

WHY WE USE ANIMALS IN TEACHING BIOLOGY

Introduction

Biology is the study of the unity and diversity of life. The unity derives from the fact that all species on earth are related by descent and share many basic features. One only has to consider DNA, ATP, or plasma membranes to appreciate the fact that all life is built on some common cellular forms and processes. Because of these basic similarities, we have learned a great deal about our own biology by studying non-human organisms, from *E. coli* bacteria to *Drosophila* to laboratory mice. When one considers the diversity of life, however, it becomes clear that each species is unique, and there is a limit to how much one can learn about one species by studying another. We learn more about ourselves by studying frogs than by studying *Drosophila*, still more by studying mammals, and still more by studying primates.

As biologists and as human beings, we share a deep respect for all life, and wish to avoid unnecessary sacrifice of living things. However, we think it is important to balance this respect with a consideration of the benefits of learning things that cannot be learned in any other way except through studying animals. We have a responsibility to articulate our reasons for using live animals in our classrooms and to provide clear policies for their humane and thoughtful treatment. We train our students to be aware of the potential for misuse of animals, and to be able to articulate the reasons they use animals in the classroom.

The faculty of the Biology Department of Lewis & Clark College believe that the study of organisms, including nonhuman animals, is an essential part of our curriculum, and it is for this reason that we offer a range of courses whose subjects are the origin, structure, and function of whole organisms. We recognize that some students have deeply-felt reservations about using live or sacrificed animals, and there are no required courses in our curriculum that use vertebrate specimens. While many careers in biology, including medicine, are incompatible with a moral objection to animal research, biology is a tremendously diverse field, and there are many kinds of biological investigation that do not require the use of animals, or that study those animals non-invasively.

So why use animals in any of our courses? First, a selfish reason: our health depends on it. If you are not already convinced of this, a quick scan through the statements of the professional associations listed below will reveal the magnitude of our debt to nonhuman animals used in research. The discoveries in medical science are directly dependent on the research conducted using nonhuman animals. And this research is directly dependent on the classroom experiences that those interested in pursuing a career in medicine must have. Simply put, the goals of humanity have been advanced by this discovery-research-education linkage.

Three reasons why we use animals in teaching biology

1) Animals are needed for students to develop the skills necessary to conduct animal research, which has been the basis for almost all of the important discoveries in biomedicine. **If we fail to educate, train and excite tomorrow's biologists, our future**

understanding of organismal function is in jeopardy. The number of up-to-date laboratories which teach new and advanced techniques is decreasing because of cost and the difficulty of animal use. If we do not teach the necessary skills, then proper or "humane" treatment of animals will be more difficult to realize. Moreover, training is necessary so that future experiments using animals are of the highest quality and do reveal the secrets about how animals "work".

2) Animals are necessary to demonstrate the difference between natural biological variability and measurement error. Working with real organisms in real investigations makes one come face-to-face with complex biological phenomena that cannot be experienced in books and models. This is critical if we are to teach critical thinking and foster creativity in the design and execution of scientific experiments. Textbooks, lectures, and simulations relay the final general principles, but seldom discuss in detail how these discoveries have been made. The excitement and frustration that accompany the discovery of new information can only be experienced by direct involvement (i.e. using all available senses). The realization that textbook relationships are not simple functions, but have variation due to the organism and measurement technique is essential.

3) Animals must be used to give students a much-needed appreciation for the diversity of life. Most animals are very different from ourselves. We are the exception, not the rule with respect to many aspects of animal function. If we never understand how animals respond to their environment, then how can we ever know if they are being treated "humanely" or what "humane" even means? Paradise for a human will certainly kill an Antarctic fish, whereas we would feel quite uncomfortable living in the hypoxic mud of some amphibians. Students must experience animal diversity with respect to function.

Why not use computer simulations instead of animals?

- Computer simulations are not a substitute for using animals in teaching for the same reason they are not a substitute for animal research: **simulations are simplifications that contain only what we already know, not what we have yet to discover.**
- We use computer simulations to supplement the novel, exciting discoveries that emerge from investigations of real animals. **Computer simulations are best at presenting a simple, clearly understandable model of structure and function.**
- The greatest shortcoming of computer simulations is that, **taken alone, they falsely represent biology as a static, boring field where the facts are already known, and where there is nothing more to discover.**
- Computer models cannot enable students to experience the excitement of studying real animals as complex integrated systems, where the unexpected can lead to profound discoveries.

Relevant information regarding use of animals in teaching and research

It is the responsibility of all those concerned with animal welfare --professional biologists, students, and animal rights activists --to know what policies and procedures

are advocated by those societies most directly involved in working with animals.

- **Federation of American Societies for Experimental Biology**
<http://opa.faseb.org/pages/PublicEducators/animalresearch.htm>
and **American Physiological Society**
<http://www.the-aps.org/pa/action/animalissues.htm>
Statements on the humane use of animals in research and teaching.
- **National Academy of Sciences**
A guide for the care and use of laboratory animals.
- **Foundation for Biomedical Research**
<http://www.fbresearch.org/Education/tabid/377/default.aspx>
Information about the benefits of animal research.
- **Animal Behavior Society**
<http://www.animalbehavior.org/ABS/Handbook/abspolicy99.html#treatment>
Guidelines for the treatment of animals in behavioral research and teaching.
- **Villanova University Biology Department**
The department's statement on use of animals in teaching:

"The primary reason for using animals in the lab is related to their value in experiential learning. The structure and function of tissues, organs and systems of organs within animal bodies are extremely complex. Without the firsthand experience of locating and manipulating muscles, bones and organs within the three-dimensional framework of the real organism, it is impossible to fully appreciate the complexities of animal form and function. Since attaining knowledge of the way in which animals "work" is one goal of the laboratory, instructors believe that the use of preserved and/or fresh specimens is imperative to your learning and appreciating the material dealt with in the course. Diagrams and other materials are also used in the course and are useful adjuncts to real animals, but they cannot substitute for them. By analogy, someone can tell you the rules of chess or baseball, but without the experience of watching a game the rules are abstract concepts, and without playing yourself it is difficult to appreciate the game or to truly understand its intricacies."