UTM ABLE Poster Session

Friday, June 6th 10:45 - 11:45 AM, Fourth Floor South Building

1. VERSATILITY OF ELECTROPHORESIS AS A TOOL FOR INQUIRY-BASED COLLABORATION IN DEVELOPMENTAL BIOLOGY AND COMPARATIVE PHYSIOLOGY.**Charlene Blando-Hoegler & Carl Hoegler** Yorktown, NY , USA

Inquiry-based collaborative pedagogy promotes strategies to improve active student learning in the lab. Courses like Developmental Biology and Comparative Physiology may effectively use polyacrylamide gel electrophoresis (PAGE) to enhance exploration and discovery about changes in proteins and enzymes during ontogenesis as well as to open insights into evolution and cell physiology. Early on in Phase I of this pedagogy, students review wet methodologies and perform database searches using prescribed instructor exercises. Later in the course in Phase II each student team develops a hypothesis and protocol about some novel interest in the form of a research proposal. After instructor approval, each project is implemented and presented before the class. Suggested projects include biochemistry of embryonic proteins of amphibians or plant seeds. Alternative approaches might involve altering physical or chemical conditions or comparative biochemical organ profiles for one organism. The depth of any one investigation is variable, and might span from gross identification of protein profiles using ladders and band intensity analysis to the use of Western Blot analysis to probe specific enzymes or proteins. The ultimate goal of this pedagogy is to build student confidence and critical thinking skills and hopefully motivate students to sustain their interest in biology beyond college.

2. PROMOTING HANDS-ON LABORATORY EXERCISES FOR ONLINE INTRODUCTORY BIOLOGY
Liane Chen, Gillian Gass, and David Patriquin Department of Biology, Dalhousie University, Halifax, Nova Scotia, Canada

Providing opportunities for hands-on laboratory experience is a major challenge to teaching science via Distance Education (DE) venues. In our two online Introductory Biology classes, we rely on virtual experiments or lab data to teach our students about the scientific method. Although students have fewer manual skills entering into second year courses, they generally perform as well academically as students from traditional campus-based courses.
We are currently developing or adapting a number of laboratory and field exercises for hands-on use by DE students. These activities make use of materials and equipment that are readily available, and use of digital cameras and uploading of images facilitates making and reporting observations. We are also examining use of a modestly priced personal digital microscope, which would greatly increase the scope of activities. Pilot testing of a lab on enzyme kinetics indicates that while most students appreciate the importance of doing hands-on activities in a science course, they prefer the computer simulations as being quicker, cleaner, and less frustrating than the hands-on lab exercise. This response suggests that we have been successful in introducing these students to the realities of scientific inquiry. The results of further pilot tests will be discussed.

3. TEACHING BIOTECHNOLOGY FOR 10TH GRADE WITH A INTERDISCIPLINARY PROJECT INCLUDING EXPERTS AS PARTNERS TO MOTIVATE FUTURE RESEARCHES

Ana Cristina da Palma Camargo, Girlene Lopes Sismotto, Regina Mara da Fonseca, Cristiana Assumpção and Denise Curi Biology Department, Colégio Bandeirantes, São Paulo, Brazil

A number of arguments can be used to show the importance of biotechnology education nowadays, including ethics and scientific education in contemporary biology programmes for 10th Grade. These include highlighting the relevance of the subject discipline reported in the news media, showing the importance of a good grasp of biology to the population in general.
On the other hand, teaching Science in a traditional way (classes, books) can give the students a wrong idea about this important area of knowledge. Trying to avoid this, Colégio Bandeirantes, a private school, has been working with an educational project – Biotechnology Project- since 1998. Teenagers have the opportunity to engage in some contemporary issues in biotechnology, including bioethics, whilst at the same time they can develop a number of important skills, notably teamwork, research, manipulation of lab materials and getting in touch with experts. During one year, students take part in lectures (biotechnology, geography, chemistry, bioethics and marketing), watch classes about basic knowledge in cytology, genetics, chemistry and molecular biology, visit University laboratories (USP), take part in "DNA goes to School" workshops (http://www.odnavaiaescola.com/indexing.htm) and create educative games and marketing of one imagine/unreal transgenic product created by them. During these activities, they debate about different issues including bioethics, stem cells, clones, transgenic food and gene therapy inside the group and with experts. Five of the best students of each year have the opportunity to make a month stagium in University`s labs. By providing information about resources, as well as venues for further exploration, we aim at opening the doors of biology resources to secondary students and motivate future researchers. In the end of this project (March to November), students should be able to work as a member of a team, recognize the diversity of informed ethical opinion about biotechnology advances, understand some practical activities involving DNA extraction, electrophoresis, PCR and Genetic engineering and really understand what science is.

4. USING SACCHAROMYCES CEREVISIAE AND A CASE STUDY TO EXPOSE STUDENTS TO MUTATION AND DNA REPAIR MECHANISMS.

Allison D'Costa[1,2] and Irma Santoro[1] [1]Dept. of Biology, Emory University, Atlanta, GA
[1,2]Div. of Science & Technology, Georgia Gwinnett College, Lawrenceville, GA

In this 4-week laboratory module for Introductory Biology, students study the effect of varying amounts of UV radiation on the survival of a wild type and "unknown" strains of yeast. The unknown, rad 1, has a mutation in a DNA repair enzyme, and is therefore more sensitive to UV. After plotting a survival curve for both strains, students are asked to determine why the "unknown" is more sensitive to UV. In this way, they learn about the role of DNA repair mechanisms present in cells. Next, using the scientific method and appropriate controls, they are asked to design group experiments using survival of yeast to show the protective effect of sunscreen, sunglasses or various kinds of fabric against UV (they can bring anything they wish to test). To help students see a connection between their experiments and a real-life situation, students read a scene from a Case study at the end of each lab. The case is a story about a child with Xeroderma Pigmentosa, a disease caused by mutations in a number of genes involved in DNA repair, some of which have homologs in yeast. This laboratory module has also been used successfully in non-majors labs without the "unknown" and Case study.

5. APPLICATION OF A NATURAL SURFACTANT TO ENHANCE BIOSEPARATION OF CONTAMINATED SEDIMENT

Hélène d'Entremont and Martin Tango
Department of Biology, Acadia University, Wolfville, NS, Canada

Soapnut is a fruit native to tropical regions. Its shells contain saponin; a natural surfactant that may be used as a personal cleanser or laundry. Due to its surfactant properties, it is suitable for use in environmental separation processes of contaminants from soil sediment. Preliminary experiments show that soapnut is less toxic than sodium lauryl sulphate (SLS) to bacterial cells; both cultured and microbes indigenous to soil samples, as measured via overnight growth on TSA plates. This study creates opportunities for students to learn about alternate approaches in the decontamination of sediment, and an introduction to potential sustainable practices.

6. A MIXED APPROACH TO TEACHING PARASITE GROUPS IN A SPECIES RELATIONSHIP LAB

Miriam Ferzli, Patty Aune, and Marianne Niedzlek-Feaver
NC State Universiy, Biological Sciences, Raleigh, NC, USA

As part of a species relationship lab for a major's introductory biology course, students are familiarized with ecto- and endoparasites by using a combination of learning approaches: collaborative work, web-based searches, specimen observations, and a traditional dissection. Students are divided into "expert" groups, and each group finds information about two parasite groups—one ecto- and one endoparasite group. A total of twelve parasite groups are covered. The information search is done through a "web journey" that takes students to various sites with material they must read, process, and organize for presentation to their peers. The objective is for students to learn representative species, basic characteristics, life histories, and parasite-host relationships. Students have to view microscope slides and preserved specimens in order to familiarize themselves with the organisms. As each group presents their parasite organisms, the rest of the class fills out a summary table provided in the lab manual. The presenters provide a visual of the parasites in the form of drawings, photographs, or may pass around preserved samples. After students learn how to describe and identify the various types of parasites, they conduct a fish dissection, during which they try to find and identify parasites. This gives students a direct opportunity to apply what they have learned. Since parasite groups include unicellular and invertebrate organisms, students are also indirectly learning about these groups.

7. THE CARTESIAN DIVER AS AN AID FOR TEACHING RESPIRATORY PHYSIOLOGY

Greg K. Fitch
Manhattan KS, U.S.A.

The mechanism by which air enters the mammalian lung is a difficult concept for many students of physiology. In particular, some students have trouble seeing how pressure can be transmitted through a fluid such as the intrapleural fluid and how the magnitude of that pressure can change. A Cartesian diver, an old-time child's toy, may be used as a piece of laboratory equipment to illustrate and make more understandable these hard-to-grasp concepts. The Cartesian diver is easy to construct from readily available materials. In addition to helping explain lung mechanics, the

performance of the Cartesian diver takes most students completely by surprise and thereby serves as a "gee whiz" moment for some students that may be remembered long after much course material has been forgotten.

8. INTRODUCING MICROARRAY TECHNOLOGY INTO THE UNDERGRADUATE LABORATORY

Rosemary Ford
Biology Department, Washington College, Chestertown, MD, USA

Because transcriptome analysis is important in providing information about gene regulation, undergraduate students should have some knowledge of microarray technology. I have taken advantage of the Genome Consortium of Active Teaching (GCAT), which provides expertise for undergraduate teachers to introduce this technology into student laboratories, materials at a reduced cost, and scanning of the microarrays. Students enrolled in the Biotechnology/Molecular Biology course plan an original experiment using yeast (Saccharomyces cerevievease) and partially complete their experiment. If students want to complete their experiment, they enroll in an Independent Research course for the following semester. Splitting the project into two semesters reduces costs since only a few projects continue into the second semester when the most expensive steps of the technology are incurred. This approach is successful in that all students are introduced to the microarray technology and have an opportunity to design an experiment of their own. Those who want to pursue this research can complete their work and present it at a regional Biology conference.

9. A LAB USING C. ELEGANS TO INVESTIGATE THE NERVOUS SYSTEM AND BEHAVIOR

Jessica Goldstein
Biology Department Barnard College, New York, NY, USA

This laboratory exercise was developed for our first-year introductory biology laboratory course to promote students' understanding of behavior and the nervous system, as well as introduce them to methods of data collection and analysis. In this exercise, students examine the chemotactic response of the nematode C. elegans towards a range of benzaldehyde concentrations. C. elegans have simple nervous systems and sense chemicals using chemosensory receptors located in their head region. When they are attracted to a chemical, they move towards it; when they want to avoid a chemical, they move away from it. Benzaldehyde was chosen for this lab because it is a known dose-dependent attractant for these animals (Bargmann et al., 1993). Students work in groups to perform chemotaxis assays to examine the chemotactic response of C. elegans for many different concentrations of benzaldehyde. Students perform each assay in triplicate and discuss the value of repeatability. They quantify attraction to benzaldehyde by calculating the chemotaxis index for each concentration examined. The data they collect can then be graphed and/or used for regression analysis. We hope that students come away from this lab with a better understanding of the relationship between the nervous system and behavior, and an increased ability to analyze quantitative data.

10. HOW DOES CUSTOM DESIGN, LAYOUT, AND IMAGERY WORK IMPACT STUDENT EDUCATION AND LEARNING

Mark Kesson
Hayden-McNeil Publishing, Plymouth, MI, USA

If layout & design, illustration & photo work, and packaging play an important role in a students laboratory experience, what are the important factors to review when considering any publishing house? --- Agreement structure, timelines, staffing, integrity of company. Although I will present this from a Hayden-McNeil Publishing perspective due to my experience, this presentation will not be a sales promotion for Hayden-McNeil Publishing. In fact, my simple objective is to inform Biology Laboratory Educators of the options available to them so that they can make the best possible decisions regarding how to develop and disseminate their original laboratory work. If the local print shop or a national product, or competitor for that matter, makes the most sense for the print publication and distribution of their work, that is certainly fine. But it is always best to understand the landscape so that science educators can continue to make the best decisions on behalf of his/her students.

11. GUMMI BEAR GENETICS: AN EXERCISE IN UNDERSTANDING EPISTASIS

Susan A. Moore
Pittsburgh, PA, USA

Typically, the dihybrid cross is introduced in the genetics classroom in terms of wrinkled and round and yellow and green peas. When the topic progresses to epistasis many students promptly disconnect with lectures on winter squash, and snails, and even puppy dog tails (well, Labrador coat color) as examples. Building upon the work of William Baker and Cynthia Thomas and their article in The Science Teacher called “Gummi Bear Genetics”, the introduction of the delicious new species—Ursa gummi to the genetics paradigm, made learning genetics fun. In this exercise, students are informed that they are trying to breed a gummi bear army. These delectable soldiers need to have specific characteristics to be good soldiers and the students must understand how these traits are inherited. With this scenario in place, students work through various crosses of gummi bears. They must predict the outcomes of dihybrid crosses that contain epistatic genes. Students are then given the offspring of a dihybrid cross and are asked to develop a hypothesis regarding the relationship between genotype and phenotype utilizing what they already know from the problems and to test their hypothesis by chi square analysis. Students are encouraged to use their imagination in describing the genotypes and phenotypes of their own offspring, however, they can use the examples from the problems they have already worked. This exercise strengthens the link between biology and statistics and makes the problem solving aspect of genetics a tasty treat.

12. MONITORING CHANGES IN SPECIES: AFRICANIZATION IN US HONEYBEES

Marianne Niedzlek-Feaver, Patricia Aune and Miriam Ferzli
North Carolina State University, NC, USA

Participants, take on the role of scientists, responding to beekeepers’ concerns that their hives may have been “Africanized.” Participants will measure the wings of worker bees and correlate that data with electrophoretic analysis of mitochondrial DNA from the same sample. Honeybees in North America were originally imported from Europe. An African subspecies was imported into South

America because of its superior honey producing potential in warmer climates. Unfortunately, individuals of African bees have been introduced and have established colonies in the USA. The Africanized colonies tend to abandon commercial hives, especially when stressed, and so cannot be used as domesticated pollinators, which are normally transported in hives to areas where they are needed. This African behavior dominates in hybrid workers and so threatens agricultural pollination and the honey industry. This is part of a laboratory that looks at evolutionary mechanisms. It allows students to compare molecular and phenotypic data, mitochondrial and genomic inheritance patterns, and competition between phenotypes and change in a species over time.

13. ABLE: A RESOURCE FOR INQUIRY-BASED LABORATORY ACTIVITIES FOR UNDERGRADUATE BIOLOGY COURSES

Karin Readel[1], Christopher Beck[2] and Michael O'Donnell[3]
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ABLE (Association for Biology Laboratory Education) is a part of the BEN collaborative. This resource includes classroom and instructor-tested inquiry-based laboratory activities for use in undergraduate biology courses. Each activity has example student handouts and notes to instructors on preparing for and implementing the activity. All materials are freely available and can be adapted for local use. The activities are contributed by faculty across a range of institution types (65 % from research institutions, 15% each from regional and liberal arts colleges, and 5% from community colleges and other institutions). Approximately 60% of the activities are geared towards the introductory level. In addition, they are fairly evenly distributed across the sub-disciplines of organismal biology (18%), ecology and evolution (29%), cell biology (21%), molecular biology (19%) and scientific inquiry/ pedagogy (13%). Possible future directions for the resource include linking experimental results and student assessments to particular lab activities and allowing users to discuss lab activities.

14. EFFECTS OF … ON ZEBRAFISH DEVELOPMENT

Emily Boone University of Richmond, VA, USA

One of the most challenging things I have found while teaching introductory biology is to find labs that are of value to students with a wide variety of interests. Too often students align themselves early on with the "cell/molecular" group or the "ecology" group and feel that anything in the "other category" is a complete waste of time. One of the last topics that we cover in our introductory biology lab sequence is zebrafish development. Students are given hour old zebrafish embryos and asked to design an experiment to explore how a given factor can potentially affect development. Not only does this lab allow students to apply concepts that they have learned in previous classes but it allows them to choose how they want to focus their research topic. Students wanting to use zebrafish as a model for human development often choose to study nicotine, alcohol or over the counter pain killers whereas students wanting to use their fish as a model for aquatic vertebrates will choose to study temperature, fertilizer runoff, salinity or acid rain. We have used this lab successfully for a number of years and it has always been a favorite among all groups of students.