# Animal Diversity

## Synopsis

Each student researches a particular group of organisms, creates a three-dimensional model that stresses some interesting aspect of that group, and then makes an oral presentation to the rest of the class.

## Objectives

In this exercise, students use model-building to help them understand a complex biological structure or set of structures. This process skill is a component of the Science as Inquiry strand of the *NC Standard Course of Study for Middle School Science*: "Mastery of integrated process skills: formulating models." Likewise, this exercise meets the *NSES Content Standard A (Science as Inquiry)* for levels 5-8, "Abilities Necessary to do Scientific Inquiry: develop descriptions, explanations, predictions, and models using evidence."

## Introduction

This exercise is designed to get students to research a particular group of organisms, create a three-dimensional model that stresses some interesting aspect of that group, and then make an oral presentation to the rest of the class. The presentation is an essential aspect of this exercise in that the students must present and explain their models to their peers, not just to the teacher. (In fact, the teacher is a peer.) This creates an ownership of the material that persists in the students' minds much longer than an assignment created just for the teacher. It also gets students interested in and appreciative of each other's ideas. Since the models are rarely professionally finished, it shows each student that his or her skills are adequate for the exercise, thus raising self-confidence. It also shows the student that to complete any assignment is an undertaking requiring multiple skills and that one's skills are not uniformly good or bad; everyone is a generous mix of skill levels. Someone has good ideas; someone knows the history best; someone has more originality in materials, another in design, and someone else in building skills; and others excel in saying things well or humorously. Therefore, everyone is good at something. Therein lies the basis of building self-confidence. Collegiality comes from the admiration of the skills in other people and the rapport created from talking to them about what they did and what they learned and what they like.

## Background Material

In the animal diversity section of my Advanced Biology class, I expose my students to the vast array of different kinds of animals. I do this by taking a genial walk through the animal phyla, starting with sponges and working my way through Cnidarians, flatworms and roundworms. (At the high school level I typically do not say much about the more obscure phyla.) I usually spend one or two class periods per phylum in the beginning, since I am introducing terms and environments unfamiliar to my students. For each group I try to cover basic anatomy (tissue layers, organ development, etc.), basic natural history (habitats, locomotion, reproduction, etc.), and evolutionary relationships to other organisms. I try to stress both similarities and differences between and among groups. I try to 'hook' my students with particularly interesting facts about each group--flow of water through sponges, mouth and anus being the same hole in polyps and jellyfish, the incredible numbers of roundworms in some soils and in the bodies of humans and their domestic beasts. In each case, I also try to get them, as humans, to 'relate' (or not) to the animals

in question--the extremely long lives of sponges, the regenerative abilities of flatworms, the abilities of corals to make major geological features, etc.

## Procedure

Once the students have seen how I present each group, I then assign each of them a group to work on themselves. These assignments are usually divvied up at the Class (rather than Phylum) level--earthworms, polychaetes, and leeches, for example, rather than all segmented worms. In each case, the student must find the information outlined above. They may use their textbook, but they must also use at least two other sources. Their goal is to teach their classmates about their particular group, in a presentation 10-15 minutes long--three or four presentations per class period. (Students are not expected to present the same detail I would cover in a much longer time period.) I do not ask them to turn in a formal written report. When I tried this, they tended to just read their reports to the class--very boring. I do, however, require them to turn in the outline, including the bibliography, they have used for their presentation. This makes it easier for me to evaluate their talks in terms of material covered, organization, etc.

As part of the presentation, each student is also required to make a three-dimensional model. The models can be descriptive of the whole animal, though I try to get them to focus their attention on some particularly interesting aspect of their organism's structure or behavior. 'Make' is loosely defined here, as can be seen from some of the examples described below. 'Found' objects can be quite illuminating. Posters and/or drawings are not acceptable as models (though they can be used in their talks).

Some examples:

- One student brought in a 2 meter-long piece of PVC pipe for his talk on polychaete worms. At the appropriate moment in his talk, he suddenly picked up the pipe, shoved his arm in one end, and out popped a multicolored feather duster attached to a broomstick, demonstrating the filter-feeding mechanism of typical tubeworms.
- Another student used Legos and built a battery operated 'centipede.'
- Yet another student used a thin, flat, circular piece of rubber (actually a rubber jar opener) and taught himself to manipulate it in such a way that he could 'walk' it along the chalkboard, demonstrating the waves generated in the foot of a snail.
- A number of students have baked cakes of appropriate shapes and then decorated them to show distinguishing characteristics. We then got to eat their organisms. I remember a 'jelly roll' hydra made of two layers of cake dyed with food coloring surrounding a mesoglea. Other students have used Jell-O with assorted suspended objects to demonstrate tissue layers or other internal structures.
- Clay, papier mâché, wire, beads, and plastic extrusions have all turned up over the years. Visits to the local scrap exchange have often proved inspirational.

In general, models with moving parts have proved to be the most captivating, while everyone has always enjoyed the edible creations. When given free reign like this, my students have usually proved themselves to be quite creative. And in later years, when I have asked returning students what they remember from the course, they almost invariably recall these talks and their models.

Finally, there should be a few minutes left for questions, comments, speculations, or any other discussion stimulated by the presentation. I usually try to help the presenting student field questions, since I do not expect high school students to be experts at this stage in their careers.

## Extensions

The same model-building assignment can be used for getting students to demonstrate organelles in a unit on cell biology. Similarly, the organs in the human body can be demonstrated in a unit on human physiology. Of course, this presentation of a class of organisms could be applied to any group of plants, protists, vertebrates, etc.

After a phylum has been discussed, seen, dissected or whatever, have students sit quietly at their desks, pull the shades to darken the room, have them close their eyes and imagine they are one of these organisms. After 3-5 minutes of silent contemplation, ask them what they 'saw' in their minds, what they thought, how it felt to live between sand grains in the beach or burrowing through human flesh. Here again, students learn from each other and gain confidence in their own ideas while simultaneously appreciating their peers.

## Instructions for Students

**1) Research:** Select a group of organisms from the supplied list. (No two students will work with the same group.) Research your group, using at least three sources, only one of which may be an encyclopedia. Other possible sources are textbooks, monographs on your particular group or the Phylum to which your group belongs, or periodical journal articles about your group or particular species in your group. Gather information about the following topics:

- anatomy and physiology, particularly those aspects which are distinctive for your organisms--the following organ systems and topics may be interesting:
    - digestive system
    - nervous system
    - skeletal/muscular system
    - reproductive system
    - locomotion
    - embryonic development
- natural history:
    - habitat
    - feeding behavior (who they eat, who eats them)
    - reproductive/social behavior
- evolutionary relationships:
    - other closely related groups
    - ancestral forms (who they are 'descended' from)
    - evidence for these relationship

**2) Presentation:** Prepare an outline, to be turned in, which you will use to guide you in your 10-minute oral presentation. This outline should include your bibliography, prepared as you would for a typical research paper. You should not write out your talk and expect to read it to the class (boring) and then turn it in as a research paper. That is not the intent here. Rather, you are expected to teach your classmates about your group of organisms. Explain things clearly; feel free to use the chalkboard and any illustrative materials you can generate; keep it lively and interesting.

**3) Model:** As part of the presentation, each student is expected to make a three-dimensional model that demonstrates some important characteristic of his or her group of organisms. Have fun with this. Be creative. Though models of a whole organism are acceptable, a model which highlights an interesting part of the organism is even better--a distinctive mouth part, an important skeletal structure, a demonstration of locomotion, a protective shell, a leg and claw, a reproductive structure, an unusual growth pattern.

Though drawings and photographs may be part of the presentation, they do not fulfill the model requirement.

**4) Question and Answer Period:** Be prepared to field a few short questions or engage in a short discussion (1-5 minutes) following your talk.



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