Abstracts of Sessions

Concurrent Paper Sessions:

P.I.1. Capstone Courses in Biology
Richard Wilson and K. Williams, Rockhurst College

Capstone courses are relatively uncommon in undergraduate biology curricula. Rockhurst College requires biology majors to take Advanced Principles of Biology during their senior year. Many upper level biology courses concentrate on narrow sub-fields of biology (such as genetics, evolution or immunology) in contrast this course is broad and integrative. We will describe the history, implementation, design and goals of our capstone course. The current format, testing procedures and student surveys of the course will also be discussed.

P.I.2. Galapagos data: Variety is the spice of life for Evolutionary Biology
Sam Donovan, University of Wisconsin-Madison, Frank Price, Hamilton College, Jim Stewart, University of Wisconsin-Madison, B. Williamson, Olathe High School, Kansas

Evolutionary theory is the conceptual center of biological science; despite the broad range of phenomena biologists study, they all share as part of their "consensus practice" the principle of descent with modification. Understanding evolution is central to biological literacy, but providing an environment where beginning students can learn to understand the nature of evolutionary biology is difficult.

Part of the difficulty is that study of evolution requires generalization from numerous, diverse types of data. Presently, there are few satisfactory tools or methods to help students explore evolutionary hypotheses as biologists do. Instruction in evolution is typically limited to reading about the products of evolution. Even when data are examined in labs, data sets are small and limited in variety. Moreover, the activities are also not true to the types of reasoning that biologists use -- they are not conducive to realistic problem posing, exploration and explanation.

We attempt to address this gap with data sets and software that allow students in introductory biology to experience what it is like to "think evolutionarily". We compiled diverse data on Darwin's finches and on the Galapagos Islands from a variety of sources into a collection of electronic data sets. Example of data include: maps of vegetation, geology, weather, distribution of finches, morphological measures, foraging data, food availability, songs, and more.

Database software makes it easy for students to extract data of their choice. This allows students to move chosen data to a variety of software tools (e.g., spreadsheet and statistical packages, MacClade) for analysis. Students are encouraged to work in groups to use the data and their own knowledge to formulate questions, extract other data to answer those questions, and present their answers to others. Students using different data invariably come up with a variety of questions and hypotheses, just as scientists do. Our talk will examine the data, software tools, and pedagogical lessons of this project.

P.I.3. Students Teaching Students: Habitat Tours, An Outdoor Lab Exercise
Tom Davis, Loras College

I have used habitat tours successfully in several of my outdoor class sessions ranging from Introductory Biology for non-majors to my Mountain Ecology course in Wyoming. Students first get a short introductory talk from me about the biogeography of an area. They are then assigned to 2 or 3 person teams and given a sheet of general questions on plants or animals to investigate. Students are released for 30-45 minutes to discover, identify, investigate, question and learn about the plant or animal components that they encounter. The groups come back, pick up the other groups and the instructor(s) and take them on a tour of the habitat.

The objectives of this kind of exercise are 1) to introduce students to the major plant and animal components of a specific habitat, and 2) to use this awareness to reduce anxiety, stimulate appreciation and foster the ability to ask questions about the environment on their own. This exercise also reduces the time spent in lecture format and gets the students personally involved in the learning process. I think that the learned information is retained longer and can be applied and compared later.

This session will first outline the process of habitat tours, discuss strengths and weaknesses and then put session attendees into groups and go on a few short outdoor tours.

P.I.4. Ethnobotany of Coastal Native American Tribes
Austin Brooks, Wabash College

Native Americans of the Northeast and Northwest coasts used hundreds of plants for food, fuel, transportation, shelter, medicines and clothing. Among the most important plants in traditional Native American culture were trees. For many of Indian tribes of the East coast, birch was a particularly important species, while the West coast tribes used cedar in a great variety of ways.

P.I.5. The Role of Computers in a Project-based Biology Curriculum
Presley F. Martin, Hamline University, St. Paul, MN

The Biology Department at Hamline University is in the process of revising its curriculum with the goal of placing more emphasis on active student engage-
ment, a research orientation, and independent thinking and learning.

A key element in our plan is the integration of computers into the curriculum. We have found that the computers are providing valuable support for our goals that go well beyond computer use per se. Areas of greatest support include support for group collaboration, facilitation of independent thinking, encouragement of high standards and professionalism, and intellectual growth and critical thinking. Our approach to computer integration, examples of student projects and presentations, and student evaluation of the role of computers in the curriculum will be presented.

P.I.6. Chlamydomonas: a Useful Model System for Undergraduate Instruction and Research
Steve Daggett, Avila College

Members of the genus Chlamydomonas are unicellular, eukaryotic, green algae. They are motile, photosynthetic, and are found in a variety of habitats. We have found that Chlamydomonas sp. provide excellent model systems for undergraduate senior research projects. There are a variety of problems that can be addressed using Chlamydomonas and they are relatively inexpensive to work with and easy to maintain. In addition, they can be incorporated into the laboratories of a number of courses including general biology, genetics, and cell biology. They can be used either to demonstrate specific phenomena or as models for short, independent research projects. Examples of how Chlamydomonas sp. can be used for each of these applications will be discussed.

P.II.1. Freshman in Science Program
Anita Salem, Jim Dronberger, Edward Kos, and Richard Wilson, Rockhurst College

Much has been written about the lack of student interest and abilities in the area of mathematics and science. Too often students rule out careers in these areas before they ever reach college. A variety of programs has been established to encourage pre-college students to become more involved and interested in science and mathematics. Of equal concern are those students who come to college eager and ready to concentrate on their studies in science and mathematics only to drop out by the end of their first year.

In 1990 the science and mathematics faculty at Rockhurst College entered into a planning process to address attrition problems. A year of biweekly meetings resulted in a November, 1991 proposal for a Freshman in Science, (FIS) program. The goal of the project was to build a support system for the curriculum that would encourage students to put forth their best effort. This paper will describe the planning process, program and results from a six year effort to keep students interested in science-related careers.

P.II.1. The Largest Bacterium
Austin Brooks, Wabash College

The largest known prokaryote (up to 600 μm in length), *Epulopiscium fishelsonia*, first was described in the mid 1980's as a prokist. It is found in the gut of herbivorous reef fishes and has not been cultured. Using small subunit ribosomal RNA gene sequence analysis, the phylogenetic position of this unique organism has been determined. It is a member of the low- (G+C) Gram positive group of bacteria. A bacterium isolated from the gut of guinea pigs, *Metabacterium polyspora*, has been shown to be closely related to *Epulopiscium* and may help to explain the unique method of replication seen in *Epulopiscium*.

P.II.3. Educational Forum I:
Building Learning Communities
Ann Larson, University of Illinois-Springfield
Buzz Hoagland, Westfield State College

NO ABSTRACT

P.II.4. What? A Facilitated Conversation on Curricular Reform
Louise Liao, Ph.D., Program Director
CELS, the Coalition for Education in the Life Sciences
http://www.wisc.edu/cels

In this session, participants are invited to join an open conversation about the culture of widespread curricular reform. Can we be clear about the critical components of "what" the students are expected to learn? While many of us have reflected on effective approaches to teaching/learning and on assessment/evaluation of student learning, it seems that we have yet to adopt guideposts regarding the diverse array of topics that comprise the life sciences curriculum. Moreover, if we have a collective responsibility for widespread reform, how should responsible curricular reform come about?

P.II.5. Student Project Studies
Gopal Krishna and Suzanne Martin, Moberly Area Community College

NO ABSTRACT

P.II.6. ...and undergraduate research for all.
Cynthia J. Horst and Susan E. Lewis, Carroll College

Several years ago the Biology Department at Carroll College instituted a student research program for all Bachelor of Science degree students. This program consists of a three-semester series of courses that introduces students to designing and carrying out a research project based on their own interests. This program functions both to allow students an opportunity to apply what they have learned in their course work to a project of their interest, and to build organizational, time-management, and personal responsibility skills. During the first semester of the program students are guided through the process of identifying and planning a research project, as they write a research proposal. During the second semester students gather the necessary equipment, learn the appropriate techniques, and complete a pilot study. During the final semester, they complete the research, write a final report and produce a poster to present at the annual sci-
ence symposium held on campus. We will be present-
ing the strengths of the program and its benefits to
students. We will also discuss challenges we are work-
ing to overcome such as how a small faculty can ac-
commodate large numbers of students who have a
wide variety of research interests.

P.III.1. Commonalities in Biology
Bill Brett, Indiana State University

Ernest L. Boyer, in a report in Rethinking the Cur-
riculum entitled "Making the Connection: The Search
for Our Common Humanity," states that an under-
graduate curriculum should be based on what he calls
the human commonalities—those universal human ex-
periences that are found among all people and all cul-
tures on the planet. I believe that Boyer's proposal
can be extended to all living things, not just to humans.
This semester I am attempting to apply these "com-
monalities" to the material covered in both an Intro-
ductive Biology course for majors and a Human As-
pects of Biology course for general education students.
Hopefully this approach will require and stimulate
more critical thinking and relating of all organisms.

My evaluation of the students and their evalua-
tion of the course will provide some indication of the
success of this method of presentation. My presenta-
tion will include greater detail of the commonalities,
examples of how they were presented to the students,
and a comparison of student participation and reten-
tion of concepts in the course this semester with pre-
vious semesters.

P.III.2. Proposal Preparation and Research
Experience for the Biology Major
Charles Bicak, University of Nebraska-Kearney

Writing is an essential skill for the biology student.
As a tool, writing affords the student an opportunity
to learn; to assess how well biological concepts are un-
derstood. I will describe a two course sequence that
immerses undergraduate students in the process of
developing a proposal to design, conduct, and com-
plete scientific work. The first course (1 semester
hour) emphasizes the literature search and experimen-
tal design while the second course (2 semester hours)
focuses on the conduction of the research. This sec-
ond course culminates with a paper written in the con-
ventional format; introduction, materials and meth-
ods, results, discussion, and literature citations. In ad-
dition, students discuss their work in a 15 minute oral
presentation and submit a posterboard.

The two course sequence emphasizes written com-
munication yet is unlike a typical "writing intensive"
course. Both the proposal and final paper are often
short...perhaps 6-8 pages. Emphasis is directed toward
student understanding of the fluid nature of science.
That is, experimental designs often must be modified
as a study progresses, the relevance of literature var-
ies as data are acquired and analyzed, and the at-
tributes of the good scientist and writer are under-
-scored. These include flexibility, persistence, the ca-
pability to be self-critical, and the dedication to dis-
covery or new ideas.

P.III.3. Educational Forum II:
What is a Biology Major?
Leona Truchan, Alverno College; Buzz Hoagland,
Westfield State College and Rob Wikel, Doane College

NO ABSTRACT

P.III.4. Evolution Towards an Open-ended
Teaching Strategy in Invertebrate Zoology
Robert L. Wallace, Ripon College

"If, as Louis Pasteur said, only prepared minds
make discoveries, science educators must ask who
prepares those minds and how is that preparation best
accomplished?"

I have been employing the precepts implicit in this
quote to establish new directions in my teaching. Here
I present a synopsis of my struggles to do this in my
favorite discipline, invertebrate zoology. No doubt
these explorations are no different from others, but the
progress I've made in reinventing my teaching may
be of interest to members of the AMCBT.

Over the past two decades at Ripon College my
exploration have moved me from a tell-'em-what-they-
need-to-know philosophy to a more open-ended teach-
ing strategy. This strategy holds that under many cir-
cumstances providing less information in the class-
room setting actually provides more learning (i.e.,
knowledge and insight). It certainly can provide much
more enthusiasm and it often reaches the disengaged
student, without isolating those already engaged. To
adopt this sort of teaching strategy I have had to aban-
don several notions, chief among these are you-need-
to-know-this and the-problems-I-pose-to-you-are-the-
most-important. With that in mind I have attempted
to develop a learning atmosphere that encourages stu-
dents to explore questions that are meaningful to them.

In my presentation, I will discuss the current struc-
ture and operation of my invertebrate zoology course,
offering examples of how I attempt to engage the stu-
dents, present specific in-class/lab questions that are
meant to stimulate discussion, and provide sample
problems that my students have explored in recent
years.

P.III.5. Visual Learning in the Curriculum
Ethel Stanley, Beloit College

Have you considered the use of biological images
as populations to be sampled? Visual datasets allow
students to practice necessary visual skills and explore
visual approaches to problem solving within specific
areas of biology. New visual datasets are presented
with an introduction to some of the visual learning
strategies along with their use in undergraduate
courses. Proactive design of visual learning expe-
rences within the biology curriculum is urged.
Concurrent Field Trip and Workshop Sessions:

W.I.1.  Sugar River Canoe Trip, Dave Waller, Beloit College
A canoe trip down one of the small rivers between Brodhead and Monroe. Assemble at the west entrance of Pearson's hall. (Limit 10 people)

W.I.2. Fossil Hunt, Carl Mendelson, Dept. of Geology, Beloit College
Several back road quarries waiting to show their treasures to you! Assemble on the first floor of Chamberlin hall and see our fabulous fossil crinoid collection which is displayed there. (Limit 10 people).

W.I.3. Prairie Field Trip, Yaffa Grossman, Beloit College
Newark Road Prairie is a 32.5 acre wet-mesic prairie that is owned and maintained by Beloit College. It is a remnant of a larger grassland system that occupied portions of southern Wisconsin prior to European settlement. Prairie ecosystems are distinguished by the dominance of a diverse array of herbaceous (non-woody) plants and the low abundance of woody plants. They occur in areas where rainfall is not sufficient to support forest trees, especially in areas with frequent fires. When fire is excluded, prairies may develop into woodlands and forest.

The Newark Road Prairie was never plowed, but it was mowed in the past. Current management includes prescribed burning to limit the development of woody plants and retain habitat suitable for herbaceous species. Participants in the field trip will examine the biological diversity at the prairie using several measures of plant species diversity. The development of woody vegetation on parts of the prairie will also be investigated.

W.I.4. DNA Labs - A Multi-Course Perspective, Karen Klyczek, University of Wisconsin-River Falls
Labs involving DNA isolation and analysis are appropriate for almost any biology course. Several hands-on activities that can be adapted to a variety of course settings will be demonstrated, including:
1. OK, I've spooled DNA, now what? - an investigation into DNA isolation from various organisms and methods for determining whether the material isolated is actually DNA
2. Beyond Of - forensic DNA analysis applications and case studies in medicine and ecology
3. Digital DNA - using readily available computer software to analyze DNA sequences obtained from the Internet

W.I.5. Internet and the Curriculum, Tim Mulkey, Indiana State University
NO ABSTRACT

W.I.6. ChemLinks: Revitalizing the Chemistry Curriculum
Sharon Anthony and Heather Mernitz, Beloit College
The ChemLinks Coalition is a 5-year curriculum development project funded by the National Science Foundation's Division of Undergraduate Education as part of its “systemic change initiative” in undergraduate chemistry education. We are developing and testing modular materials about chemistry and the environment, chemistry and technology in society, and the molecular basis of life. With these modules, designed for students and faculty to use in a variety of institutional settings, we change the way students learn chemistry by challenging them to formulate and solve real problems using active and collaborative learning strategies. By starting with questions and developing the concepts and methodologies to answer them, we model how science is actually done. Treating real, interdisciplinary problems of interest to students, we promote scientific literacy for all students (both science and non-science majors) and demonstrate the importance of science to society.

To introduce you to the ChemLinks philosophy we will do an activity from the module “What should we do about global warming?” In this module, students investigate properties of greenhouse gases and their potential link to global temperature changes. Emphasis is placed on understanding the chemical reactions that influence greenhouse gas concentrations, and in particular, determining which of our daily activities contribute significantly to rising greenhouse gas concentrations. Your task will be to determine whether your breathing or your car release more carbon dioxide into the atmosphere in a year.

W.II.1 Case Writing I, Margaret A. Waterman, Southeast Missouri State Univ.
The use of realistic, complex problems can provide science faculty a way to bring meaningful connections to related science concepts. Because this approach uses complex, ill-defined problems, case-based learning can promote integration of content across several disciplines. As students explore the scenario and suggest courses of action, they see a need for integrated and useful scientific knowledge.

This is designed as a two-part workshop. In part I, participants will see examples of cases used for undergraduate biology teaching, may experience learning with a case, and then they will begin to draft a case. In part II, a group case review approach will be used to help case authors plan further work on their cases. Discussion in part II will depend on participants' interests, and may touch on assessment, teaching approaches, integration of material across disciplines, and other topics.

W.II.2 Computerized Lab Practicals using Digital Chisel & Connectex Color---Quick Cam by Harold L. Wilkinson, Millikin University
Have you ever had to give a make-up for a lab practical? Maybe your students need a little practice before taking the actual practical exam. This workshop will inform you about an alternative that may save you some time and complaints. Using the Digital Chisel computer software for the Macintosh and the Connectex Color Quick Cam, you will learn how to construct computerized lab practicals with relative ease. Ability to use the Macintosh computer desired but not necessary.
W.II.3. Case It! - A Collaborative, Web-Based BioQUEST Project to Integrate Case-based Learning into National Biology Curricula Using Molecular Biology Simulations
Mark Bergland and Kim Mogen, UW-River Falls
This workshop will provide updated information on the status of the Case It! project first conceived at the 1995 BioQUEST Summer Workshop. Results of class-testing of the “DNA electrophoresis module for Case It!” will be discussed, and participants will be able to use the module to analyze existing cases or build their own case using internet resources such as Genbank.

W.II.4. Dairyland Seed Tour: Evolutionary Biology in Agriculture
John R. Jungck, Beloit College
Students often presume that “Evolution” as a class is highly philosophical, historical, literary, conceptual, and mathematical. My “Evolution” class is all that, but it is a laboratory and field course as well. One field trip that better helps them understand the commercial utility of a deep understanding of evolutionary biology is to Dairyland Seed International in Clinton, WI. The researchers at this company regularly do mass selection on hundreds of thousands to millions of plants in order to produce a new commercial variety. They select for resistance to insects, bacteria, and fungi, for durability in cold, wet, hot, and windy conditions, and for low use of fertilizer. The intensity of the breeding and selection programs as well as the scientific foundation of the staff in population genetics, plant pathology, agronomy, soil science, and statistics unfailingly impresses many students who, though they have a strong love for working “outdoors,” have never even considered agriculture as a potential scientific career, much less as an important area of evolutionary biology.

W.II.5. Wisconsin Fermentation Tour, Marion Fass, Beloit College
Beloit is a regional center for food processing, and now the home of Gray’s Ale, an excellent microbrew. Join us for a tour of Gray’s Brewery led by founder, Fred Gray, to discuss the role of microorganisms in food production.

W.III.1. Case Writing II, Margaret A. Waterman, Southeast Missouri State Univ.
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W.III.2. Internet Friendly or Internet Phobic? Uses of the Internet in College Biology
Marion Fass, Beloit College
While I think that there are a variety of people who can address this – Ann Larson from UIS is developing data sharing for student analysis, John Jungck uses genetic sequences from the web for between-species comparisons, I simply use disease surveillance information for my emerging diseases course and am working with students to assess credibility of web resources.

This will become critical as more of our students come to campus with internet experience, but not the skills to discern credibility or to find scientifically-important data. We will be challenged both to keep up with them and to guide them. We need to begin discussions on the best ways to benefit from these new technologies in the classroom and the lab.

W.III.3. Workshop Evolution: Using a BioQUEST Simulation (EVOLVE) and the JMP Statistical Package to Examine Fisher’s Fundamental Theorem of Natural Selection
Frank Price, Hamilton College
This hands-on workshop aims to give participants experience with how software can be used to enhance students’ understanding of evolution, of experimental design, and of the value of examining multiple, diverse, rich and dynamic visual displays of quantitative information.

We will briefly introduce participants to EVOLVE, a BioQUEST simulation of microevolution. The program allows students to use demographic rates of survival, reproduction and migration of three genotypes to ask and answer questions about natural selection, genetic drift and gene flow. Importantly for students’ learning, EVOLVE allows them to overlay graphs of data on any combination of nine different population parameters over time. However, students often progress beyond these basic graphs and ask questions that suggest more abstract representations of data, such as rates of change vs time, or vs allele frequency. Fortunately, EVOLVE results can be imported into other software tools that enable students to answer those additional questions.

The majority of the workshop will give participants experience with the JMP statistical package (SAS Institute) and how it can enhance students’ understanding of evolution, of data manipulation, and of the value of examining multiple representations of data. Compared to other software (e.g., spreadsheets), JMP is unusually easy to use, yet provides extraordinarily powerful data manipulation and rich and dynamic visual displays of data. Participants will use JMP and EVOLVE data to examine a variety of displays such as change in allele frequency vs frequency, and ternary plots of genotype frequencies. Finally, we will compute and graph mean and variance of population fitness to examine Fisher’s fundamental theorem of natural selection, which states that the rate of increase in fitness of a population is equal to its genetic variance in fitness.