SCIENCE

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BIOLOGY AND WAR[1]

1. BIOLOGY is not the science which can throw any light on the origin of war, since wars are caused by economic, political and social conditions. Although these conditions are in the last analysis based upon human instincts it does not seem profitable for the present to trace the connection.

It is also outside the speaker's problem to discuss the effects of war. Compared with the misery and anguish, the general loss of life and of liberty, and the economic waste caused by war, the possible hereditary effects on the population, if there are any, are too trivial to be mentioned.

As far as your speaker has been able to see, biology can at present offer a contribution to the problem of war in one direction only, namely to test some of the claims of war enthusiasts who insist that from a biological viewpoint wars are justifiable or even desirable.

2. These war enthusiasts maintain that unless a nation engages occasionally in war it will lose all those virile virtues, especially courage, which are necessary for its survival. We do not need to argue whether the acts committed in a state of homicidal emotion are the real or only manifestations of courage; we may also overlook the manifestations of virility left behind by invading or retreating armies. The assumption that virility or courage (whatever may be meant by these terms) will disappear if not practised in the form of war implies an unproven and apparently false biological assumption, namely, that functions not practised or organs not used will disappear

[1] Read at the meeting of Naturalists, December 29, 1916.

in the offspring. Such arguments were very common in biology before the experimental method was recognized as necessary to test the validity of our assumptions. Since experimental tests were made we have learned that eyes do not degenerate when animals are kept in the dark. Thus Payne raised sixty-nine successive generations of *Drosophila* in the dark without noticing any trace of degeneracy in the eye or its function. Uhlenhuth found that eyes when transplanted into the back of salamanders will (after a transitory degeneration) regenerate completely, and remain normal no matter whether the animals are kept in the dark or in the light. Hereditary blindness (*e. g.*, hereditary glaucoma in man) is apparently due to a mutation (probably a chemical change in one chromosome) which originates, as far as our present facts show, independently of use or disuse of the eye. We know through Morgan's observations that insects with mutilated or rudimentary wings may arise suddenly as mutations from parents which used their wings. Lack of the practise of flying does according to our present knowledge no more lead to the hereditary disappearance of wings than darkness leads to hereditary degeneration of the eyes. The statement, that a nation by not going to war will lose any of its inherited "virile virtues" is not supported by our present biological knowledge.

3. The biology of which the war enthusiasts make use is essentially antiquated, and so we need not be surprised to find that they consider war to be based on what they call the "biological law of nature," the "struggle for existence," or the "survival of the fittest." Such ideas are expressed by war enthusiasts in America as well as in Europe and we may be permitted to make the following quotation without giving the name of its author.

> The struggle for existence is in the life of nature the basis of all healthy development. All existing things show themselves to be the result of contesting forces. So in the life of man the struggle is not merely the destructive but the life-giving principle. . . . The law of the stronger holds good everywhere. Those forms survive which are able to procure for themselves the most favorable conditions of life and to assert themselves in the universal economy of nature. The weaker succumb. This struggle is regulated and restrained by the unconscious sway of biological laws and by the interplay of opposite forces. In the plant world and the animal world this process is worked out in unconscious tragedy. In the human race it is consciously carried out, and regulated by social ordinances. The man of strong will and strong intellect tries by every means to assert himself, . . . and in this effort the individual is far from being guided merely by the consciousness of right. . . . The nation is made up of individuals. . . . The motive which influences each member is prominent in the whole body. It is a persistent struggle for possessions . . . and right is respected so far only as it is compatible with advantage.

The "struggle for existence" and the "survival of the fittest" are no "laws of nature" in the sense in which the term law is used in the exact sciences. We speak of a law of nature when we are able to express a phenomenon as a mathematical function of its variables. We thus speak of a law of gravitation, of Ohm's law, or in biology of Mendel's law of segregation. As long as biologists did not realize that their statements needed not only a qualitative experimental test but also a quantitative verification they talked in a loose way, and this did not change until the methods of physics and physical chemistry began to invade biological research. The progress made by Mendel lay in this, that he introduced the quantitative method of the physicist into the investigations of hybridization and he was ignored because the zoologists and botanists of his time did not grasp the fact that the progress of science depends upon the invention or application of such methods.

The terms "survival of the fittest" or "struggle for existence" were never more than poor metaphors to express the fact that the chemical compounds required for the growth of organisms are restricted in quantity and that as a consequence unlimited reproduction of organisms is impossible. Aside from the limitation of food, the physical conditions (*e. g.*, too low or too high a temperature) existing on the different parts of the globe, act as a restricting influence. The methods by which the stronger "conquer" weaker nations have nothing in common with the fact that salt water fish die when put into fresh water or that microorganisms can not multiply unless they have their proper culture medium. The majority of organisms, *e. g.*, plants, bacteria of the soil, and many others, can in no way be called predatory organisms. Of course, there are animals which are as brutal and predatory as the war enthusiasts think human beings should be—but this is a different thing from calling this brutality a universal law of living nature. Fortunately the normal human being does not belong to this brutal type.

There is a wide quantitative difference in the development of instincts and of the power of inhibition in different human individuals, and these differences may be hereditary. Individuals with a strong homicidal mania, who just manage to suppress their paranoic tendencies, will welcome war since it removes for them the burden of constant inhibition, and unfortunately such poorly balanced individuals have rather too frequently been the leaders of governments. No human society can be expected to exist unless the necessity of suppressing or curbing the harmful and pathological instincts of individuals is recognized, and a nation is liable to pay a high price for the privilege of having a semipathological individual at the head of its government.

4. The war enthusiasts also derive from what they are pleased to call the "law of nature" the statement that "superior races" have the right of impressing their civilization upon "inferior races." The information concerning the relative value of races is furnished by a group of writers who call themselves "racial biologists." This "racial biology" is based on quotations from the erudite statements of theologians, philologists, historians, politicians, anthropologists, and also occasionally of biologists, especially of the nonexperimenting type. The method of standardizing the different races is consequently neither quantitative nor experimental, for, as the best known "race biologist," Houston Chamberlain, says, "there is something in the world besides compass and yard measure. Where the learned fails with his artificial construction, one single unbiased glance can illuminate the truth like a sunbeam." A few quotations from Chamberlain will show how this method of "sunbeams" is applied in special cases. Thus Chamberlain tries to prove that the Celtic Bretons in France are really Germanic.

> These Celtic minds of former centuries, teeming with strength, are not merely free and not merely pious any more than the Breton seamen of to-day, but they are both free and pious and it is this very combination that expresses what is specifically Germanic, as we observe it from Charlemagne to Queen Louise.

And as a sop to biology, Chamberlain states:

> Let us therefore not be in too great a hurry to assert that Germanicism does not lie in blood; it does lie in it; not in the sense that this blood guarantees Germanic sentiment and capacity but that it makes these possible. This limitation is therefore a very clear one: as a rule that man is Germanic who is descended from Germanic ancestors.

It will not be necessary at a meeting of biologists to state that Mendelian characters are generally inherited singly and in-

dependently, and that we know nothing about the inheritance of piety and freedom, either separately or in Germanic linkage. The writer wishes also to apologize for being compelled to point out that it is not good biology to maintain that the oblique eyes of the Chinese or Japanese are an indication of an oblique character, or that in a hybrid the "bad" qualities of the parents are dominant over the "good" ones.

5. While the statements of the war enthusiasts will not be taken seriously by those familiar with the methods and results of experimental biology, the sad fact remains that this pseudobiology has had at least a share in the production of the tragedy which is being enacted in Europe. For wars are impossible unless the masses are aroused to a state of emotionalism and fanaticism, and the pseudobiology of literateurs and politicians may serve this purpose in the future as it has in the past. The government has at last begun to realize that it is its duty to protect the masses from the medical quack. Your speaker is of the opinion that the masses need equal protection from the irresponsible literateur or politician who makes it his business to spread the seed of fanaticism and emotionalism by a claim of knowledge of biology which he does not possess. The cure for this form of pernicious mischief is the spread of knowledge of the exact sciences which will put an end to the business of the pseudoscientist.

Since at present the making of war is left in the hands of the statesmen, it may be well to mention at least that the exact sciences have paved the way for the replacement of the present type of statesmanship by a new one; according to which statesmanship consists in the application of the results of the exact sciences to the improvement of the lot of humanity. This includes not only the technical but also the theoretical results of science, since these theoretical results will free the minds from all those forms of ignorance, superstition and fanaticism which are the culture medium of mob emotionalism. If we succeed in substituting for the present a new type of statesmen, who are familiar with and follow the development of the *exact*—*i. e.*, the experimental and quantitative—sciences, and who are willing and capable of applying the results of exact science to the intellectual, moral, physical and economical uplift of the masses, we shall at least diminish the danger of war.

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ASYMMETRIC SYNTHESES AND THEIR BEARING ON THE DOCTRINE OF VITALISM. II

The fact that an asymmetric compound prepared in the laboratory is always obtained in the inactive form is in itself of no great significance. As has been already stated, the result is just what one would expect. It assumes its significance, however, when taken in conjunction with the fact that an asymmetric compound occurring in nature, with very rare exceptions, exists in the active form. In other words, it is the difference between the results of the laboratory synthesis and those of nature that impart to this general subject its remarkable interest.

The view that the production of the active forms of asymmetric compounds is characteristic of living organisms was advanced first by Pasteur. The following quotations are taken from his lecture delivered before the Chemical Society of Paris in 1860.

All artificial bodies and all minerals have superposable images. Opposed to these are many organic substances (I might say nearly all, if I were