

## A FIRST COURSE IN ZOOLOGY IN THE HIGH SCHOOL— CONTENT AND ORGANIZATION<sup>1</sup>.

BY JEROME ISENBARGER,

*Nicholas Senn High School, Chicago, Ill.*

There are three important factors which must be considered in the development of any well-regulated course in high school zoology. These are (1) the teacher, (2) the laboratory, and (3) field work. There is a fourth which looms far above any of these and which should control and determine all other factors, namely, the pupil. I hold that first, foremost, and all of the time the needs, likes, and dislikes of the pupil must be kept in mind while considering any problem which enters into the shaping of a suitable course in zoology for high school pupils.

The teacher of zoology should be an enthusiastic believer in his subject. He should be guided in his selection of material for a successful course by a purpose similar to that expressed by Dr. Hodge in a formula as: "Learning those things that are best worth knowing, to the end of doing those things that make life most worth living." He should be thoroughly cognizant of the fact that zoology should meet a need in the high school curriculum which can be met by no other subject. In other words, it should have aims and purposes distinctly its own.

To my mind, the teacher should conduct rather than "hear" the pupils in their recitations, and he should be a participator with them in their laboratory work. He should bridge over the gaps by amplifying and suggesting at every turn.

The study of animal forms must appeal to the pupil as real. The pupil must be impressed with the fact that the nature which he is studying is near at hand and not something which is foreign to his everyday life. The natural love for things living must be fostered. Since the youth at high school age is a utilitarian, he should be led to see the interrelations of plant and animal life and the relation of animals to human welfare.

I am of the opinion that if our aims for the study of animals are to be realized, the principles which I have briefly outlined must determine the subject matter of the high school course. It will naturally vary according to the individual preparation of the teacher and to peculiar local conditions, but in any event the course must rest upon some substantial foundation and it must lead somewhere.

<sup>1</sup>Read before the Biology Section of the Central Association of Science and Mathematics Teachers, at University of Chicago, December 2, 1916.

It is not my purpose to attempt to outline a course of study. It will be within the scope of this paper to give some of the main features of the work which we have found suited to the needs of the boys and girls in the Nicholas Senn High School, together with some additional comments.

The course during the fall semester begins with the study of insects. In selecting forms for study no attention is paid to taxonomic order. Such forms are selected as can be studied in succession alive in the laboratory and in the field. As a rule we find it best to begin with the Lepidoptera. Caterpillars of the *Polyphemus* and *Cecropia* moths are still easily obtained during the first and second weeks of September, and pupae can also be found. The larvae are fed upon willow leaves during the study and until they pupate. The process of cocoon spinning is watched with great interest. As it is impossible to study the adult forms of these insects alive at this time, the pupils are given prepared specimens in Riker mounts for this study. Other Lepidopterous insects whose life history the pupils are permitted to observe in the laboratory are black swallowtail, monarch, and mourning cloak butterflies. The moth cocoons which were spun in the laboratory are kept in the laboratory until March or April when the pupils can see the moths emerge.

The locust beetle has been found a convenient form of beetle to study alive. Placed in a cotton-stoppered tube with a sprig of goldenrod it forms an excellent study in protective coloration. I have not been able to secure living grubs for this study, so use preserved grubs of the June beetle. Beef and fish scraps exposed in an open quart jar among the weeds in a vacant lot will attract scavenger beetles and will afford an opportunity of studying a most interesting life history.

When the study of the housefly is begun, material which has previously been prepared will show larvae, pupae, and adult flies. Each pupil is furnished a cotton-stoppered tube containing fully developed maggots. By the next day these will have formed pupae, and left in the same tube will develop into the adult form. It is an impressive experiment to secure larvae from a garbage can which has been only partially covered and left for four or five days.

After a study of Diptera, each pupil makes a sanitary survey of his neighborhood, locating on a map places where conditions are such that flies or mosquitoes may breed, also shops where food is sold with their grade in per cent as to cleanliness, also

houses where there have been cases of transmissible disease for which flies or mosquitoes might have been responsible. The pupil embodies the results of his investigation in a report in which he includes his conclusion with regard to the relation between the sanitary condition and the health of the community. While the maps and reports have not been uniformly good, yet I have been very much pleased with the manner in which this problem has been attacked. It furnishes an excellent lesson in civic responsibility, and tends to develop a civic pride which is highly desirable.

The list of insect studies is not complete, but those given serve to illustrate in general the manner in which representatives of eight or nine orders are taken up. In every case representatives of the order are studied alive in the field or in the laboratory, or in both field and laboratory.

As final work in the study of insects, tables are made showing lists of beneficial insects, insects which transmit disease, and insects injurious to farm, orchard, and garden crops. Various methods of controlling the different types of insect pests are studied, and the pupils are taught how to make use of the services furnished by national and state departments of entomology. A much-needed addition to our equipment is a barrel spray pump which might be loaned to pupils to aid in the fight against scale insects.

The length of time given to the study of insects is ten weeks. Thus they are made the main feature of the work of the fall semester. The work on spiders is introduced by placing female garden spiders in the cage with the flies while the latter are still plentiful. Habits of web and cocoon spinning are readily observed as well as those of feeding. Crayfish are easily kept alive in shallow water in the laboratory for study following that of insects and spiders. The points emphasized with the crustacea are relations to environment, parasitism, evolution, and geological history.

The studies of Protozoa, sponges, coelenterates, worms, and mollusks serve to develop in a logical manner the subjects of the different metabolic processes and reproduction and development.

The vertebrates are left for the work of the second semester. The two groups which should receive the emphasis in the spring term are the birds and the mammals. The lower forms should be taken up as subordinate. Very little if any dissection should

be attempted, and classification should deal largely with the larger groups.

As the fall season is particularly suited for the study of insects, so the spring is particularly suited for the study of the birds. The summer and fall migrations are extended over so long a period that they are seldom noticed except by the experienced bird student. Bird habits, bird homes, and bird protection are best studied when the birds are with us in greatest numbers during the spring migrations.

The bird work begins on March 1 when the classes begin to make the annual bird calendar. A few lessons are given previous to this date to introduce the work and to pave the way for an interest which will develop lively competition.

Each pupil is given a number of blank forms showing a picture of a bird with blank spaces for a list of characters, locality, number of birds seen, date, and name of the observer. When a pupil sees a bird for the first time during the season, he fills into the picture the characteristic markings and into the blank spaces the description which would serve to identify the bird.

The pupil either identifies his bird on the spot with the aid of a color key, or he may take the slips which he has filled out into the laboratory and make use of the books of the library in making his identifications. In either case the identification is checked up by the instructor before it is counted to the pupil's credit.

As the birds are reported for the first time, the bird calendar is made up. Opposite the name of the bird is the locality, date, and the name of the pupil who first reported it. Many of the pupils work independently, doing their field work alone or in groups, but field trips by classes are necessary in order that those who are more dependent may receive some help and to guard against the temptation to use dishonest methods. These class trips are taken during laboratory periods, in the morning before school, in the evening after school, or on Saturday morning. During the last spring term, one of our teachers and a considerable number of her pupils were sufficiently enthusiastic to begin the morning trips at 4 o'clock in order to study the birds at the time of their greatest activity.

A certain number of identifications are required of each pupil, but most of the pupils do not stop with the required number but enter into a lively contest for the greatest number of birds correctly reported. The average highest number identified by

any one pupil during the past three years was 148, and the average of the highest number reported by all members of the classes was 174.

During the period of bird study, the birds are considered from every angle in their relation to man's well-being. The value of the birds as destroyers of injurious forms of animal and plant life, and the importance of protective measures, are studied by means of class discussions, library work, pictures, and stereopticon slides. The bird is considered as a neighbor and a friend whose importance is sufficient to demand respect.

Mammal study is a phase of the zoology work which merits more prominence in the course than is usually accorded it. The work may center in domestic animals and pets, but in cities with living wild animals in captivity and with many books on mammals available the work should be quite extensive.

Living mammals such as guinea pigs and rabbits should be kept in the laboratory and such other living animals as may be available should be used, but here much use should be made also of books.

The course in zoology which I have had in mind while preparing this paper covers the work of a full year. It could hardly be modified to form a successful half-year's course. Experience in schools of various grades in different sections of the country in half-year courses of zoology and botany has convinced me that a half-year course in either subject cannot be satisfactory. Insect study, to be effective, must come in the fall, while the bird and mammal work must come in the spring—and there is material a-plenty for the time intervening.

I have not differentiated between the course suitable for the pupil who is to enter college and that suitable for the pupil whose school training is to end with that of the high school. A college instructor told me that he preferred pupils for his classes who have not had high school zoology. Students who have had a rehashed college course in the high school are inclined to overestimate their real ability, and as a result look upon the freshman college work as a review. After all, the test of the value of a course is not information stored up, but power developed. I am inclined to think that the zoological training that will best fit for life will also best fit for college. If the high school work is suited to the needs of high school pupils, we need have no worry over the question of duplication in the first year of college.

The real measure of a high school course in zoology is the amount of life, figurative and literal, that is put into it. Pupils must see and handle the living animals in the laboratory, and observe and study them in the field. We should permit minute dissections and involved taxonomic studies to go back to the college whence they came. Let us give our pupil the knowledge and training which he craves and needs, that which will add in the greatest degree to his fullness of life as an individual and to his worth as a citizen in the community.

---

### THE AMARYLLIS.

BY GENEVIEVE MONSCH,  
*Froebel School, Gary, Ind.*

In the numerous lists of plants for indoor decoration or for schoolroom use, there is one which is seldom included and which I think should never be omitted, no matter how small the list. This is the amaryllis.

About two years ago, I was given an amaryllis in the zenith of its glory by the man who has charge of our school grounds. Since that time it has never failed to send up at least one tall handsome stalk of most beautiful deep pink blossoms in the middle of the winter, and again about midsummer. An accident to the heating plant soon after Christmas (January 19, 1916) killed off practically all of our most valuable conservatory plants, and our amaryllis was reduced to a mere mass of limp, lifeless leaves. After some deliberation, we decided to save out of our frozen stock most of those plants that had such underground parts as bulbs (like the hyacinth, tulips, and amaryllis), or rootstocks (as ferns), or corms (as cyclamen, etc.), in spite of the fact that we knew that it would take so much time and energy to get them back to normal that they were really scarcely deserving of so much space in our small and always crowded conservatory.

However, the amaryllis more than repaid us for our pains. In not less than two days, one of the children espied a new "leaf" already an inch above the ground. This new "leaf" turned out to be a big flower bud which shot upward with such surprising rapidity that even the most unobserving children could "see it" grow from day to day. Many of the pupils became interested in measuring it each morning before school. This is what they found: