

THE STUDY OF ZOOLOGY AS A FACTOR IN SOCIAL AND ECONOMIC PROGRESS

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One of the real functions of the high school should be the training of men and women to live. In the secondary schools a large percentage of our population find their training and mental equipment for life. A realization of this state of affairs is bringing about a complete reorganization of the high school curriculum. Fortunately, most people have ceased to consider the primary function of the high school that of preparation for college. The modern trend of vocational education is a manifestation of the extreme point of view in this reorganization. No longer is any subject or group of subjects retained in the curriculum because of some hypothetical cultural value. Utilitarian values are constantly being more stressed. This, with the addition of new subjects to the curriculum, necessarily leads to a sort of competition between subjects. Values are constantly being weighed one against another with the result that many subjects are on their way toward elimination.

Few administrators stop to ask the question if the basis for rejection of any subject is the intrinsic value of the subject *per se* or rather a valuation which has become attached to the subject because of unfortunate conditions and circumstances entirely foreign to the subject but usually associated with it, I believe in the case of zoology in the high schools it can be shown that the materials selected for study and the methods of presentation are responsible for the decline, where such has existed, rather than any intrinsic weakness in the fundamental subject matter as a factor in directing human activity.

A decade or two ago men like Spencer, Huxley, and Forbes convinced the educational world concerning the values of biology with the result that the study of biology was given a considerable impetus and prestige as a subject of instruction in the schools. At that time the number of subjects offered in the high school was relatively small. Competition between subjects for a place in the curriculum had scarcely begun. Biology

of the possibilities of direct transfer of methods and content to the problems of man himself. The study of the structure, habits, functions, economic relations, reactions to stimuli, carried out in the field and laboratory upon various animals finds direct application of methods in the study of man himself. The origin and meaning of sex, relations of individuals within a community, degeneracy as an adaptation to conditions of life, are all purely zoological problems capable of direct transfer in the study of the identical problems concerning the human animal. Not all these things can find full explanation in a high school course in zoology, but the student may there be started to thinking along the right lines and to that extent his whole attitude toward life may be modified.

Let us look for a while at some of the problems of every day life, an approach to which can be best made through a properly organized course in zoology for high school pupils. As indicated in an earlier part of this paper practically no one questions the intellectual, the moral, and the aesthetic values of zoology as a subject of instruction. On the other hand these values may well be assumed to be associated in varying degrees with all subjects of instruction. As far as these alone are concerned, one subject probably serves as well as another for training students of high school age. There are, however, phases of zoological knowledge which hold peculiar values for the individual and for society. Were these to cease being matters of common knowledge among so-called educated peoples much of social and economic progress would be retarded. Conversely any agency tending toward the wider dissemination of such knowledge is distinctly opening the way to the solution of many of our economic and social problems.

No one questions the value to mankind of the knowledge of animals in their relations to disease, and the numerous problems associated with this phase of zoology. These have been cited so often that it seems hardly worth while to more than mention a few specific examples. A few generations ago a scourge like typhoid fever was looked upon as a problem which was to be solved by the members of the medical profession. Today it has in addition assumed a distinctly social significance. Little can be done in any community toward the

prevention of a disease like typhoid without the education of all persons in that community in the reasons for exterminating the fly, based upon a study of the structure and habits of that animal. This in turn demands some knowledge of the life history of the fly, for effective measures toward extermination all presuppose such knowledge. Studies of this sort give to the individual more than the training in powers of observation and reasoning which frequently are considered the goal of zoological training. The pupil is not only given possession of facts which, put into practice, make him a better citizen, but at the same time he is given a distinct advantage over those who are not possessed of this kind of zoological knowledge.

Few persons lead an existence which does not at some time or other bring them into contact with insect pests of household, crops, domestic animals, or of man himself. All effective means of combating and controlling such pests find their solution in the feeding habits and life history of the insects. Simple problems in development and in the structure of the mouth parts of the insects, which are correlated directly with the feeding habits, are studies which may be taken up to good advantage by the average student of high school age.

The enactment of fish and game laws, and laws for the protection of song birds all have as their aim, directly or indirectly, the conservation of the resources of our country. Persistent violators of these laws are, on the whole, the ignorant classes of society for whom the claims of personal liberty are stronger than the demands of social obligation. Bird protection laws would have much greater effect if more people had definite knowledge of the economic importance of our birds in holding insect pests of fruit, grains, and other crops in check. Game laws would cease to be looked upon as infringements upon personal rights if greater numbers of our citizens were informed upon the breeding habits of our game animals and understood the severity of the struggle for existence among such animals as population becomes denser over the entire continent. State and federal officials would find not only support in enforcing existing laws but demands for more effective legislation if the reasons underlying such laws were more fully understood. This would unquestionably be the case if more

general knowledge of such matters were given in our public schools. The final success of the United States in constructing the Panama Canal has often been heralded as more of a biological than of an engineering accomplishment. Other nations starting the task failed, not because of insufficient knowledge of the engineering problems involved but because of the lack of appreciation of the biological phases of the problems of sanitation and transmission of disease. Huge accomplishments of this kind, if they were numerous enough, would convince the most skeptical persons of the values in applied zoology, for the most of us are influenced by the spectacular. However, it may be asserted without fear of contradiction that extension to all persons of fundamental knowledge concerning animals as agencies in disease with means of controlling such relations would stand for more, economically, to the nation than any number of spectacular achievements such as the one just mentioned.

It is difficult, if not impossible, to place a correct monetary estimate upon human life yet the most conservative of figures show that the economic loss to the people of the United States through what are termed preventable diseases is appalling. Many of these diseases do not involve animals other than man directly, so it may be claimed that a knowledge of zoology has no bearing in coping with them. But on the other hand the study of zoology in its relations to problems of sanitation and medicine furnishes a point of departure from which these topics may be reached in dealing with high school classes. The instance of hookworm in its bearing upon the economic problems of the South finds direct application at this point. A few years ago no one would have guessed that a small intestinal parasite could have produced such pronounced direct effect upon the economic status of a community as have been demonstrated in the case of the hookworm. Thousands of non-producing individuals throughout the South constitute an incipient reserve to our economic situation awaiting the application of zoological knowledge and establishment of sanitary conditions to transform them from physical and mental abnormalities into productive citizens. Outside agencies, such as the establishing of commissions for the extermination of such a

pest, are effective but their influence cannot be equal to that of a general dissemination of knowledge concerning such animals through a well organized course in zoology.

The savage goes to the medicine man for a charm and an incantation to keep off disease. To by far too large a percentage of the civilized world vaccination, administration of antitoxins, and similar preventive measures of the modern physician are regarded with a superstition differing from that of the savage only in degree. Our whole system of modern medicine is destined to be built more and more upon the foundation of the development of immunity and preventive medicine. It is not sufficient for the welfare of society that men and women in our colleges be trained in the general methods of the preparation of sera, antitoxins, vaccines and the like, for they constitute by far too small a percentage of our total population. The pity is that some knowledge of these intensely interesting and vital relations of man to other animals in the prevention and control of disease cannot be given to all classes of society. If future generations are to be prepared for the reception of the advances which are bound to come in the practice of preventive medicine, it is essential that the general public be educated along these lines. Otherwise advance in this line would suffer the same fate as that accorded the practice of vaccination when it was first introduced into this country. History is replete with the records of social and economic revolutions which, once started, have failed because of the fact that the people had not been prepared to accept them. The logical place for the preparation of the general public for the advances in medicine which have been outlined above rests with our high schools and more specifically in connection with the courses in zoology.

Our public press in the past few years has conducted several campaigns against the quacks operating under the disguise of the medical profession. Occasionally we read sensational articles upon the apprehension of a few miscreants and the exposure of their methods of operation. The vast majority of the tribe remains unmolested and stands as a stigma in most communities. Most thinking people if asked for an explanation of why these conditions exist are free to confess that ignorance rests at the bottom of the whole system. It is not, however, the

ignorance of illiteracy for many of the victims are of what we might call the educated class. The ignorance that plays into the hands of such imposters is the ignorance of the human body which prudish persons frequently mistake for a type of chastity. Any person ignorant of the structure of the human body and its normal functions is just as much an obstacle in the path of social and economic advances of a community or nation as is the quack who preys upon such ignorance.

Turning now to some of the other phases of zoology which might be emphasized as of direct human value, the much discussed problems of heredity and those of sociology growing out of the operations of heredity can have little significance to the individual who is not acquainted with the fundamental concepts of the animal cell and its structure. Not that I claim an extensive study of the cell by students of this age is desirable or even possible, but the concept of the cell as the unit of bodily structure with at least a brief knowledge of the reproduction of the cell and the functions of the chromosomes as bearers of the determiners of hereditary qualities constitute a type of knowledge possession of which is essential to right thinking and to the abandoning of superstition regarding the genesis of life and the hereditary relation of parent and offspring.

A full realization of man's place in the universe can come only after a careful study of man's relations to other animals. In its entirety, this is a problem too deep for the adolescent mind to grasp. However, it has been well said that primitive man *felt* rather than knew his relationship with other animals. In much the same way the child with his inherent interest in animals offers a foundation already prepared upon which to build a knowledge of those animals and a beginning of an understanding of his relations to other organic beings. Here is a field where the study of zoology alone can direct the primitive instincts of kinship between man and other forms of life toward the formulation of a rational concept of man's place in the universe.

Some practical knowledge of organic evolution must be behind every move in the progress of man. The facts of evolu-

tion may be recorded on the printed page but some facts standing alone have little true significance to the individual who has not had some first hand knowledge of the structure of a graded series of animal forms. Further, in the study of the varieties of domesticated animals we find material which is able to impress the high school student with the idea of plasticity of animal form and the responses of the organism to the factors of evolution even though they are here manipulated to great extent by man. It is but a step from this conclusion to a realization that these same laws of evolution are operative upon the human being. True, not all high school students would grasp the significance of such a conclusion; not all would be able to take this final step; but the chances are that many would sooner or later be able to think the problem through for themselves and arrive at the conclusion that since man is subject to these same laws of change, man and his creations must participate in the endless march of time. If his progress is not upward it must be in the opposite direction for the progressive change of evolution works equally in either direction. Such a conception is an absolute essential for a social or economic leader of men. For that reason it seems imperative that the background against which such concepts may be formed should be presented to as many of the future leaders as possible. The high school is none too early to begin training along such lines.