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BIOLOGICAL LAWS AND SOCIAL PROGRESS.

BY

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In such a meeting as this it is entirely proper to recall the services of science to man, the discoveries which have contributed to his health and comfort and given him knowledge of the world in which he lives. By the aid of science man has acquired such control over nature as his imagination formerly attributed only to the gods. Today, he mounts into the air with Mercury, dives into the deep with Neptune, and when he speaks from the summit of some Mt. Marconi, his voice is heard in the uttermost part of the earth. These discoveries, and especially the great services of the scientist in the world war, have won for science a high place in popular esteem.

But peace has brought demands that are no less insistent than those of war. At the present time all progressive nations are facing certain social problems which were already pressing for solution in 1914. In the strain and stress of war the issues have been more sharply defined. Scientists may assist in the solution of these problems by the contribution of discoveries and inventions which make for better living, but such relief will be only temporary. A more lasting contribution, I believe, may be made by emphasizing those biological principles which must control all progressive evolution, both in society and elsewhere in the organic world. I wish, therefore, in the performance of the task assigned to me as president of the Academy, to call your attention to an old theme: namely, the importance of the general laws of biology in social progress.

That the evolution of human society follows the same laws that control evolution in other fields, is a fact often repeated since Herbert Spencer and Huxley insisted on its importance. In both cases evolution is essentially a process of differentiation and integration of parts or units originally alike and equal. The nature of these changes is shown in the embryonic development of every higher plant or animal, the multiplication of cells being followed, on the one hand, by division of labor, formation of tissues, organs and organ systems, on the other hand, by coordination and integration of associated parts to form a complete whole. Societies are formed in the same way. Beginning with a group of individuals which do all kinds of work, by division of labor and cooperation they form complex organizations which are able to accomplish vastly more than separate individuals could do. Here, also, as in animal and plant bodies, the greater the division of labor, the more dependent become the parts on the whole, the more dependent the whole upon the parts.

This tendency to differentiation in organisms is limited by other laws which produce more or less uniformity and stability. In embryonic life this conservatism leads to a repetition of ancestral history, in which the embryo follows a certain definite path and gives rise to an individual of a

definite pattern. Even embryo man is not ashamed of his ancestors, although some adult men are. If this condition dominates both adult and embryonic life, the species may continue indefinitely without change, like the brachiopod Lingula, the same today as in Cambrian time. Differentiation on the other hand, creates new species and thus forms the basis of progressive evolution. Continuous repetition of the process through long periods of time has given rise to all the higher animals and plants. In the great majority of organisms, however, progress has been slow, and in many cases, has ceased altogether. Of the vast number of species that now live, or have lived, on the earth, only a few have found the path leading to high rank.

These differences in the capacity of organisms for progressive evolution may be explained in a way by saying that certain types are more plastic than others. Some are easily moulded into new shapes, while others change slowly or not at all. When such a species reaches the limit of differentiation permitted by its organization, it may continue to exist on the same plane, but it can not advance. According to Herrick, the evolution of the whole group of arthopods has been definitely limited by the lack of plasticity of the ladder type of nervous system, which apparently reached its highest development in cretaceous insects about two million years ago. At the same time also were established those rigid instincts which have continued without change down to the present. The more plastic tubular nervous system of the vertebrates, on the other hand, has shown itself capable of enormous development, and has provided the nervous equipment of those animals in which inherited instincts are largely controlled by intelligence. With a nervous system constructed on the tubular plan, the mammals have advanced farther than other animals, but among these only the primates reached the highest grade of development. From this group finally came man.

With the advent of man the old laws of evolution continue to operate, but they are more or less under the control of intelligence, which becomes a factor of increasing importance. As men were drawn together for protection or otherwise, societies were formed and division of labor occurred, but no physical differences appeared, such as are found in other animal societies, and thus each individual man retained the capacity to do all kinds of work. In such societies were laid the foundations for those collective activities, such as language, literature, science and government, which go to make up civilization. Henceforth each generation receives not only the heritage of the germ cells but also a heritage of knowledge accumulated by previous generations. By virtue of man's superior mental capacity, each generation appropriates the inherited wisdom, adds its own contribution to the general store and transmits the whole to its successor. In this manner the social heritage is enlarged.

Continuous operation of the general laws of evolution in human history is indicated by the appearance of different types and races of men, the inhabitants of different regions showing different characteristics, as in the case of lower organisms. As population and division of labor increased, more or less permanent conditions developed, but many of the early societies have doubtless disappeared without leaving a trace of their existence, while others are known only by implements or other remains. Among the surviving peoples all grades of culture are represented, many having ceased

to advance long before they came in contact with the more progressive nations of western Europe.

During this long period of social evolution the human body has shown no great changes. According to Osborn, the Cro-Magnon race which inhabited Europe during paleolithic time was fully equal to modern man in physical development, perhaps also in mental capacity. A similar stability is shown by man's animal instincts. Only by adding to his social heritage has man advanced.

Henceforth human progress has been largely a series of attempts to solve certain fundamental problems. One of the first of these to receive attention was the problem of government. After experimenting with various systems, some democratic, some autocratic, many including caste and slavery, the more advanced nations of the world have adopted the democratic ideal of equal units cooperating in such a manner as to secure both the freedom of the individual and the security of the state. Under this ideal, differentiation is limited to differences in mental capacity, wealth or occupation, and each individual is free to make the most of himself. The ensuing struggle results in the development of the fittest and thus promotes the welfare of society.

Recently the adequacy of this ideal has been called in question by the advocates and supporters of a new experiment in class government. In Russia, the ancient stronghold of democracy, revolution has usurped the place of evolution, the government of the Czar has been overthrown, and in its place has been set up an autocracy of the proletariat, "the worst autocracy the world has even known". This system destroys the incentive to individual effort by denying the right to hold private property or to engage in private enterprise. By confiscating the property of the capitalistic classes, this system has thus far maintained itself and is spreading its poison throughout the world. In the immediate future it is a factor to be reckoned with, both in Europe and Asia. Spasmodic outbreaks may also occur elsewhere, nevertheless the influence of Bolshevism seems to be waning as its funds approach the point of exhaustion, and the final result of the experiment, apparently, will be to strengthen the cause of government by all the people.

Another problem, the solution of which lies still in the future, is the problem of international relations. The need of adjustment in this field has been recognized only in recent times. In international affairs, the rise of civilization has been marked by natural selection,—the "ape and tiger method" which figured so largely in the evolution of lower organisms. In the past, and even in recent time, attempts have been made to justify this method on various grounds. But conditions have changed. Modern nations are no longer isolated, as were the ancients. By increase of population and by improved means of communication the nations of the world have become one, and the prosperity of every state is closely linked with that of its neighbors. These common interests of nations demand a recognition of their oneness in international law,—a recognition of the principle of cooperation in place of natural selection. Unfortunately the high hopes that were conceived during the war have not yet been fully realized. But some progress has been made. The same need that led individual man to form societies is now insisting on the formation of a society of nations.

Some sort of a working league of all leading nations seems to be the next step forward.

The importance of more complete coordination in the industrial affairs of nations has become more and more apparent during recent years. A modern state is composed of many industrial groups, each one seeking special advantages for its members, and often without regard for the interests of other groups or for the good of society. Labor decides to strike in order to obtain a larger share of the profits of industry, employers endeavor to enforce their demands by means of the lockout. The result, in both cases, is an interruption of industry, while the damage too often falls chiefly on the innocent public. A few generations ago strikes and lockouts were used only as weapons of last resort, to obtain redress for grievances, either real or imagined. Today they are often used as a matter of policy, whenever the time is favorable for advancing the interests of the party concerned. The necessity of society thus becomes the golden opportunity of both capital and labor, and so dependent is society on the continuous operation of certain industries, that swift calamity would follow even a brief interruption of work. The possibility of a general strike of coal miners or railway employees has been brought uncomfortably near during recent years.

In this country, at the present time, there is no reason for alarm in regard to the final outcome of such a strike. Certain compromises would be made, work would finally be resumed and the authority of society would be vindicated. Such a settlement, however, would not prevent a repetition of the disturbances. In those industries which are essential to the public welfare, both strikes and lockouts must be prevented, and this can be done only by removing the cause. In the great industrial expansion of the past century, certain organizations of capital and labor have been formed in the social body, but the hormones which should regulate their activities are lacking. Differentiation has outrun coordination. It is necessary to adjust the relations between society and the classes so that the welfare of all shall be safeguarded. When the classes recognize the fact that they are merely organs of the social body, and when they realize that this dependence carries with it duties as well as rights, then it will be possible to enact laws which will insure a reasonable measure of industrial peace. Only by such cooperation can the classes reach their own highest good.

Some progress has been made toward this goal. Employers and employees are beginning to appreciate their obligations. Labor did its share to win the war and it has generally resisted the seductive advances of Bolshevism. It is to be hoped that the lesson of cooperation learned during the war will help to solve the problems of peace. Failure to accomplish this must mean failure in everything. Only when a species is headed for destruction are violations of the laws of coordination tolerated, even for a time.

Other social problems which are calling for attention, are due to violation of certain laws of reproduction. The growth of human population is subject to the same general laws that hold good among lower forms. The increase of every species must eventually reach a limit, and this limit has actually been reached by the great majority of living species,—a stage in which the average increase equals the average death-rate, and population

fluctuates only slightly from time to time, as conditions are favorable or unfavorable for additions. Such a condition of equilibrium may be temporary or it may continue indefinitely. In the former case, under favorable conditions, it may be followed by a new increase, while unfavorable conditions may lead to actual decrease and final extermination.

In the case of man, the increase of population must be limited finally by the supply of food and other necessities. In China and India, at the present time, population varies directly with the food supply. A similar condition, which existed in Japan for more than 150 years, was brought to an end by contact with Western civilization and the adoption of Western methods and inventions. As a result, population in Japan increased 60 per cent. from 1871 to 1915, and the increase still continues. A somewhat similar change occurred in Europe after the Industrial Revolution. About 300 years ago the population of Europe had become stationary because of a high death-rate due to war, famine and plagues. When the discoveries of science made possible the control of devastating diseases and provided for a more constant food supply, population increased rapidly. At the present time, because of a declining birth-rate, population is again approaching equilibrium,—a condition already reached in France. In England, between 1871 and 1911, the rate of increase declined from 1.38 per cent. per annum to 1 per cent. per annum, and the same tendency is evident in the United States and elsewhere. According to East, the high cost of living, due to decrease of the food supply, is the chief cause of this decline, but it is not the only cause.

Under conditions now existing in international affairs, when military strength is one of the chief concerns of nations, the present tendency of the birth rate is naturally considered undesirable. If the population of France had increased as rapidly as that of Germany after 1871, the Kaiser would probably have hesitated to begin the world war in 1914. But the laws which control population are not easily changed to satisfy national ambitions or fears. It is well, therefore, to recognize the fact, that unless science comes to the rescue with improved methods of food production, the birth-rate of civilized nations must continue to decline until population becomes stationary.

The deplorable feature of the situation, from a biological standpoint, is the fact that the decline of the birth-rate is selective: it is greatest in those classes of society, which by reason of heredity and education, should be expected to contribute offspring of greatest value. Such conditions have not been confined to modern times. In the two centuries from 500 B. C. to 300 B. C., Greece produced a group of men whose achievements, judged by modern standards, indicate native ability of a high order. But the brilliant Athenian race declined, and many smaller groups,—families of statesmen, artists and scholars of later centuries, have completely disappeared. Few families of this class, according to Broman, survive a period of 250 years.

In these modern times, society takes the talented child and educates him largely at public expense, in order that he may contribute something of immediate value to the state, but the conservation of this talent for the use of future generations is a matter in which society has taken little interest. Man is wasteful of coal and of other resources of the earth, but

for these he has at least the hope that he may find substitutes. The most deplorable waste is the waste of the hereditary sources from which genius springs. Professor Cattell tells us that a Harvard graduate has, on the average, three-fourths of a son, a Vassar graduate, one-half of a daughter. College graduates are regularly informed by the commencement speaker that they are the salt of the earth, the leaven of the whole lump of society, but in a biological sense the leaven is weak and the salt has lost much of its saltness. The call for highly educated men in the universities, colleges and the professions is greater today than ever before and it is certain to increase. If present tendencies continue, the future will see a great drain on the biological resources of the civilized nations.

In order to improve his stock, the breeder of domestic animals selects only perfect specimens; he knows that elimination of the superior animals will mean race deterioration. Has human mental capacity declined because the talented ones of past ages failed to perpetuate their kind? There are those who believe that such a decline has occurred since the days of Aristotle. Perhaps it is safe to say there has been no great improvement. But this much is certain. Heredity is a factor in mental evolution, and if human talent had maintained itself in the past without loss, the average mental capacity of modern civilized man would be higher than it actually is. Whether a decline of this average mental capacity has occurred, or will hereafter occur, must depend on the relation between losses and gains. To balance the loss of talent in the educated classes, there is the possibility of increase from mutations, or talent may increase in a latent condition. We know that heritable variations have occurred in the past; the existence of different races of men is sufficient evidence of this. But if this evidence seems to justify the belief that progressive mutation of the mental faculties occurs today, we are still ignorant in regard to the frequency of their occurrence. We are not certain that they replace any considerable part of the losses of talent in civilized countries. There is, however, more or less latent talent among men, in families whose members are undeveloped because of lack of education. In the United States and other progressive nations the amount of such talent may also be augmented by immigration. From all of these sources, it is possible the increase may be sufficient to fill the places made vacant by the extermination of educated families. But substitution is not restoration. The losses on the firing line can not be made good by calling up the reserves; the total strength of the army is nevertheless reduced. We must conclude that man is advancing socially at the expense of his biological heritage. Whether this heritage is increasing or decreasing is uncertain, but under the most favorable conditions, society is falling behind the high development of which it is capable. At present the only hope for improvement lies in a campaign of education. Society should see to it that the rewards of service are sufficient to enable the educated man to live a normal life as head of a family. The educated man should appreciate his obligations to society. The problem is to discover a way to utilize available talent and at the same time to conserve it for future generations.

But if civilization has been unfavorable for the reproduction of the educated classes, it has been especially favorable for the reproduction of the uneducated. In fact, it has become a veritable paradise for the unfit. In

his treatment of the dependent classes, man has suspended the process of natural selection; he preserves and cares for the mentally unfortunate, permits them to multiply, and by marriage with normal individuals, to increase the number of tainted persons in the community. At the same time he is placing on society the burden of caring for an increasing number of persons who are totally unable to care for themselves. The seriousness of this problem is well known and considerable progress has been made toward a solution. Increase of the abnormal must be prevented by proper measures, and the entire group of defectives must be reduced to the lowest possible minimum. At the same time, education of the public in regard to the importance of eugenic marriage will reduce the number of tainted persons in society.

The entire situation, as I have described it, may be summarized as follows: In the development of society certain laws of progressive evolution have been violated. Man has produced an artificial environment in which the defective classes are increasing while the educated classes are not perpetuating themselves. He has permitted the formation of social groups but has not insisted on the proper coordination of these organs of the social body. In international affairs he still employs the "ape and tiger methods" of his ancestors. The scientist is interested in the solution of these problems because he is a citizen, and since the problems are largely scientific, he should assist in their solution. I will not go as far as Groves, who says that since the scientist has made our era, he is also responsible for its problems. The duty of the scientist is investigation. Our social problems have arisen because of the weakness of human nature. The supreme test is this: Can human intelligence devise plans for overcoming the defects of our social system, and having found such plans will it be able to make them effective? Looking backward at the progress already made, there is reason for encouragement. Present conditions have been reached through a long process of development. There is every reason to believe that the scientific era of society has only begun. If all of the best elements will join in enforcing the necessary obedience to the fundamental laws of evolution, the golden age of society is yet to be. Such a future can be achieved only through cooperation.