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APPLICATION OF ZOOLOGY TO THE LIFE OF THE PUPIL AND OF THE COMMUNITY.

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The first attempts to teach zoölogy in the high school through the laboratory as a foundation were made but comparatively few years ago, well within the memory and experience of the older teachers now present. There were no suitable text-books, and the laboratory course was modeled upon the well-known Huxley and Martin course; the exhaustive study of types. This course had its value as a disciplinary course, but it did not appeal to the experience of the pupil and certainly did not appeal to the enthusiasm of the pupil. The course was simply a modified college course, and even the laboratory tables and other equipment of the laboratory were copied direct from the college laboratory.

Almost from the first many of the teachers of zoölogy saw that such a course was not suited to the needs of the high school pupil and began slowly to lop off from the type studies and add more variety to the course, but the change has worked out very slowly and probably a large majority of teachers of zoölogy at the present time use a modified type course arranged in evolutionary order, or with insects used as an introduction.

Of late some teachers and some authors of text-books are cutting away from the type plan and evolutionary order and are arranging the work by topics or problems. But probably the most potent force at work now to alter the point of view of teachers of zoölogy is the rapid introduction of courses in agriculture into the curricula of high schools. The question before us to-day is really as to whether agriculture may not altogether supplant zoölogy and botany—especially in the smaller cities and towns. There is insistent demand, and I believe it is right, that our courses be made more practical and more within the experiences, present and future, of our pupils. Many schools are solving this by putting in agriculture in place of biology.

¹Read before the biology section of the Central Association of Science and Mathematics Teachers, in Chicago, Dec. 1, 1911.

Can the course in zoölogy be made more practical and be made to appeal to both pupil and community as something worth while and at the same time retain its value as a training in scientific habit? I believe the subject of zoölogy is well qualified to fill such a role.

We shall inquire first as to the points of contact between man and the animals, more especially as to those which may come within the experience of a school community and of the pupils, or may have influence upon them. These points of contact and influence are more extensive and influential than one would, at first thought, suppose. Beginning with the higher animals, there are first of all the domesticated animals, including the pets of the family—the horse, cow, cat, dog, poultry, etc. The wild animals that furnish fur should be mentioned. Then there is a large group of both wild and domesticated animals that furnish food in one way or another for the table. The birds form a very important group with which all come in contact—even if they do not realize their usefulness. Reptiles and amphibians have interest because of their usefulness in keeping down insect pests. The fishes are always interesting to all.

But the insects, as destroyers of vegetation—field crops, trees, gardens, and house plants—carriers of disease, pests in the household, as well as by their usefulness in certain ways, furnish the surest means of connecting zoölogy with the interest of both community and pupils. Even the lowly earthworm can be made to contribute a share of interest.

It is not necessary, however, for me to enumerate all the points of contact, for they are well known to all teachers of zoölogy. The real question is as to how to present or teach the subject in such a way that the pupils and the community shall really be reached and their interest aroused to a point where it shall be a permanent possession. My first suggestion is that the study of animals as types be abandoned. Instead, study the animals that will teach something and always let the pupils discover why that particular animal is important, what facts it illustrates. By far the best animals to begin with are the insects, for they are within the experience of everyone. Don't take insects unknown to the pupils, at least at the first, when there are the flies, mosquitoes, bees, butterflies, and many others known to all. If the teacher is alive to his opportunity the pupils will carry home to their parents and friends many tales of the insects, which are bound to stir up interest because of the contact of the insects in one way or another with the lives of these people.

There are certain animals which are comparatively unimportant when studied incidentally, merely because they belong to some group under consideration. But bring these animals together to illustrate some topic and their value and interest are increased many fold. Parasitism is a topic of this sort. Instead of referring to it incidentally in passing several groups why not defer the study of these animals until the right stage is reached, then bring together into one study as many examples of parasitism and degeneration as practicable? The lesson is bound to be much more impressive when reënforced by a number of examples.

Other topics that may profitably be taught in this way are degeneration, influence of habitat, development, adaptation, and many others. In fact, it would be comparatively easy to reduce the entire study of zoölogy to a series of carefully-graded topics using studies of animals as illustration, but I am not prepared to say at the present time that it is best to carry the topic method to this conclusion.

Another method for increasing interest and the practical aspect of zoölogy is the proper use of an outdoor laboratory. This is a comparatively new idea but one that is bound to come into use. By an outdoor I mean a plot of land near the school building, not necessarily very large, given over to the departments of zoölogy and botany. There should be an allowance made by the school board to pay for the heavy manual labor and for tools and fertilizers as needed. The plot should be fenced and there should be in it a small pond or pool. In this plot there should be planted trees, shrubs, and perennials native to the neighborhood. There would be beds for experimental work by classes in botany. Incidentally, there would be many animals attacking the plants which it would be the business of the zoölogy classes to study and exterminate. The plot should be near enough to the school so that classes could take their regular period of work in this outdoor laboratory whenever desired. Very practical work on animals could be done here that could not be done with artificial conditions in the indoor laboratory. After this plot was once started its cost for upkeep would not be great, and the money will be cheerfully voted when once its great use and purpose is understood by school boards.

Another thing indispensable for an up-to-date laboratory is the library. I refer to a reference library for the pupils, not for the teacher. In this library there should be collected books on natural history and some on travels, also elementary text-books co-

ordinate with the one used as the adopted text-book. There should be nontechnical books for identifying animals such as the pupils may bring in from the field or home. Such a library need not cost over \$200 at the start and should be added to from time. The teacher should contrive natural uses for the library, one of the best being to assign interesting topics for short papers in concluding a topic under study in the laboratory.

One of the very best studies for gaining the real interest of pupils, an interest that will be communicated to the parents as well, is the field study of birds. When once the interest in birds is awakened it becomes a permanent possession that is seldom wholly lost in later years. The good done by such a study is beyond calculation. Every school should organize a junior Audubon Association and spread the knowledge of the work of this society.

Aside from the enthusiasm of the teacher himself probably the most efficient aid in stimulating enthusiasm in the class is to have a great abundance of living animals in the laboratory. It does not pay to be stingy or lazy in providing such material. Pupils like to see them and watch their movements, and they like lots of specimens when studying an animal. Instead of making one weary set of crayfishes, for example, do service for several successive classes, why not have a fresh lot for each class? They do not cost much, and it will make the study very much more attractive and give better results. The same thing applies to all studies of animals in the laboratory. It is surely wicked to have the same poor earth worm or frog or any other animal handled again and again by successive classes until it ceases to react and perhaps gives up even its life. An abundance of material would avoid this and have a much better effect upon the class to say nothing of the quality of the results obtained.

There should also be many animals kept in the laboratory simply because they are attractive and the pupils like them. Such are fish, mice, canaries or chickens, snails, honey bees, ants, and in season many others.

The study of the higher vertebrates has always proved more interesting to my pupils than those of lower types of life, and I believe this is generally true in other schools, but we go on year after year consuming the greater portion of the year with studies of invertebrates and find so little time at our disposal when the vertebrates are reached that the mammals are scarcely touched. It is true that these studies cannot be so easily managed by our

present laboratory methods. We cannot go out and gather up squirrels and rabbits as we can grasshoppers. There is no doubt, though, that studies of mammals could be accomplished in a satisfactory manner and that they would yield better results with our pupils than many of the invertebrate studies.

In all studies from the beginning to the end of the course the relation of animals and man should be brought out in various ways. Sometimes this is a direct relationship, sometimes only indirect but it will always add interest to the studies.

I have left to the last the discussion of the influence of a series of such studies as I have outlined upon the moral character of the pupils and through them upon the community. There is no other subject in the curriculum that can have so great an influence, not even botany, which, however, may exert greater influence in certain other directions which are important to the community. There are several ways in which this influence is exerted. The most important of these is the fact that pupils in zoölogy cannot be blind to the truth that the laws and reactions upon the lives of animals they are studying must also apply to their own lives. Consider such studies as these—community life of various animals and the effect of this mode of life upon the individual; the effect of mode of life upon structure; the influence of habitat; the degeneration due to sedentary life and the nonuse of organs or parts of the body; the effects of parasitism. It would be a dull pupil indeed who could not see the bearing of these laws upon his own life and the lives of others. These animals he is studying are living things the same as he, and the effect follows cause with unfailing regularity, too unfailing to be misunderstood. If studies are carried to mammals the pupil comes closer to himself and discovers again the same laws governing.

In zoölogy the subjects of reproduction, the sexes, and development are studied as a matter of course, fully and frankly without danger of embarrassment and the scientific meaning of these subjects is learned in a way that will best influence the pupil. The law of inheritance and the doctrine of evolution become clear, at least, as to their general bearing. If the pupil gained nothing else in the entire year's work than an understanding of these subjects it would be time well spent.

If zoölogy is taught in the right manner the pupil learns the value of accuracy, truthfulness. That scientific conclusions are not based upon guesses or imperfect observations. He should

gain some idea, at least, of what science and the scientific method mean, and that in this method there can be no shams or falsehood.

In conclusion I wish to sum up the points I have endeavored to make clear. The pupil learns much about the lives of animals in his surroundings. He learns the good that some do, and learns to treat these with respect because of this. He learns to love certain animals, to watch their comings and goings and their intimate life. He learns of dangers from other animals and how he may protect himself and his friends from these dangers. He learns of the harm that still others do and how they may be successfully combated. He learns to know himself and certain vital laws that govern him. He learns to respect the truth and to consider it as fundamental to right thinking. He learns that effect follows cause with unfailing certainty. He may even learn very much that he is not aware of at the time, but when the right time comes it comes back to him to guide him to the right decision.

But among all the good things zoölogy has done for my pupils, there is one thing I have not mentioned that has pleased me most of all. The enthusiasm and liking for the study have been the means of putting new ambition and determination into a good many boys to stick to their school work and redeem wasted opportunities. A fine enthusiasm will do wonders for a boy, even though every other influence is against him, and it is cases of this sort that I have watched that have given me much courage and a whole-souled belief in my subject.

JUDICIAL WISDOM.

Indiana has a good pure food law and, more important still, it has efficient and active officers to enforce it. One of the valuable provisions of the Indiana act was designed to protect the public from the sale of impure milk. The newspapers have recently chronicled the fact that an Indiana dairyman was found by the state inspectors to be selling dirty milk. The officers purchased some of this milk for the purpose of securing evidence against the dairyman. They found the dirt and the dairyman was prosecuted for selling a filthy product. When the case came into court, the attorneys for the milk dealer maintained that their client was not guilty of violating the law because it must be shown that the milk was purchased for human food, when, as a matter of fact, it was purchased in this instance for purposes of analysis. The judge before whom the case came sustained the motion of the defendant's attorneys and held that the dairyman was not guilty of an offense under the Indiana Food and Drugs Act! The *Journal of the American Medical Association* reports this decision in a recent issue and says that it refrains from commenting on this example of judicial wisdom for fear of violating the postal laws.