



ASSOCIATION FOR BIOLOGY LABORATORY EDUCATION

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Chromatophores and Color Change in Killifish (*Fundulus heteroclitus*)

Seung M. Hong and Malcolm H. Taylor (Department of Biological Sciences, University of Delaware, Newark, DE, 19716; email: smhong@udel.edu)

This exercise was designed to have students 1) observe a physiological color change in whole organisms, and 2) correlate the color change (*in vivo*) with the responses occurring at the cellular level (*in vitro*), especially in dermal melanophores. The color change process is relatively fast (30-45 min) in killifish subjected to a black background, and the time course can be quantified using a simple color index of 1 - 5. Dermal melanophores are very large and the degree of melanin dispersion can be easily determined under the dissecting microscope (Hogben and Slome, 1931). This pre-designed experiment was used as a pilot study prior to a subsequent series of student-designed experiments with an emphasis on mechanisms of physiological color change in animals.

Hogben, L., and D. Slome. 1931. The pigmentary effector system. VI. The dual character of endocrine co-ordination in amphibian colour change. Proceedings of the Royal Society of London. Series B, 108:10-53.

Concept Mapping as a Learning Strategy in Introductory Biology Laboratories

Amy Marion and Ralph Prezler (Department of Biology, New Mexico State University, Las Cruces, NM 88003; phone: (505) 646-3926, email : amarion@nmsu.edu)

This workshop presents new data regarding the effectiveness of student-designed concept maps as a learning tool in introductory biology laboratories. Our introductory biology lab courses have traditionally used short quizzes at the beginning of each lab period as an incentive to encourage students to read the exercise before lab. Because students have not performed the lab at the time they take the quiz, the quizzes usually are composed of objective questions that evaluate a student's recall of the general purpose of the lab exercise and a few terms defined in the lab manual. To help students develop a stronger conceptual framework for understanding the lab exercise, we have begun to incorporate concept maps into our introductory laboratories. To assess the effectiveness of concept maps in comparison to quizzes, instructors teaching two different laboratory sections have conducted one section in the traditional manner of administering quizzes at the beginning of each lab, and a second section of the same course using concept mapping. Students were instructed in the design of concept maps, and they developed their own maps for each lab exercise. I will present comparisons of student performance in traditional lab sections and sections using concept mapping. Workshop participants will also have an opportunity to work in teams to develop a concept map for a biology lab exercise.

Integration of Computer Lab and Wet Lab Without Loss of Functionality: Computer-augmented wet labs

Brenda Leady and Dale Leady (University of Toledo Department of Biological Sciences 2801 W. Bancroft St., Toledo, OH 43606; Phone: (419)530-2181; E-mail: brenda.lead@utoledo.edu)

Biology labs are typically not conducive to computer use. The hazards of a wet lab preclude computers being on the bench top, so students either use laptops or go to a PC lab in another room. Laptops are prone to drops and spills, and are expensive and difficult to repair. Sending them to another lab isolates the lab experience and prevents many applications of the computer in the lab. However, computer use is important in preparing students for the future. We have integrated a full computer lab into our introductory teaching labs. Every pair of students has their own PC at the

lab bench. The CPU sits under the bench in modified cabinets while a flat screen panel sits on top of the desk. Tower style CPUs are cheaper to buy and easier to repair and upgrade than notebooks. The flat screens are protected by plastic splash shields we made ourselves. Keyboards and mice have yet to be replaced due to lab damage in hundreds of hours of use. The 12 student PCs are controlled by an instructor PC at the teaching assistant station. “NetSupport School” software allows us to turn the machines on and off, and monitor and control student use. Almost every lab has a worksheet to fill out electronically, a spreadsheet to complete or a graph to make. We also use spectrophotometers connected to the computers for direct data gathering. We plan to add video microscopy to our labs in the near future. Computers do not replace wet labs; they augment them. We will demonstrate the use of the software program used to control the labs, as well as the physical set up and considerations in a computer-augmented wet lab.

A Quantitative Genetics Exercise

Paul Willing (Biology Department, Union College, Schenectady, NY 12308; Phone: (518) 388-6713; E-mail: willingp@union.edu)

Our general biology students do two simple Mendelian genetics experiments in their first term, one with *Drosophila* and one with C-Ferns. Our students also do a natural selection lab using pillbugs (ABLE workshop, 19:307-316), which requires that students understand a little bit about quantitative inheritance. To prepare students for the natural selection experiment, we introduce the lab with a 30-45 minute simulation of inheritance of a multifactorial trait: susceptibility to colon cancer. Each student represents an individual in a population, and is given two alleles of 8 different genes. Each pair of alleles contributes a negative or positive number to their colon cancer susceptibility. Some of the alleles are recessive, some dominant, some partially dominant, some X-linked, and some have an epistatic effect over another gene. Each student adds up his/her susceptibility – a score of zero indicates average genetic susceptibility, a negative number indicates more than average susceptibility, and a positive number means less than average susceptibility. Each pair of students then assumes the role of a married couple; each member of a couple selects one allele of each gene to contribute to their offspring (1 or 2). We record each parents’ and each child’s score for susceptibility to colon cancer in an EXCEL spreadsheet and project this on the screen for class discussion. This exercise also helps students learn a little about population genetics, partial dominance, epistasis, X-linked inheritance, etc.

Interactive Computer Keys: Tools for understanding biodiversity

Mandy L. Heddle (Environmental Programs/COSMOS, 248 Schatzel Hall, Bowling Green State University, Bowling Green, OH 43402; Phone: (419) 372-2854; E-mail: mlheddle@bgnet.bgsu.edu)

International concern about the loss of global biodiversity requires that understanding organism diversity be a high priority in biology labs. Instead, systematics, taxonomy, and biodiversity are often a small part of the curriculum, if included at all. One cause of this disparity is that students and teachers are often frustrated when using dichotomous keys to identify organisms. Confusion may stem from inexperience with the characters used in the key or because the key itself is inaccurate or unclear. This exercise has students create two kinds of keys: a dichotomous key and an interactive key designed on the computer. Students test and compare the two keys and investigate the limitations and advantages of each. Students learn how to create their