

# How-To-Do-It

## Supplemental Exercises for the Invertebrate Zoology Laboratory

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In an attempt to broaden the educational scope of laboratory investigations in invertebrate zoology, some years ago I developed a scheme which not only increases the breadth of information gained in the course, but also gives students experience in field work and in the practical use of a variety of techniques used in the course of laboratory and library work. Although these supplemental exercises are used in my course in invertebrate zoology, I am certain they can be adapted to other laboratory courses in biology.

The course I teach consists of three hours of lecture and one three-hour laboratory each week of the semester. I do not take a taxonomic approach in the course; rather, we discuss the phylogenetic trends of organ systems and how they relate to adaptation to habitat. As each organ system is studied in the laboratory, the students are given a variety of live and preserved specimens from a number of phyla to observe. In some cases the specimens are already dissected; in other cases, the students do their own dissecting. I have written the exercises for each laboratory session and Sherman and Sherman's *The Invertebrates: Form and Function* (Macmillan Publishing Co., Inc.) is used as a reference.

The supplemental exercises are done entirely outside the formal meeting times for the course. The assignment entails the collection of specimens from both aquatic and terrestrial habitats and the use of these specimens to complete a series of individual tasks. Students are provided all the materials they require for the collection and preservation of specimens and, if need be, directions to local habitats that will likely contain the kind of specimen they may be seeking. The species they collect and use are entirely of their own choosing. In total, there are five exercises and one must be completed by each of the five specific deadline dates. These deadlines are spread out over the se-

mester to eliminate procrastination and the inevitable end-of-semester rush to get all of the assignments completed on time. The order in which each exercise is completed and submitted for evaluation is not specified in order to allow the students freedom of choice about when and what individual exercises are done.

Regarding the specimens, a few stipulations do apply. The five specimens used must represent five different invertebrate phyla. Also, among the specimens used there must be at least one representative from an aquatic or terrestrial habitat.

One of the tasks that must be performed is a complete description of the habitat from which one of the specimens is taken. The physical, faunal and floral aspects of the habitat must be noted. In reference to the former, for example, we are fortunate to have equipment at our disposal that permits basic analyses of soil and water. The purpose of this exercise is to stress the importance of the ecological relationships of the organism, relationships which I feel are overlooked too often in survey courses such as this.

A second exercise entails the description of the external characteristics (e.g., antennae, appendages, body regions, mouthparts, photoreceptor locations) of another specimen. In this exercise, diagrams are not permitted, forcing students to use their command of the English language to present a description clear enough to permit a reader to visualize the organism being described.

Using yet another specimen, the internal organ systems must be described as completely as is practical. Here, diagrams or sketches may be used in conjunction with the narrative. I have found that it is a good idea to suggest to the students that they use one of their specimens that appears to be easily dissectable and to inform them that they may require more than one specimen for this par-

ticular assignment.

The fourth requirement is the construction of a properly labeled line drawing, along the lines of what might be submitted for publication, of the dorsal external surface, or its equivalent, of a specimen. I issue a handout that provides directions on how the drawing should be done. Sophomore or higher level undergraduate students in biology have ample experience with making sketches in the course of their laboratory work, but, in most cases, virtually no experience in producing more formal drawings. This exercise introduces them to this facet of documentation in the biology laboratory.

The final exercise is a library assignment. Using the resources of the campus library, the student must submit an annotated bibliography concerning their fifth specimen, or, considering the resources of our rather modest library, its close relatives. There must be a minimum of 10 sources cited. I should add here that students in my invertebrate zoology course also are required to submit a library research paper on a subject of their own choosing as part of the course requirements. The annotated bibliography and the references in the paper cannot coincide.

I have found this laboratory-library project to be a valuable and useful adjunct to the invertebrate zoology course. In addition to providing the experiences outlined above, I believe the successful completion of these exercises teaches, even forces, students to work on their own and to be more self-reliant. In general, the students appreciate the kinds of experiences that these exercises give them and they realize that the knowledge gained and the techniques learned provide them with skills they will need in other upper division and even graduate level courses that they may take.

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