000,000 years ago
Triassic period lasted	35,000,000 years
Triassic period commenced	190,000,000 years ago
Mesozoic era commenced	190,000,000 years ago
Paleozoic era lasted	360,000,000 years
Permian period lasted	25,000,000 years
Permian period commenced	215,000,000 years ago
Pennsylvanian period lasted	40,000,000 years
Pennsylvanian period commenced	255,000,000 years ago
Mississippian period lasted	45,000,000 years
Mississippian period commenced	300,000,000 years ago
Devonian period lasted	50,000,000 years
Devonian period commenced	350,000,000 years ago
Silurian period lasted	60,000,000 years
Silurian period commenced	410,000,000 years ago
Ordovician period lasted	70,000,000 years
Ordovician period commenced	480,000,000 years ago
Cambrian period lasted	70,000,000 years
Cambrian period commenced	550,000,000 years ago
Paleozoic era commenced	550,000,000 years ago
Proterozoic era lasted	450,000,000 years
Proterozoic era commenced	1,000,000,000 years ago
Archeozoic era lasted	750,000,000 years
Archeozoic era commenced	1,750,000,000 years ago



All who have been in the country in spring or in the wet California winter, have heard the loud, “crack-it, crack-it, crack-it,” of the tree toad (hyla). Not much larger than a man’s thumb, by this call he attracts the female from the surrounding terrain to the water in which, as shown in the picture, her eggs must be laid.