

## THE GROWTH OF SENTIENCY.

MULTIPLICATION is the primal lesson of living beings. If all the plants upon the surface of the earth should be destroyed except one young palm, one young oak, and one young pine, and these should be allowed to bear their fruits, and every seed should grow and reproduce its kind in a succession of generations, the palm, the oak, and the pine might live to see their progeny covering the whole earth. And the younger palms, oaks, and pines would stand so dense under the shadow of the taller forests that the world would be a jungle impenetrable to the larger beasts. Such are the powers of reproduction with which palms, oaks, and pines are endowed; and yet they do not equal those of many lower orders. This marvelous fecundity, especially in the lower forms, has played an important part in the evolution of plants, the nature of which must be understood. Few plant germs reach adult life. Every successful passage through the term of existence is offset by a multitude of failures. The life of the very few is secured by the martyrdom of the very many.

If many are called and few are chosen, how are the favored few selected? The answer is the modern doctrine of evolution; it is the principle of "the survival of the fittest in the struggle for existence"; it is the philosophy that Darwin embodies in the phrase "natural selection." Nature gives more lives than she can support. There is not enough food for the individuals requiring it, and only those live that obtain sufficient nutriment. There is not enough room for the growth of all the germs produced, and only those live that find a habitat. Of the multitude, some perish on the rocks, some languish in the darkness, some are drowned in the waters, and some are devoured by animals. The few live because they do not fall on the rocks, but are implanted in the soil; because they are not buried in the darkness, but are bathed in the sunlight; because they are not

overwhelmed by deep waters, but are nourished by gentle rains; because they are not devoured by the hungry, but dwell among the living. The few live, in other words, because they are the favorites of surrounding circumstances. In the more stately phrase of the philosophy of evolution, they are "adapted to the environment." But this general statement must be followed a little further, that its deeper significance may be grasped.

The earth, as the home of living beings, presents an almost infinite variety of conditions, and beings not adapted to one set of these may be adapted to another; so that a great variety of living forms are produced, suited to a great variety of circumstances. Plants are developed to live in air, on the land, and in the sea; in polar zones, in temperate lands, and in torrid regions; on mountains, on plains, and in valleys; in arid lands and in humid lands. The life which teems upon the earth is thus crowded into every available spot, and yet the fountains of life never fail. Every spring sends its stream into the flooded world. There is life for all the earth, and more life, and still more life; forever and forever it comes. Under such conditions of abundance, of wanton superfluity, the new-born plants are ushered into the world to compete with one another for continued existence. Thus the whole world of vegetable life is in a struggle; all plants are engaged in warfare one with another.

Let us look at some of the ways in which this competition is carried on. The plant must have air and water, for its food is the body of the wind and its drink the body of the storm; but food and drink are only the vehicles of life, not life itself. Plant life is sunlight, transformed and organized by air-fed tissue. The life of the forest, of the meadow, and of the mossy bank is drawn from the effulgence of the orb of day, for it is in the loom of the plant that the light of the sun is woven into life. For this light every plant struggles; toward the fountain every plant turns, that it may drink; aloft it lifts its head, higher and still higher above its fellows, and abroad it stretches its branches, and athwart the course of the sunbeams it spreads its leaves, that it may catch as much sunlight as it can. The plant that lifts its head highest, and spreads its limbs widest, and clothes itself with the densest verdure, is the successful competitor. Its

prosperity is its neighbors' adversity; its life is its neighbors' death. A shadow is the sword of a great tree, and with this weapon it slays a thousand. The life of one is the death of many. But those that drink from the fountain of life are the best of their race; those that are stricken with the shadow sword fall because they have less of plant excellence than their destroyer. It is a survival of the fittest; it is natural selection; it is evolution toward higher life.

Animals live on plants. They devour tissue and transmute vitality, and here the method of natural selection is reinforced. The sweetest and most nutritious plants become the food of animals; those that are bitter, those whose tissues are hard, those that are clothed with thorns, and those that secrete poisons, escape and live. So the plants that have killed their neighbors with shadow swords make defensive warfare on the animals that come to devour them; and the hard, the bitter, the stinging, and the poisonous are in the long run the successful competitors for life. The progress of the few is through the death of the many, and out of this progress are developed hardness, bitterness, piercing cruelty, and deadly poison. Time would fail to tell how plants bear flowers that ever become more graceful in form, more beautiful in color, and more delicious in perfume, through the agency of winged insects; how fruits become luscious and more luscious through the agency of birds of the air. But so it is. The tender and the hard grow on the same hillside, the beautiful and the ugly grow in the same forest, sweet odors and foul stench arise from the same meadow, and salubrious and noxious fruits may be gathered from the same copse. The progress of the few is secured by the sacrifice of the many, and good and evil flourish in the same soil.

Turning to contemplate the evolution of animal life, we find facts of like character. If a barrel of oysters should be planted in an estuary of the sea and their progeny should all be preserved in successive generations for a decade, the oyster field thus produced would supply a bounteous repast for every man, woman, and child on the face of the earth. A multitudinous population is crowded into every possible region and place, and the fountains of life are ever flowing. A few may live, while

many must die. Besides the unconscious passive warfare of the plant, we thus have the designed and aggressive warfare of the animal, and all the world is at war. Air, earth, and sea are vast battlefields filled with animals large and small, flying through the air, prowling on the land, and swimming through the waters, on predatory forays—a world filled with all imaginary forms of life, all seeking whom they may devour. Those that fight best are saved; those that conceal themselves most deftly are preserved; those whose flight is most rapid reach protection. It is in this manner that many living beings are gradually furnished with defensive armor, and that defenseless beings grow sharp of vision, quick of hearing, and fleet of motion. Thus weapons of multitudinous forms are developed. Insects are provided with saws, knives, and stilettos; other creatures have teeth that pierce and cut and grind, and sharp beaks and talons and hoofs and tusks and horns; and some defend themselves with foul odors and deadly poisons. Strange, terrible, and loathsome are the many defensive and offensive devices of the animal world; and all these grow out of the struggle for existence. Competition among plants and animals is fierce, merciless, and deadly. Out of competition fear and pain are born; out of competition come anger and hatred and ferocity. But it must not be forgotten that from this same competition arise things most beautiful and lovely, such as the wing of the butterfly, the plumage of the bird, the fur of the beast, the hum of the honey bee, the song of the nightingale, and the chatter of the squirrel. So good and evil dwell together.

The prodigality of life in the lower forms and the competition which arises therefrom, lead to two results, namely, the differentiation of co-ordinate species and the development of higher forms. These results combined are known as evolution. Germs of life are carried by wind and water, by animals themselves, and by other agencies, and are distributed wherever air may be wafted, wherever water may flow, wherever walking animals may go, wherever winged animals may fly, wherever creeping animals may crawl, and wherever finned animals may swim. The mountain, the hill, the plain, and the valley are thus perennially covered with germs, and the moor and the fen are abundantly

supplied. The springs, the brooks, the creeks, the rivers, the lakes, and the seas are filled with germs. Seeds are carried even into most inhospitable places, such as caves and hot springs. Wherever they are carried they are developed, and gradually species are evolved adapted to all these varying environments. Thus arises a multiplicity of forms peculiar to the multiplicity of habitats. The mountain crag becomes the home of the dwarf, the opulent valley the home of the giant. The fiord has its denizens and the tropic sea its people. The rock is clothed with lichens and the ooze with moss. The sandy desert of the tropics has its fields of opuntia; the icy desert of the paleocrycitic sea has its protococcus. In each habitat, by the death of those that fail in the struggle for existence, and by the preservation, from generation to generation, of those that develop the characteristics best adapted to environment, a serial progress is made. The new species developed have characteristics which constitute them higher beings in the scale of existence. These beings climb the ladder of life by rungs which, though separated by generations, are in fact so close together on the scale of progress that the minute degrees of evolution are indistinguishable when taken separately, and are only to be recognized in groups; as the motion of the hand on the dial is not marked by moments, but by hours. Yet germs and generations are plenty. Lives and years multiply, and all these bring the multiple changes which constitute transformation. By such processes of evolution species are differentiated and biotic life is developed.

The law of evolution which governs that mode of life called "vitality," is denominated "the survival of the fittest in the struggle for existence." Under its sanction diverse species are developed. Most of such species make little or no progress; a smaller number develop a higher life; and an ever-diminishing number of species burgeon and grow still higher and higher, until only a few reach exalted position, and man alone crowns the column. The great efficiency of the law of the survival of the fittest depends upon the enormous multiplicity of individuals, which causes them to compete for life. If the germs developed should not be more than equal to the duty of supplying the waste caused by death, the rate of progress would be greatly

diminished, and life would become stationary, or nearly so. Other things being equal, the lower the form the greater the rate of reproduction; and steadily, as forms become higher, the rate of reproduction is diminished, until in the highest it is scarcely more than enough to supply the demands of current life. Under this law the rate of evolution becomes slower from age to age, with advancing development. The survival of the fittest gives hope to the worm, but despair to the man. It is a process which comes to an end; for the beings developed under the law ever become more complex, so that reproduction demands more and more of the energies of life, until a species is so highly developed that it can do no more than preserve its numbers, and has no surplus to be slain in the interest of progress.

Now the rate of progress is known to have been steadily accelerated from the earliest geologic time to the present. For many decades scientific men have been studying the life of the globe, as it has been entombed in the rocks from Algonkian time to the present. At first vast periods elapsed during which little progress was made, but from age to age the rate of evolution was increased until the higher animals appeared. Then a new era was inaugurated, and age followed age with greater and still greater activity, until, as we see in the Neocene rocks, forms were developed in ever shorter periods. The latest geologic times have been the theaters of the greatest biologic development. If this is true—and it is a well-established fact in paleontology—then some new method of evolution must obtain; a second law must be added to Nature's code of procedure. That law has been discovered; in fact, it was known first.

When animal life was evolved, sentience was developed with it. The nervous system is the plexus by which the organs of the body are so correlated and made interdependent that they work together and assist one another. The organs feel with and for one another, and every one labors for the common good. If a larger share of effort is demanded from some organs than from others, such others recognize the fact by generously supplying the necessary materials of life. If the animal must escape by flight, its wings become the centers of interest to all the other organs, which become opulent donors of vitality. In this man-

ner the organs of flight are developed by exercise. If, in the battle of brutes during the struggle for existence, horns are brought into play for offensive or defensive purposes, under the guidance of sentience all of the other organs pour their power into that one which has become for them the tower of defense. It is in this manner that animals grow unsymmetrically, the preference being given to those organs or parts which, under the circumstances, are of the highest importance; and the important part is that which is used, the development being in the direction of size, of strength, or of deftness, as the circumstances demand. Again, the conditions of life may be such that certain organs or parts are rarely used, and, being unused for the common good, they are neglected. From the unused parts the vitality is drafted to the used parts, and the former gradually, from generation to generation, become weaker, until they are atrophied. In the economy of organic or sentient life, the drone is doomed. Thus, by the effects of use and non-use, species are multiplied, and species whose development is in the most fortunate direction are lifted into higher planes of existence.

All this co-operation, leading to evolution as it does, is born of sentience, and special organs of sentience are slowly produced to perform special functions. The termini of the nerves become more efficient organs of touch when this sense is of advantage to the species, for the other organs willingly yield the vitality necessary for such development. When it becomes advantageous to the species that the animal should select its food properly, as it must at every feast, all the other organs yield vitality to those nerves that guard the portal to digestive life, and thus taste is developed. Whenever it becomes important to follow the track of the animal which is to be the source of food, or whenever, in the selection of food, odors can be made a guide, all of the organs yield a store of vitality to the nerves that guard the entrance to the lungs, and thus the sense of smell is developed. When enemies lurk under the veil of darkness, or announce their approach from afar in murmurs on the air, all the organs of the being become interested in the detection of sounds which the enemies may make, and supply to the organ of hearing all the life that can be used; thus organs of hearing are evolved. The light of day is



used to signal the presence of food and drink, or to herald the coming of foe or of friend, and thus the watchful eye is the favorite of the community of organs; all yield to its need, and by constant use it attains to the highest development. Organs of sentience, when gained, may be lost, for the ear unthrilled by sound must die, the eye unpulsed by light must expire.

Thus it is that all of the organs are developed through the agency of sentience, and that the special organs of sentience themselves are most highly evolved, under the sanction of the law that the organ which is of the most important use to the animal, under the conditions which the environment presents, is the one exercised. The stimulus given to the evolution of special organs under this law results in the production of many monstrous, uncouth beasts, with disproportionate parts. Beasts of huge size are developed, because bulk alone sometimes gives mastery; but these monsters, though they often appear in the course of geologic history, are comparatively short-lived as species, since the undue tendency to monstrosity ultimately defeats itself. Animals of proportions adapted to special conditions do not persist with changing environment. As the conditions are in constant change, these marvelous animals are put at a disadvantage and are soon extinguished; but many develop special organs that prove to be of more permanent value, and such animals come to be most highly evolved. One set of organs of prime value is developed under the law of exercise; these are the organs of sense, because sentience leads to percipience and percipience to volition. And that knowledge which arises through percipience and that control of conduct which arises through volition, lead to higher species through evolution, until one species, man, stands at the head.

The "environment" under which the number of species increases and certain species make progress in the scale of being, means more than the physical conditions under which they exist. Besides the physical environment, there is a life environment. Each species has conditions imposed by other beings. Some plants are parasitic; and plants not only destroy one another, but protect one another. Then animal life is derived from plant life. Some animals are parasitic; some use others for their food; and



animals protect one another and destroy one another. It is thus that the environment has two series of complex conditions, one derived from physical nature and another from biotic nature. These conditions are multifarious and complex, and the plexus of causation is not easily unraveled; but they all work together for the survival of the fittest, and conspire in many complex ways to promote development by exercise. Some of these secondary laws, like that of sexual selection, play important roles, but for the purposes now in view they may be neglected. The co-operating law of heredity also has been left without exposition. This only can be said here: germs are not born of germs, but of adults, and thus the efforts of protracted life are handed down by inheritance. Adult generation is the fact observed, and it fully explains the effects produced. Germ generation is a fancy of the speculator who coins axioms about the unknown. Such hypotheses are valuable in science, but they must not be used as established principles for its foundation.

It has been seen that the law of selection becomes less and less operative as species become higher and higher. On the other hand, the law of exercise is more efficient with the progress of life forms. It is thus that the higher evolution of animals is chiefly dependent upon the law of exercise; and when the organs developed in this manner are of general and perpetual value, evolution proceeds in a geometric ratio. It should also be noticed that the law of exercise co-operates with the law of selection in securing the preservation of the fittest among those developed by exercise.

Under selection and exercise three results are effected: 1. A multitudinous host of living species is produced, covering the land, filling the air, and populating the sea. This gives rise to the science of systematic biology, in which the forms of species are studied in relation to their integral organs, and in which all are classified. 2. By the combined agency of selection and exercise, higher and ever higher species are evolved, in classes the members of which are connected by genetic lines. Thus, animal forms are arranged in series, or lines, diverging from the lowest to the highest. Many lines of evolution have ended, because the beings developed were not ultimately adapted to an evolving environ-

ment; but those most fortunately differentiated have continued to the present time, and their lines of genesis lead back to the beginning of life in Algonkian time. Thus animals are seriated; the succession of forms found in the animal, from the germ to the adult, is compared with the succession of forms found in the geologic series, and lo! it is an epitome of the same. 3. Living beings are adapted to environment, and this results in a geographic distribution of profound interest. The geography of life is one of the most alluring studies of modern science, for by it the laws of life are shown to be related to the laws of climate. The student in this field must be both a physicist and a biologist. He is interested, for instance, in the great ocean currents.

Now turn to contemplate the ocean vast :  
Wherever mariner is borne by mast,  
There mighty currents flow from clime to clime,  
Through torrid zones and zones of crystal rime.

Where out of polar fiords glaciers creep,  
There ocean rivers rise, and, plunging deep,  
Roll down the world to equatorial main,  
From iceberg seas to seas of hurricane.

And other rivers rise in seas of sun,  
And poleward far their spreading waters run,  
To give the bays and inlets sweeter calm,  
And bless the continents with zephyr balm.

His field also embraces all the wonderful movements of the atmosphere, set in motion by the revolution of the earth, diverted by the ever-changing effect of the sun, and still further influenced by the conformation of the land in continental plateaus and mountain systems. All elements of climate fall into his theme, with zones, altitudes, and depths; and the whole field of astro-physics lies in his way for exploration. With this he must study the conditions of life and the systematic groupings of animals. The domain of psychology also constitutes a part of his field, for the science of sentience is the foundation of the science of psychology.

The plant has vitality, and perchance the beginnings of sentience may be found in some species; but this mode of life is the primal attribute of animals. They feel pains and pleasures,

and have organs for the purpose. The struggle of the plant is for life, because its sole endowment is vitality. The struggle of the animal is also for life; but to this is added the struggle for happiness, because of the endowment of sentiency. As special organs for this purpose are evolved, the endeavor to secure happiness grows. Thus it is that the second law of evolution is developed by exercise in the endeavor to secure happiness. The animal endowed with the power of feeling pains and pleasures, constantly exercises not only its muscular organs, but still more its sentient organs. The animal flees from danger, and defends itself from attack. In the alembic of life, more vitality is evolved than is needed for the stern purposes of bare existence; so animals engage in sports, and the time is shared between toil and play. The cubs of the bear dance on the greensward; the swallow floats on the air with lilting wings of joy; the trout plays in the brook as if sunlight were elysium.

The life of the animal is one of great vitality, from the very lowest forms, seen only with the microscope, to the busy crowd of the city mart. This vitality is the chief source of the evolution of sentiency, which reacts upon the physical organs until sentient life and exercise seem to be one. All pleasures, all pains, all emotions, are expressed in activities. So far as human investigation can discover, they are only activities. Such is the teaching of the latest scientific psychology.

The evolution of life is accomplished in four stages. In the first mode of life, which is vitality, progress is made by the survival of the fittest in the struggle for existence. In the second mode of life, which is sentiency, progress is made by the development of organs in the struggle for happiness. In the third mode of life, which is percipiency, progress is made by the discovery of truth in the struggle for knowledge. In the fourth mode of life, which is volitiency, progress is made by the establishment of justice in the struggle for peace.

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## MADAME DE STAËL.

AMONG the many important works which have lately been published on the Continent, reconstructing the history of France during the struggle of the Revolution and during the periods that immediately preceded and followed it, scarcely any have been so comprehensive, and not many have been so valuable, as "The History of the Life and Times of Madame de Staël," by Lady Blennerhassett. The author—a Bavarian lady who was an intimate friend and favorite pupil of Dr. Döllinger—has brought to her task a knowledge, which is scarcely rivaled in its completeness, of the French, German, English, and Italian literatures relating to the period; and she has produced a work of which it is in one sense the merit, but in another the defect, that it sweeps over a far wider field than might be expected from its title. It is seldom, I think, a judicious thing to confuse the provinces of history and biography by turning the life of an individual into an elaborate history of his time; and in the few cases in which this method has been successfully pursued, the biographer has selected as his subject some man like Cromwell, or Frederick the Great, or Napoleon, who was indisputably the chief mover of his age. When figures of less prominence are chosen, both the history and the biography are apt to suffer. The true perspective, or relative magnitude, of events is impaired, and the book is almost sure to lose something of its artistic charm and of its popularity. Mr. Masson, as it seems to me, committed a mistake of this kind in his "Life of Milton," when he grouped around the great Puritan poet—who, however illustrious, was certainly not the central figure of his time—a full and valuable history of the Commonwealth, and of large sections of the reigns of Charles I. and Charles II.

In like manner, a great part of the work of Lady Blennerhassett is not biography, but history, and history of a very high order. Madame de Staël was so closely connected in her own