THE FOUR MODES OF LIFE.

THE plant lives on air and water. Vegetal life is increase in magnitude and number. With some exceptions, the waste products of the plant are such as it cannot use in the process of assimilation. The life of the plant is expended in its own accumulation and in the preparation of the germs of reproduction. Plant life is molecular motion. The food of the plant is storm; the life of the plant is sunshine. In the transformation of air and water into plant tissue, the process is concealed from man. With the microscope he discovers the change in cellular structure, and by chemical research he obtains some information in relation to the molecular combination involved; but man, with all his power of perception, fails to discover the orderly procession of atoms and molecules from inorganic existence to plant life. With all research there is yet an unknown. Sweet odors, delicious tastes, beautiful forms, and delicate colors are developed by this mysterious process. Man discovers that colors are ethereal modes of motion transformed by the petal. He discovers that forms are the organized motions of atoms and molecules, as the form of the solar system depends on the systematic revolution of its worlds. He discovers that flavors and odors are modes of motion transmitted to the nervous system. But exactly what these motions are he is unable to discover, because the moving atoms and molecules are too minute to come under his observation as discrete bodies.

From the mountain top the climber sees the forest beyond the valley, but he cannot resolve it into separate trees. From a neighboring hill he distinguishes one of the trees, but cannot resolve it into trunk, branches, leaves, and flowers. Under the shade of the tree he discovers its morphologic elements, and, plucking a flower, he resolves it into sepals, petals, pistils, and stamens, with interdependent parts; but with the naked eye he cannot distinguish smaller constituent parts. From the eye-

piece of his microscope he resolves these component parts into cells. Now he can gain no better vantage ground for his perception; but with his reason, armed with methods of chemical and physical research, he reaches the induction that discrete atoms and molecules are systematically grouped in the petals by motion. Their characteristics are yet unknown to him; his perception and reason alike are baffled by the minute constitution of matter. A mystery of minitude incloses the investigator with a wall through which he finds no portals. Thus it is that, although much is known of plant structure and life, there is still, beyond, a recognized unknown. Vitality is a mystery.

The plant is the food of the animal, and the life of the plant is the life of the animal. Storm and sunshine are thus transferred by the vegetal world to the animal world. Plants receive food that is wafted to them, but animals seek their food. They wander over the valleys, climb the mountains, traverse the waters, and navigate the air to obtain it. Not only do they utilize the vegetal world, but some live on others. Plant life is molecular motion, but in animal life molar motion is added. For this an osseous framework is developed, to which muscles are attached, and these muscles are controlled and correlated for locomotion by a system of nerves. In animal life, to nutrition is added muscular function, and that nervous function by which muscular action is induced and co-ordinated. The body of the plant, its completed product, is the raw material for animal life; this must be elaborated, and a congeries of organs for digestion and circulation appears. As the animal is endowed with locomotion, it must secure a supply of motion which can be used for that purpose, and this it obtains from its food, building tissue only to tear it down again for the motion necessary for locomotion and then to return it to the inorganic world. So the process continues, and the new ever replaces the old. An animal is but a form of organic parts through which a stream of matter pours. A plant builds itself into an aggregation which is permanent while life lasts; an animal builds itself into an aggregation which passes away to supply its locomotive life. The plant is a snow bank that piles up while the storm continues; the animal is a river that must be fed by perennial springs, and

it flows on in a form which persists, while the matter of which it is composed is forever changing. As the river is the same in form, but ever changing in substance, so an animal is a persistent form with a passing substance.

Much is known of the animal structure and its functions, of the substance and its life. The organs of elaboration and nutrition have been discriminated, and the tissues of which they are composed are found to consist of cells and modified cells. The functions of these organs and tissues have also been subjects of investigation, until knowledge has been pushed far; yet man has not been able to reach the limits of the minute in these processes of animal life, and there are molecular structures and molecular motions of nutrition about which he speculates but about which he knows little. Of the transmutation of this molecular motion of nutrition into the molar motion of locomotion, he has also learned much. He has analyzed the structure into bones, ligaments, muscles, and nerves. He has resolved these organs into tissues and then into cells or corpuscles, and he discovers structure in these elements. Thus far he goes with his perception; then by his reason he resolves cells into molecules; but how the motion of nutrition is transformed into molar motion in the realm of these molecules and atoms, he has not learned. In plant life there is a mystery of transformation in the region of the minute. In animal life there is a similar mystery in the change of the assimilative life of the plant into the nutritive life of the animal, and in the transformation of this into muscular function, which involves the genesis of sentiency. He who is engaged in the investigation of animal life has his vision darkened by a veil of minitude, through which he sees molecules as cells moving, as one of old saw men as trees moving.

The new psychology, as a science, deals with the nervous system and relates psychic activities to nerve functions. Theories relating to the substance of the soul are relegated to the realm of philosophy, where the old questions are still discussed with the subtleties of dialectics. The philosophers who deal with these subjects still seek to know whether the real generates the ideal or the ideal generates the real, and to what extent the universe masks itself under an illusive veil of phenomena. The

scientific psychologist deals with the structure and functions of the nervous system. In his investigations he resolves this system into a congeries of organs, and these organs he again resolves into nerve fibers and corpuscles. He discovers that these structural units exist in vast numbers, that there are hundreds of millions of each in one organization, and that they are all connected and systematically arranged. Then he finds out that one such element as the corpuscle has structure or differentiated parts. All these things he discovers by perception. His reasoning powers go further, and he learns that the smallest units revealed to his perception may still be resolved into molecules; but here he reaches the limits of his analysis of structure.

The organs are composed of animal tissue having animal life, and the same questions relating to their structure and motions appear as present themselves in animal life. A region of the unknown is reached in the direction of the minute. It has been seen that nutrition is a more complex form of motion than plant assimilation, and that the molecular motions organized by animal tissue are transmuted into molar motions. Thus a part of the motion of the animal tissue is draughted away to be used in locomotion. With the higher nervous system a new mode of motion arises, exhibited in percipiency, which is the foundation of knowing. This is an additional transmutation; for it an additional supply of motion must be furnished, and there must be a new method.

In order to set forth clearly the facts essential to this discussion in relation to motion, a secondary term as a new name for motion is convenient, and for this purpose the store of animal motion which is transmuted into psychic motion will be called a force. In using the term "force" in this manner it must be understood that it is a symbol for the antecedent motion, and not for an occult something which generates motion. How is animal force transmuted into mind motion, or psychosis, or psychic activity? Now scientific investigations in psychology have gone a long way in the last few decades, in the solution of this problem, and the functions of the nervous system are rapidly being revealed by the acute researches of an army of scientific men. The external forces of the universe play upon the river of animal life, and constitute the agencies by which animal life is transmuted

into psychic life. Psychic life is transformed animal life. The agencies of transformation are external forces, which act upon the life of the nervous system through organs specialized for that purpose. These are the sense organs. The function of the senses, therefore, is to transmute animal activity into psychic activity. Through them the forces of the universe impinge upon the animal river, and transform its even current by inducing waves, or shocks, or vibrations, or impulses, which, being organized, appear as psychic activities.

For the purpose of this discussion it is not necessary to consider some of the less important of these impinging forces. The chief external agents in psychic transmutation are touch, taste, smell, hearing, and sight. The forces of touch are molar, and by impinging with great force upon the river of animal life of the nervous system, they produce strong but rude psychic effects. Through the agency of taste, chemical forces impinge upon the organism of psychic life and produce effects of importance in animal life, especially as a stimulus to obtain food. The impinging forces that come through the organs of smell are probably also of a chemical nature, and they effect results in psychic transmutation. The impinging forces of hearing come through the air in the well-known waves of sound, and by them the nervous system is put in communication with vibrating agencies in an extensive environment. The forces of a vast field play upon the nervous system, and sound is thus one of the great agencies in psychic transformation. All emotion, all cognition, and all volition generated by speech are transformations accomplished by this agency. The apparatus of hearing combines the vibrations of the atmosphere from 16 in a second to 40,000 in a second, and in combining them discovers voice, and music, and the multitudinous sounds of nature. But the master agency in the production of mind is vision. Its medium is the universal ether, and its force or store of motion is the light of the cosmos; through it the mind is put in communication with the universe, and by it corpuscles and stars are revealed. The effective environment of the mind through vision embraces the near and the far, the minute and the vast. The apparatus of vision discovers the intensities and the combinations of the pulsations of the ether,

as they are made known in chiaro-oscuro and color; through this apparatus are revealed the secrets of space and time, and the forms and motions of things terrestrial and celestial.

Now, the thing to be emphasized is this: the mode of life which we have here called psychosis is the transmutation of the river of animal life by impinging forces of many kinds—molar forces exerted through the sense of touch, chiefly by solids; chemical forces exerted through taste by fluid substances; perhaps chemical forces through smell, the agencies of which are diffused in the air almost in the molecular condition; gaseous motions coming through the air; and the ethereal motions of light. Thus the nervous system is put into communication with the external world through the solid, fluid, gaseous, and ethereal states of matter; and all these forces, all these modes of motion, impinge upon the river of life and transform the animal life of nutrition into the life of mind. How this transformation is accomplished, far down in the atomic constitution of the system, is yet unknown; but in this transmutation the genesis of percipiency is involved. This is the unknown of psychic life; here again we meet the mystery of minitude. There are two limits to the human perception and the human understanding, two walls that converge at the dawn of the life of the species—an opaque *façade* of magnitude on one hand, and one of minitude on the other. But with the progress of knowledge the walls diverge, and a wider landscape of truth is ever presented. It is the dream of the philosopher that these walls may vanish, while it is the dogma of the philosopher that they will never disappear.

The fourth mode of life is exhibited by social organization. The units here organized are men. The primal organization is based on sex. It has its foundation, therefore, in animal life; but man, endowed with a high degree of psychic life, develops this new organization in a most elaborate manner, with units of individuals, families, and governmental bodies, such as clans, tribes, and confederacies in the tribal state, and districts, parishes, townships, towns, counties, cities, and nations in the national state. Concurrent with this, other systems of units are developed, such as associations for religious worship, for social enjoyment, for literary and artistic improvement, and for the

promotion of many other ends. Still parallel with the regulative, governmental, and corporate organization of units, a vast system or plexus of industrial units, or associations of men, is discovered. Through them all, the people of the state are made interdependent and mutually helpful, and the interdependence and helpfulness extend to international relations. It is not necessary here to set forth systematically and fully the social organization of mankind; the facts are too well known. Still, it is a fourth mode of life, a fourth method of aggregation, by which animal life and psychic life are transmuted into conduct. How this transmutation is accomplished is known to a large extent, for it is recounted in the history of peoples. Conduct is the fourth mode of life; and this function of society has its mystery, for in the ultimate analysis of conduct motives are reached, and the power of choice is developed, which is unperceived in itself and known only as manifested in conduct.

Thus, whatever line of investigation may be taken, the unknown is reached. The mystery that limits possible knowledge is relative to our intellectual faculties, and is antipodal, being in the direction of minitude on the one hand and in that of magnitude on the other. Within these limits there is much that is unknown, but everywhere investigators work with hope, being assured that by well-directed labor they will be rewarded. They are also steadily engaged in pushing back the antipodal limits. The darkness of the resolvable unknown still hangs like a cloud over all science, but the sunlight of research is steadily dissipating it. Then the smoke of dialectic disputation inflames the mental eye, and the smoke and the cloud blend in one vast mass through which men but peer at the known.

In the above exposition an attempt has been made to point out the four grand modes of life, and to show that they may be clearly discriminated when they are fully developed, and that this is true although the phenomena of each mode have not been fully resolved into ultimate elements. The attempt has been made to discriminate between the known and the unknown, to characterize only the known, and to formulate no logical dogmas about mysteries. Whether the phenomena of all of these modes of life are ultimately to be resolved into matter and motion, into

matter and spirit, into force and spirit, or into matter, motion, and spirit, is left to the philosophy of the present and to the science of the future. The analysis and concomitant synthesis have not yet been made, except in dialectics, which the scientific man is unable to understand, and which is known only by those who have special illumination.

In characterizing the four modes of life as fully developed, it has been assumed that they have developed, and that in every mode of life is presented a series of changes from a lower to a higher degree—such a series as the mathematician and logician would characterize as infinite, and which may be called the "series of becoming," by which that which was has become that which is. This "becoming" is evolution, and evolution is the negation of the syllogism of the excluded middle. For it is not true that there is an impassable chasm between the "is" and the "is not," or between being and not being, since in every process a series of becoming fills the gap.

There are many wonderful transformations. The bell transforms the blow into the chime; the violin transforms the strokes of the arm into melody; the organs of speech transform breath into the language of the old, old story. Transformation is the primal law of nature. The nuptial kiss of oxygen and hydrogen transforms them into water, and the twain are one. A slight fall in temperature transforms water into ice, and changes the rain drop into the snow flake; and by the passing breeze the snow bank is transformed into the cloud resplendent in the evening sun. By change of temperature the cloud is transformed into the glacier, and by another change of temperature the glacier is transformed into the river. The river transforms the plain into valleys and hills, and gathering up the sands carries them to the sea, where tides and currents bear them along the shore and slowly form fringing islands, which combine in building continents. Then the cooling of the crust of the earth, with various accessory agencies, transforms the coastal plain into plateaus, which are carved into mountains by rivers. Thus the inorganic transformations are many, from instantaneous chemical combination to the slow development of mountains.

The inorganic transformations are wonderful, but those of the

modes of life are more wonderful. The plant transforms the cloud into the lily; this is the transformation of substance by assimilation. Then the acorn is transformed into the oak; this is transformation by the life process. Spores, by a long process of evolution, are transformed into sequoias; this is the process of becoming by heredity through the generations. The fruits of the copse become thrushes, acorns become squirrels, and antelopes become mountain lions; this is transformation by the agencies of nutrition. A floating ovum in a brook becomes a trout, and an egg becomes a robin; these are the transformations of individuals through a lifetime. Monads are changed into eagles and lions; such transformations are accomplished through heredity from generation to generation.

In the transformations of plant and animal life that have thus been illustrated, three grand classes may be observed, as follows: There are the changes of assimilation and the series of changes of nutrition; becoming or transformation in this manner is called "histogenesis." Then there is the transformation which comes in the course of a lifetime to an individual plant or animal, by which the germ is changed into the adult and the adult stage slowly passes to death by old age; this change is called "ontogenesis." Then there is the transformation that arises through heredity, where slight changes from generation to generation accumulate until the process is complete; this is called "phylogenesis." In all these the unknown in the direction of minitude is reached, so that there is always a mystery.

Then there are the transformations of psychic and social life, more wonderful still. The sight of a reptile is transformed into the emotion of horror; the pain of a scratch in a babe is transformed into the sorrows of old age; the thrill of impact received by a mollusk on the shore, as the waves dash against it, is transformed into the ecstasy produced by a symphony. The light analyzed by rain drops is transformed into the vision of a rainbow; the prattling questions of the child are transformed into the researches of the sage; the crude perception of resistance in the beginning of the world's life is transformed into the knowledge of the solar system; sympathy for distress is transformed into deeds of heroism; the infantine pommeling of vacuity is

transformed into the enterprise which spans the continent with a railroad; the shrinking of a polyp from the beating of the sands dashed by the waves of the sea is transformed into the volition that guides a nation. A motive of love is transformed into a journey across the sea; a motive of gain into the tunneling of a mountain; and the love of truth into chemical research. Childish toddling is transformed into a cotillion; playing for marbles into gambling for stocks; and the soothing of the pain of a playmate into the life of benefaction. Finally, the meandering of the worm for food is transformed into conduct controlled by æsthetic principles.

In the four modes of life, as they have here been characterized, the many transformations can all be resolved into four that are fundamental, each one of which pertains to one of the modes. The first is involved in the genesis of life, in which we have the mystery of vitality; the second is involved in the genesis of feeling, where we have the mystery of sentiency; the third is involved in the genesis of knowledge, where we have the mystery of percipiency; the fourth is involved in the genesis of conduct, where we have the mystery of volition or choice, for which I should like to coin the word "volitiency." Vitality, sentiency, percipiency, and volitiency are the four great mysteries belonging to the four modes of life. As we know much about gravity, as explained by the laws or conditions of gravity; as we know much of chemism and the conditions for chemical reactions, as set forth in the science of chemistry; so we know much about vitality, sentiency, percipiency, and volitiency. And yet in all these properties there is an unknown.

The science of the evolution of life is the science which explains the conditions of the four mysteries or methods of transformation, and it seeks in each case to discover the series of becoming. When the several steps of these series are fully discovered, the genesis is explained. Whence come the power of living, the power of feeling, the power of knowing, and the power of choosing? These are yet the mysteries of life. These powers come in the order in which they have been named, and constitute a series of transformations. The fact of their becoming is well known, the order in which they arise is well known, and

many of the conditions under which they arise are well known. Vitality comes with protoplasm, sentiency with nerve structure, percipiency with ganglionic structure, and volitiency with the compounding of ganglions in the encephalon.

In the four modes of life there are four lines of evolution or becoming, but they are not parallel. From the midst of plant life springs animal life, from the midst of animal life springs psychic life, and from the midst of psychic life springs social life; and each presents a distinct series of becoming, governed by its own laws of evolution. As there are four kinds of life, so there are four kinds of evolution, four methods of becoming, four systems of laws; that is, there are four groups of phenomena and four methods of genesis. But in the complexities of the cosmos the phenomena are entangled; and in the doctrines of evolution taught by scientific men, and reiterated in the literature of the times, the four methods of becoming have been still further entangled and confused. Thus the laws of evolution applying to plants and to animals have been supposed to be identical with the laws of evolution of men in society, making the doctrines of evolution opposed to the plans of men in their endeavor to improve their condition. The survival of the fittest is supposed to be a more potent process than the endeavor for improvement, and mercy and charity are supposed to thwart the laws of universal progress.

The law of evolution itself has been evolved. It has its stages of becoming, and by process of development is gradually transformed. The law of the destruction of the many for the advantage of the few is first discovered in plant life, is modified in animal life, is further changed in psychic life, and through the development of conduct in social life ultimately becomes a system of ethics composed of laws of conduct marvelous in their beneficence. The story of becoming, exhibited in the development of the laws of evolution, is the supreme wonder.

J. W. POWELL.

AS THE CHINESE SEE US.

It sometimes does us good "to see ourselves as others see us." Montesquieu made a happy hit when, in his "Persian Letters," he gave the French the benefit of Uzbeg's intelligent criticism. Goldsmith, who is not above imitation, favors us, in his "Citizen of the World," with the views of a Chinese philosopher. Lienchi Altangi is still on his travels. We meet him on the ocean steamer, at the summer watering place, and in the boxes of our fashionable theaters. He inspects our machinery and studies the mechanism of our social and political systems. He is not a *flaneur* in quest of distraction, but an observer by profession, reporting his impressions for the information of his people. To us he expresses himself in the language of oriental compliment, but if we wish to know what he thinks of us we must hear what he says to his countrymen.

The High Commissioner Keying, who was sent to Canton in 1842 to negotiate a treaty with the English, tried to be polite when he was placed at table between two European ladies. The ladies, it is needless to say, were charmed by his urbanity; but some years later, when, on the capture of the city, copies of his reports to the Emperor fell into the hands of the English, they saw the other side of the picture. One of the reports ran:

"Your majesty's servant accepted from policy an invitation to dine with the barbarian chief, but what was his astonishment to find himself seated between two women! His first impulse was to regard the affair as an affront, and to leave the table; but, on second thought, he deemed it better to conceal his feelings, and not to risk the rupture of our negotiation."

Two of the earliest narratives of Chinese travel in the West —one by Lin, of Amoy, written about forty years ago, the other by Pin, of Peking, written in 1866—are in the form of verse. The travelers saw so much that was new and strange that they naturally rushed into heroics. Their poetry is not, however, all