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COMPARATIVE ANATOMY IN THE SMALL SCHOOL

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We have been using for about eight years at Drake University, a plan in presenting our course in comparative anatomy which we think has been very successful. It is a plan which will work most efficiently in smaller schools, schools where the number in comparative anatomy laboratories does not exceed fifteen people, but some phases of it can be applied to the larger class.

At Drake the comparative anatomy course is a six hour course given throughout the year, three semester hours credit each semester. The number enrolled ranges from ten to fifteen; twelve is about the average number. The first semester in laboratory we start with the Amphioxus and go through the bird. The second semester is devoted entirely to the mammal. The course is organized to include at least one, often two, lectures a week, and a minimum of five hours of laboratory. A definite period of one hour, three times a week is set when all members of the class are expected to be present. During this period the lectures are given, laboratory work outlined, general discussions are held, and dissections are compared and discussed. The rest of the laboratory work is done at the convenience of the student, and no roll is taken. In making up this additional time there is a strong tendency on the part of students to work all afternoon, or for several consecutive hours. The advantage of working continuous hours is obvious in laboratory work. Students are asked to complete certain projects in a given time. Frequent unannounced written and oral tests are given. There can be no doubt but that this method encourages self reliance and interest in individual achievement.

Now as to the nature of the work covered, which is the object of this paper. Some time ago it became obvious to us that comparative anatomy could so readily mean more than merely comparison of important features of classes of vertebrates — fish with amphibian, amphibian with reptile, reptile with bird, etc. Unless I am misinformed, most first semester comparative anatomy courses include a detailed study of the following forms: amphioxus, dogfish, perch, necturus, turtle, and pigeon; reserving the mammal for the second semester. The plan we've been using is to compare

not only one class with another class, but different orders within classes.

There are some of the classes of vertebrates which lend themselves particularly well to comparative study. Let us use, for example, the fishes and reptiles. Instead of all of the members of our class dissecting the perch, we use as many different kinds of fish as there are number of people in the class.

In selecting the fish to be used, we try to present as many different features as possible. For example, deep sea fish and fresh water; fish representing the four different kinds of scales; with and without air bladders; with and without pneumatic duct attachments; with and without an operculum; long narrow fish, and short broad ones, with elongated body cavities, and those with short, broad cavities with a resultant elongated or crowded condition of internal organs. Those with a definite variation in number and placement of digestive caecae, so interesting in the fish as a class. And, finally, those covering a wide range of breeding habits, and variations in the reproductive system of the oviparous and viviparous forms. We used the following kinds last year: The Sturgeon (Acipenser) to represent the typical ganoid, and the Garpike (Lepidosteus osseus) from the bony ganoids. From the Teleosti we selected the Catfish (Amiurus melas), Carp (Cyprinus carpio), Shark-sucker (Echeneis naucartes), Eel (Anguilla chryspa), a Flounder (Pseudopleuro-nectes americanus), Perch, Sea Robin (Prionotus carolinus), Butterfish (Rhombus tricanthus), and Trout (Salmo).

Likewise in studying the reptile, instead of everyone dissecting a turtle, we use various kinds of reptiles. One student has a Terrapin turtle, another a soft-shelled, and another a box; others a black snake, Natrix, a rattler, a garter snake, or Puffing adder. Still others a collared lizard, horned toad etc. Again there is an attempt to select reptiles as different from one another as possible.

These two groups, fishes and reptiles, perhaps lend themselves best for comparative study, but this idea can be carried out in other classes too. For example, instead of using one particular border line chordate as a representative type, use several different kinds. One might use Balano-glossus, or some other worm-like marine Chordate, and different representatives of the tunicates, lampreys and hagfishes. Instead of everyone dissecting the Dogfish, some are given Rays, and Skates of various kinds, thus helping to connect a little better the lower Chordates with the intermediate types. Instead of everyone studying the Necturus, use

different kinds of Amphibia, the Bullfrog and various kinds of Salamanders and Necturi, showing different kinds of external gills and corresponding changes in circulation etc.

We have not, as yet, carried this idea into the second semester, which is devoted entirely to the mammal. It seems to us that the cat is a fairly good representative of this class. If thought advisable, the rabbit, a gopher, squirrel, bat, rat and some other forms may be used. Such representatives would show some structural modifications for adaption to life underground, in trees, air etc. Also some internal adaptations such as digestive caecae in the rabbit, length of the intestine in herbiverous and carniverous forms, reproductive variations, and variations in the buccal cavities of many of these forms.

There are, we think, some very definite advantages in this plan. It encourages individual observation. Any good standard laboratory manual may be used with directions for dissection of some representative from each class of animals. Students use this as a guide and work out, by their own observation and initiative, the ways in which their speciman is different from this type form. There is always a tendency to see what your manual tells you to see. Any method which encourages a student to see things for himself and interpret what he sees, is important.

It is much easier to see why snakes, turtles, and lizards are in the same class of vertebrates after they have been actually compared in the laboratory, than when compared from a textbook or by the teacher in a lecture. They can see, for themselves, not only that the fundamental organization of a typical reptile has certain definite outstanding characteristics, but can compare one reptile with another, one fish with another etc.

Each student makes an individual report and points out to the class any unusual features in his specimen during an hour provided for that purpose. For example, if his reptile is a rattler, he shows his dissection of the fangs and poison sac, and any other interesting features, including in his report, any interesting habits of the rattler group. If his fish is a Butterfish, or one possessing a very large number of digestive caecae, he points out to the class those interesting facts discovered in his dissection when he makes his report. If the gall bladder in his snake is located an inch or two posterior to the liver, he draws attention to that fact. The time limit for these reports is usually eight or ten minutes. This eliminates lengthy, rambly, unorganized and uninteresting material. He must have done his own work, because no one else has an

animal like his, thus making it difficult to get help from any other member of the class. The tendency then is to make this problem of his a personal problem, to take some pride in the type of report he makes, and to have dissected carefully enough to have something to report.

A library covering the work is kept available at all times, in the comparative anatomy room. Students sign their own cards for books and stick to the rules. In three or four years we have only lost one book from the room.

After all the reports are given, it is essential, of course, to be sure that typical characteristics of each class of vertebrates are clearly pointed out by the teacher, and a general summary given. Class characteristics are much more convincing after they have been observed in several animals, than when observed in only one type form.

The cost item as we see it, is the only important drawback. To get a dozen Terrapin turtles is much less expensive than to get one each of twelve different kinds of reptiles. Also it is difficult to obtain many forms in single numbers with the circulatory system injected. It does cost more to give the course this way, but it is our contention that the value received is correspondingly high.

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