CONCURRENT PAPER SESSION I

The Evolution of Service-Learning: Fostering Curiousity and Reflective Practice in an Evolution Course; Mindy L Walker, *Rockhurst University*

The challenge of incorporating service learning and reflection into a course about the principles of organic evolution is a daunting one. In a pilot project to do just that in a senior-level Evolution class, I asked that students participate in the cooperative efforts of global grid-computing projects. Contributing to these projects permitted students to take part in the collective effort to understand 1) the molecular nature of disease, or 2) global climate change, both pertinent issues in society and evolutionary biology. In conjunction with the computing aspect of the project, students conducted interviews with people who were intimate with the topic of their project and maintained blogs to reflect on their endeavor and to answer posted questions. Not only did this project clarify the nature and causation of disease and global climate change, it made these topics "real" to the students and promoted an understanding of the effects of evolution in society and its impact on societal thinking.

Microbe Cards Project; Nighat Kokan, *Cardinal Stritch University*

The microbe cards project allows students a means to reinforce their learning about the different microbes discussed in a microbiology class. This semester long project integrates what student learn in lectures, through individual research and peer presentations to a microbe "road map" that they develop over the course of the semester. Students get a master list of microbes at the beginning of the semester which is posted to their course website. Students make 3" x 5" colored index cards in the following categories: bacteria, viruses, protozoa, fungi and miscellaneous agents of disease, with each category getting a specific color. Students bring these cards to their lectures to add additional information in class and during peer presentations. Simple recall, online tests and in class pretests are used to assess student learning during the semester with an in class final exam at the end of the semester. This assignment allows students to integrate the different microbes and etiologic agents of disease with another "Microbiology in the News" project presented last year (see ACUBE 51st Annual Meeting Abstracts, 2007). Execution of the project, microbe lists, test questions, student assessments, and responses will be presented at the meeting.

Defending the Lowly Prokaryotes: new Challenges for BIOGaia Learning Activity; [1]Abour Cherif, [1]Linda Michel, [2]Farah Movahed Zadeh, [1]Robert Aron, *[1]DeVry University, [2]University of Illiois at Chicago*

In this learning activity the students assume the role of geneticists, bioengineers, microbiologists, pharmacologists, pathophysiologists, and those who have expertise in the field of ethics, to plan and implement strategy for the members of the bacteria domain to protect themselves from other life forms on Earth. Students work together to collect information and acquire the knowledge to solve the problem; develop and implement a protection plan for members of the bacteria domain; and then "act out" conflicts. They also learn to take on the roles of others, and improve their social skills and academic performance. By actively engaging in this activity, students learn and re-enforce their understanding of the composition of the cell membrane and membrane lipids, and the relationship between cell wall, cell membrane, and antibiotic and in turn cell reproduction.

Biology on the Cheap: Using Technology to Get More Biology for the Buck; James Clack, Division of Science, Indiana University – Purdue University

Departments, schools and universities continually struggle to implement and maintain laboratory courses in the face of expanded technologies and increasing costs. One solution to these problems may lie in taking advantage of advances in technology that result in lower cost of implementation of equipment used for labs. Examples of emerging generations of equipment and software that can be used in areas such as image acquisition and analysis, fluorescence imaging, data acquisition and analysis, and other technology applicable to laboratory analysis will be compared. A simple analysis regarding the relative user-friendliness of hardware/software combinations versus relative cost will be presented. Other examples of possible cost-saving areas will be discussed.

CONCURRENT WORKSHOP and ROUNDTABLES* SESSION I

Evaluating the Need for Non-Majors Biology Introductory Survey Courses; Led by Stephen S Daggett, *Avila University*

Many college and university biology departments offer more than one introductory survey class: one for majors and at least one for non-majors. The reasons for this segregation vary with the institution's needs and resources. In addition, biology is not the only science that has implemented this segregation. Chemistry and physics have implemented non-majors courses as well. However, the sciences are a minority among the academic disciplines in offering these courses. At a time when there are national concerns about science literacy and how to assess learning, is it time to evaluate this split between majors courses and non-majors courses? This round table discussion will explore the history of this practice, the current status of these courses, and consideration of the question about whether this is healthy for science education.

How to Turn a Lecture into an Active Learning Experience; Debra Meuler, *Cardinal Stritch University*

Signal transduction is one aspect of the complex system cells use to coordinate basic cellular activities. Most often, signal transduction is taught using a lecture format where students passively listen to a professor describing the mechanism for a particular signal transduction pathway. Research indicates, however, that deeper learning occurs when students are more actively engaged in the learning process. Active learning is a teaching pedagogy that engages the student in the learning process and focuses the responsibility of learning on the learner. Active learning moves the classroom from a teacher centered learning environment toward one that is more student centered.

In this presentation I will model an activity in which a traditional teacher centered lecture on signal transduction is converted to an experience where students are actively engaged in their own learning. During the workshop, the audience will participate in an activity that uses guided questioning to construct a model for how receptor tyrosine kinases transmit a signal to the interior of a cell via the Ras pathway. This approach proved very successful for teaching signal transduction in an undergraduate cell physiology course and has an added advantage in that it provides a template for teaching other topics using an active learning approach.

Planning a Darwin Day; Tara Maginnis, *St. Edward's University*

February 12th, 2009 will be the bicentennial of Darwin's Birthday, and provides an exciting opportunity to educate your campus community about evolutionary biology, Charles Darwin,

and the contributions he made to science. During this session, I will present a variety of ideas about hosting an event that span small, 50-minute classroom activities to large, campus-wide commemorations. Afterwards, a roundtable discussion will hopefully provide attendees with further suggestions and agendas to celebrate Darwin's 200th birthday to some capacity at their institution. Please specify whether you prefer Finch Fries or a Dodo Dog to accompany your Primordial Punch (Cambrian Chips & Salsa available for an additional fee).

***Assessment Using Student-Generated Questions**; Led by Paul Weihe, *Central College*

Many forms of assessment involve asking students questions. However, much like the process of interviewing the candidate for a job, the questions students themselves ask may be much more indicative of their knowledge, skills, and attitudes. I present several methods I use to incorporate student-generated questions both in and out of class, and discuss what these questions reveal about the student's past learning and about the student's future activity. Among the techniques discussed are quick hand-written notes in class discussion; questions for other students during peer-review; and questions asked and answered by the student on an exam. These questions involve higher-level thinking skills including synthesis and critical analyses, and will typically lead to further learning. I will also discuss strategies for incorporating student's questions into assessment initiatives.

***Do Graduating Seniors Really Understand Scientific Method and Its Application?**; Led by Aggy Vanderpool[1] and Tom Davis [2]; [2]*Lincoln Memorial University*, [1] *Loras College*

CONCURRENT PAPER SESSION II

Collaborative Experiments and Tours in Introductory Plant Science Course; I.P. Handayani, K. Wimberley, D. Ferguson and P. Williams, *Murray State University*

Collaborative experiments and tours involving crop, horticulture and soil science were developed to enhance students understanding in Plant Science at Murray State University, Kentucky. These activities were seen as a potential mean to use knowledge in a typical fashion while at the same time generating enthusiasm for the subject. Evaluation of three terms showed that these activities foster knowledge creation and transformational learning and the course became more effective than conventional (lecture-based) approaches. Discussion on particular experiment and tour in crop, horticulture and soil science will be addressed during presentation.

Assessing Undergraduate Research; Gains in Learning and Skills in Biology, Mathematics, and Biomathematics; Terry Derting and Renee Fister, *Murray State University*

Although students gain knowledge and a variety of skills through undergraduate research experiences, assessment of these diverse gains is sometimes difficult. Such gains can also occur through inquiry-based classroom activities. We will present and explain a variety of tested assessments which can be used to determine gains in students understanding of science as a process of inquiry, student perceptions of the contributions which research experiences provide to them, and ways in which technology can enhance student learning in mathematics and the sciences. The assessments we present are applicable to many situations involving hands-on learning activities in addition to formal undergraduate research programs.

Medicinal Plants Taught as an Interdisciplinary Course: Content, Process, and Assessment; Joyce V. Cadwaller, *Saint Mary of the Woods College*

Medicinal plants are interesting biological entities which are popular throughout the world as alternative medicines, i.e., cheaper options to ones produced by drug companies. Medicinal Plants: Science and Culture is a course which explores the some of the major groups of medicinal plants, their biology and chemistry and how they are used. Comparison of Kenyan (African) and North American Indian remedies by the students are made to bring in the cultural aspects of the use of plants. Use of some of these plants in a religious context is explored both culturally and scientifically. Some of the most well known drugs used in religious ceremonies are psychoactive and the students explore this aspect of medicinal drugs and their use. The course involves student presentations in the campus format and a series of research papers in the distance format. All interdisciplinary courses at the College have a college-wide assessment component which must address a controversial issue related to the topic and since this is a new course, it also needs to be assessed for its effectiveness. Examples of the College-wide and course assessments with the developed rubrics will be shown

Cooperative Learning Activities in Human Anatomy and Physiology; Kathleen Marr, *Lakeland College*

Human Anatomy and Physiology courses tend to be fact-driven and concept loaded. Lab activities traditionally over-focus on anatomy and go light on physiology and clinical applications. Two activities involving cooperative learning are presented as practice in this session to demonstrate problem solving, critical thinking skills, application of physiological principles, cooperative learning and peer evaluation. One exercise is rooted in Cardiovascular physiology with respect to Dr Death's (Kevorkhian's) suicide machine. The second activity relates to oxygen/carbon dioxide levels in diving. Both activities will be part of the presentation as well as how they can be used to assess student learning and critical thinking skills.

CONCURRENT WORKSHOP and ROUNDTABLES* SESSION II

Effective Understanding of the Human Body Organs: A Role Play Activity for Deep Learning; Abour Cherif[1], Dianne Jedlicka[1], Ateegh Al-Arabi[2], Sujata Verma[3], Robert Aron[1], [1]*DeVry University,* [2]*Johnson County Community College*[2], [3]*Ivy Tech State College*[3]

In this learning activity each group of students assumes the role of a human body organ. The group then designs and implements a plan to argue that this organ is the most important one in the human body. Students work together to collect information and acquire the needed knowledge to design and develop a plan and then "act out" the plan by successfully arguing that their selected organ is the most important one in the human body. By doing so, they learn to make choices, and to take on the roles of others, and improve their social skills and academic performance. By actively engaging in this activity, students learn and re-enforce their understanding of the composition and the functions of body organs and organ systems, and interrelationship they all play in specific organized fashion that help the survival of the living body as a whole and in turn provides a state of homeostasis throughout life.

Nature Education Genetics; Robin McGuire, *Nature Education*

Nature Publishing Group, one of the world's leading publishers of science research and journalism, will launch "Nature Education" in the fall of 2008. The Nature Education product line is intended to provide a new and fresh online approach to higher education science learning which fosters global communication and collaboration, not only in developed but also under-developed countries that would normally not have access to highly valuable education resources.

This presentation will be a demonstration of the new Nature Education Genetics website, a cost-free, genetics focused site specifically geared for use by higher education students and faculty. Nature Education Genetics is content rich, web 2.0 enabled site focusing on evidence-based content with many of the community-based features that will engage students in information sharing and collaboration. Faculty can create online course packs for their students by choosing content from categories such as What Do We Know?, How Do We Know It? and Why Do We Care?, each of which incorporate treatments of historical or contemporary research activities alongside thoughtful discussions of key genetics concepts. Nature Education Genetics is the first of the science sites that will be created by Nature Education for higher education audiences under the Nature Education umbrella.

***First-Year Biology Courses-The Good, The Bad and…..Teaching Well-Prepared and Under-Prepared Students in the Same Course**; Led by Aggy Vanderpool, *Lincoln Memorial University*

***The Adult Learner and Self-Assessment**, Led by Marya Czech, *Lourdes College*
Assessment strategies in our various undergraduate courses may be inadvertently biased toward full-time, traditional age students. Adult learners, who are now 40% of the nationwide undergraduate population, present a challenging case study for assessment for several reasons:

- They may have experienced various forms of evaluation and assessment in the work place which differ from assessment in the academic setting.
- Their skill at memorizing and processing facts may be inferior to that of fresh-out-of-high school students.
- Their study skills are rusty at best.
- Their motivation and enthusiasm for learning may be at a higher level than that of their traditional counterparts.
- Their critical thinking skills are best exemplified and honed in writing and speaking, cooperative learning, group work and discussion.

Attendees will be free to share their experiences with adult learners in the science classroom and lab and discuss possible assessment strategies which maximize the experience for both institution and students.

***Sharing Ideas and Approaches to Program Level Assessment**; Led by Laura Salem and Chad Scholes, *Rockhurst University*

What are the goals you want for your biology program? What learning outcomes do you have for your program? Assessment at the program level provides us with information about how students meet program level learning goals. In this session, we will share our work on program level assessment including development of a senior exit survey for biology majors and a matrix developed to map skills and content in our curriculum. Our discussion will center around how to develop and assess program level goals for biology majors.

Concurrent Workshop Session III

Effective Learning Outcomes; Rebecca Burton, *Alverno College*

The first step toward developing effective assessments is developing meaningful learning outcomes. In this workshop we will discuss attributes of effective learning outcomes and work in small groups to apply these concepts to course and program outcomes. We will also discuss how student progress towards the learning outcomes can be assessed. If time allows, we will work on developing criteria to be used as rubrics and for self assessment.

CSI Converse Summer Workshops-A Model for Promoting and Increasing Participation of High School Students in Sciences; Neval Erturk and S Strickland, *Converse College*

According to the 2002 National Science Board Report, the United States will need to train and educate an additional 1.9 million workers in the scientific field . However, recent research indicates that interest of American high school students in studying Science, Engineering, Technology and Mathematics (STEM) fields has continued to decline during the last 30 years, and attracting high school students to these fields remains a challenge.

In order to motivate high school students towards sciences we designed a one week long interdisciplinary workshop. Our purpose is to introduce students to basic knowledge of biology and chemistry presented in a familiar and exciting context—Forensics. During the workshops students are introduced to biological and chemical knowledge and skills in the context of crime scene investigation. The workshop covers fingerprinting, forensic DNA analysis, basics of microscopy, basics of chromatography, density analysis, blood typing, and other related laboratory skills. The course is enriched with lectures given by CSI professionals and a field trip to the Crime Lab. The students are given a comprehensive evaluation at the end of the program. Our evaluations show participants feel motivated and excited about science after attending the CSI Converse workshops.

The Experimental Design Ability Test (EDAT); An Assessment Strategy to Probe Critical Thinking; Karen Sirum, *Bowling Green State University*

Undergraduate science education goals include development of students' scientific thinking skills, valuing evidence, and the propensity to use these skills and values in everyday decisions. An integrated assessment approach, including the design and implementation of a new instrument called the Experimental Design Ability Test (EDAT), is being used to assess learning in upper level biology courses and an introductory biology course that aims to bring these skills and values to all students.

The EDAT measures gains in students' understanding of the criteria for good experimental design through their open-ended response to a prompt grounded in everyday life science problems. A simple and specific scoring rubric is used to analyze student responses and provides for consistent and rapid evaluation.

In addition to the EDAT, the California Critical Thinking Disposition Inventory is used to assess gains in students' disposition to use critical thinking and the Student Assessment of Learning Gains survey is used to determine students' self-reported gains in knowledge, skills, and attitudes in science.

Participants in this session will have the opportunity to use the EDAT and learn about a new scientific thinking skills test that may help provide an answer to the question "How do we know there is learning?"

Digging in Time: Stories Fossils Tell; Gerald Adams, Abour Cherif, *Columbia College Chicago, Devry University*

Scientists study fossils for two basic reasons: 1) to understand the history of life on Earth, and how living things have evolved through time; and 2) as a tool to help decipher the ages of the earth materials in which fossils are found. This activity is meant to introduce students to fossils; what they look like, how they form, where they are found, and how they may be used to answer "larger" questions. We have used the following hands-on-activity effectively in college introductory biology and geology classes. The activity has been effective for our students who are media, art and communications majors, who are taking science classes to complete their General Education credits required for graduation. We intended that the activity would help students fulfill the General Education science outcome "to develop basic scientific literacy, demonstrate scientific thinking skills, and understand the scientific method of inquiry". Recently, we have modified this activity for high school biology and earth science classes where it has initially met with the same success and student enthusiasm. The activity as we've presented it is intended to be modified to fit whatever the individual teacher or department has available in the way of fossils.

The activity is divided into two parts: The first part is written for teachers who decide to try this activity in their classes. The second part is the complete students' handout and student review and discussion questions that are actually given to students who participate in the activity.

POSTER SESSION and SUSTAINING MEMBERS EXHIBITS

Teaching About Plants Outside Biology Class; Paul Weihe, *Central College*

Many college students, even Biology majors, have little experience studying plants. I argue that everyone needs a basic understanding of botany and its relevance to life on Earth. Further, Biology majors in particular must have an appreciation for the insights about life science gained from studying botany. Here I present several examples of activities I use outside of Botany class to teach about plants, even in a Gen-Ed setting. Activities involving ethnobotany (maple syruping, tea infusions, dyeing), plant ecology (insect galls, community similarity comparison), plant evolution (comparative survey, identification keys), and simple anatomy & physiology are discussed. I also propose specific botanical knowledge and skills I believe every Biology student should have, and also basic concepts every college student should know

Addressing the Problem of the Underprepared Student in Literature-based Seminars; David J Matthes and Devavani Chatterjea, *University of Minnesota*

Literature-based seminars introduce students to the community of science and the scientific process in the most direct way short of actually working in the field or laboratory on independent research projects. Two common challenges in seminar courses, however, are that students don't know how to read an article in the primary literature critically or how to make substantive contributions to the discussion of the articles that they read. The learning impact of the seminar is reduced in proportion to the number of students who come to the seminar underprepared and/or don't participate actively in the discussion. We have developed a general, iterative assessment strategy that addresses both of these issues and has made a dramatic impact on the quality of the seminar courses in our department. Both student preparation (% of students who have read and engaged the article critically before the seminar) and student participation (% of students who

make a substantive contribution to the discussion) have approached 100% for each week of the seminar. Student ratings of these seminar courses have also been among the highest in the department suggesting that students readily accept the additional feedback required of them in this course design.

From a phenotype to a gene: a guided inquiry laboratory series for undergraduate students; Irina Makarevitch, Hamline University

In introductory genetics courses, one of the most difficult topics for students to grasp is gene mapping and positional cloning. Complicated logic of multiple sequential steps necessary to identify a gene controlling a phenotype presents a problem for students. Here we present a series of inquiry laboratory exercises providing students with hands-on experience in gene mapping and positional cloning analysis of maize mutant genes controlling an easily scorable phenotype. The Laboratory series we developed takes five three-hour periods and includes the following activities: (i) mutant screening and tissue collection, (ii) DNA isolation, (iii) choice of appropriate markers, (iv) PCR and gel electrophoresis, (v) genetic distance calculation, and (vi) genome sequence analysis aimed at identifying a potential candidate gene and confrming it's identity by DNA sequence analysis.

The instructor can choose the mutant line from a vast collection of publicly available maize lines carrying easily scorable mutant phenotypes controlled by partially or precisely mapped genes. The choice of genes that have been only mapped to a chromosome bin (approximately 1/10th of a chromosome) would allow for a more open-ended inquiry based research Lab as opposed to a Lab for which an answer is known. We will present the layout and details of this series of Lab exercises, including students' results and assessment of student learning.

The Four Hour Introduction to Bioinformatics; David J Matthes, *University of Minnesota*

With the explosive growth of publicly-accessible bioinformation and the freely-available online computational tools for finding and analyzing that bioinformation, the time has come to ensure that all biology students are introduced to bioinformatics. While it would be best for students in the biosciences to have a semester-long course in the use of bioinformatics tools and databases, offering even a brief introduction to the subject can be transformative. Three elements define an effective introduction to bioinformatics. First, the seminar must be hands-on with an internet-connected computer for each student or pair of students. Second, the seminar should be question-driven such that students experience the power of online bioinformatics tools and databases for helping them explore relevant questions. And third, the seminar should be tailored to the existing skills and knowledge of the students involved and carefully designed to provide maximum value for those students. Here I present examples of content – learning objectives, task descriptions and student work – for two bioinformatics seminars, one for incoming freshman biology majors and the other for incoming graduate students in the biosciences, and discuss issues of assessment that both shape the seminar and justify the time and resources such a seminar requires.

Using Pre-Assessment to Identify At Risk-Studetns in an Introductory Microbiology Course; Alex Lowery, *Gainesville State College*

Some students taking our microbiology course, designed for health professions majors, lack the recommended course prerequisite and/or may come poorly-prepared for study in such a rigorous, content-intensive science course. To identify these "at-risk" students, I gave a pre-test (scored to a maximum 100 points), containing questions on basic math, cell biology and chemistry, to all my students on their first day of class from Spring Semester of 2006 - Spring Semester 2008 (n = 289). The mean score for the test was 69, with the distribution of scores as follows: 6% of students scored 90 - 100; 17% of students scored 80 - 89; 26% of students scored 70 - 79; 29% of students scored 60 - 69; and 22% of students scored < 60. This lowest scoring group I considered to be "at-risk" and offered advise, especially regarding early withdrawal from the course, seeking out tutors, or just simply spending extra time studying. This group ultimately made up nearly one-half of all the students who eventually withdrew from the course. Having the recommended course prerequisite (a college-level biology course) was important to student success. Students with the prerequisite had a average score of 70 on the pre-test, whereas students lacking the prerequisite had an average score of only 56. Furthermore, fewer than 10% of the former group withdrew from the course compared to 30% of the latter group (and all of these students scored < 60 on the pre-test). These results demonstrate the predictive potential of using pre-assessment to spot at-risk students.

Ecological Issues in Soil Science Laboratory Course; I. P. Handayani, *Murray State University*

The objectives of this course are to build basic laboratory skills and understand the role of ecosystem to address soil problems regarding to sustainable agriculture. The paper will describe an interactive class project to help students visualize the effect of various land uses (i.e., forest/woodland, grassland/pasture, cultivated field) on soil characteristics. Students collected soil samples from the local farms and analyzed them in the lab. Written reports on these activities were prepared in the style of scientific journal articles or posters. This course also presents opportunities to teach simple statistics, such as mean, standard deviation and coefficient of variation. Discussions among students improved the understanding about the limits of numerical data, their analysis and interpretation. Students struggle with the expectation that reports are presented in journal article or poster, but overall response to the course has been positive. Through inquiry based work, students can construct a personal understanding about the process, practice, and outcomes of exercise. This project is adaptable for use at diverse educational levels in biology and ecology.

Integration and Evaluation of Research in a Cell Biology Lab—The Effect on Learning Outcomes; Christine Bezotte, *Elmira College*

This laboratory component addresses the "detachment" students perceive between classroom learning and its application to "real-science." By incorporating the practical aspects of investigative research and analysis, the lab provides contextual relevance to understanding the biology behind an observed effect. An active learning opportunity enhances problem solving and encourages critical thinking skills through evaluation of research applications and its resulting data. The goal of the project is to engage students in relevant contextual learning experiences; the idea is to allow them to *demonstrate* the *knowledge* they have acquired.

The lab is not a “cook book” course, but a series of exercises that are designed to explore a problem or concept. Students are introduced to many research techniques and utilize "state of the art" equipment. The students have the opportunity to experience the dedication and perseverance required for research. The pre-lab class meets for regular ‘research meetings” to discuss results, problems, methodology and directions. They must demonstrate the extra effort to understand the principles behind the experimentation. Students ask the question, then design, execute and analyze their results.

The exercise encourages student integration of learned concepts in Cell Biology in ways that have scientific significance. Observed results will be presented and discussed

The Neurobiology of Addiction: Assessment and Collaboration; Debra Murray and Glena Temple, *Viterbo University*

In 2005, Viterbo University launched Biopsychology, a collaborative interdisciplinary major. Each semester either Biology or Psychology offers a seminar course. In the spring of 2008, instructors from Biology and Psychology collaborated to offer a seminar course “The Neurobiology of Addiction”. The instructors worked collaboratively emphasizing the neurobiology or psychology of addiction. In this special topics course students read and reviewed recent, relative research in the area of neurobiology of addiction. Students worked in small groups to present overviews of the articles selected for class discussion. Students also developed presentations for their peers and as part of the final they completed an in depth study of a particular topic relative to the neurobiology of addiction. At the end of the semester students responded to a survey assessing their learning relative to neurobiology and substance abuse. One hundred percent of the students identified the symposium as effective or very effective to their overall learning. We asked about their review of research articles 12.5 responded that it was an ok learning strategy, 25% said it was effective, and 62.5 said it was a very effective learning strategy. This poster will provide instructions for replication of similar teaching formats for science courses.

Assessing Learning in Biology Classes; Kim Fredricks and Debra Murray, *Viterbo University*

In the spring of 2008, the Biology and Psychology Departments of Viterbo University initiated a collaborative learning project emphasizing neuroscience and addictions. A major emphasis of this project was to incorporate active learning strategies into the assessment process. Previous research has shown college students involved with active learning make connections and retain information more effectively (Angelo and Cross 1993, Meyers and Jones 1993, and Bonwell and Eison 1991). The main objective for this project was to engage students in active learning strategies to facilitate connections between neuroscience and addictions. The assessment /active learning strategies consisted of three independent components: (1) developing a case study, (2) creating midterm examination questions with answers, and (3) researching and developing a poster integrating neuroscience and addictions.

The evaluation process used an anonymous student survey and observations from instructors and mental health and addictions professionals. Thirty percent of the students rated the integration of alcohol and other drug abuse content into the neuroscience course as useful, and an additional 50% rated it as very useful. All students rated the substance abuse symposium as an effective learning strategy. The outcomes of the project supported integration of active learning strategies into the assessment process

Case Studies and Data Analysis Assignments as Tools for Improving Critical Thinking Skills in Anatomy and Physiology Courses; Kristen Walton, *Missouri Western State University*

Many biology courses, including lower-division courses for nonmajors, require students to learn an extensive amount of new vocabulary and concepts in a short time frame. Students often feel overwhelmed by content and chose memorization over more in-depth learning that involves critical thinking about the subject. The use of case studies and active learning are well-documented tools for improving student engagement and retention of content. To provide students in a one-semester anatomy & physiology course for allied health majors with opportunities to improve their critical thinking skills, case studies and data analysis activities were used as in-class or take-home assignments. These activities were written by the instructor or drawn from the National Center for Case Study Teaching in Science or published articles on teaching with classic papers in physiology. Many students demonstrated an improved ability to work through complex physiological problems, such as applications of homeostasis, by the end of the semester. Students were surveyed for self-assessment of the value of these activities in increasing their understanding of content and concepts. Activities that require students to analyze and apply content to case studies or data can increase student learning and critical thinking in anatomy and physiology.

Post-Course Communication with Non-Science Majors; Lynn Gille, Todd Egan and Mary Anne Perks, *Elmira College*

A desired learning outcome for non-science majors is some retention of concepts from their science course required for graduation after the course ends. However, this may be difficult to measure. We like to think our students reflect on their past experiences with science and continue to be interested and informed citizens as well as consumers of scientific information. However, to what degree does this really happen?

To facilitate continued interest in science, post-course communications have been used to maintain the students' interest, and serve as a way to assess their learning. Communication with students is facilitated using an online course management system, such as Blackboard or ANGEL. News stories relevant to the recently completed course are sent via the course-embedded email list. Feedback from students has been very positive, and no student has chosen to opt out of these communications.

Modular Curriculum for Introductory Genetics Laboratory Course Using *Saccharomyces cerevisiae* as a Model Organism; [1]Tristan J Lubinski, [1]Elizabeth M Denham, Michael J Piatelli, and [2]Gregory R Smith, *Boston College*, [2]*Lakeland College*

Laboratory courses provide a valuable opportunity for students to augment their education by gaining hands-on experience with the techniques and ideas they have learned about in lecture. However, these courses tend to be disjointed and they often struggle to maintain a cohesion that is necessary for students to connect various experiments both to each other and to lecture material. Here we present multiple independent yet interrelated modules for use in an introductory laboratory course using Saccharomyces cerevisiae as a model organism. Topics covered in this curriculum include basic yeast techniques, complementation, random spore analysis, gene deletion, transformation, plasmid mapping, mating type determination, and PCR primer design. While each of these modules can be performed separately, they are arranged in such a way that the

information learned in one module provides the background and some of the materials necessary for carrying out the next. The modules can be utilized in genetics, molecular and cell biology, and biotechnology laboratory courses, depending on which combination of modules is selected. Student performance is evaluated through the observation of laboratory practices and a series of lab reports. This curriculum has been implemented successfully in classes ranging from twelve to two hundred enrolled students.

Using Textbook Annotations as an Assessment Tool, Neval Erturk, *Converse College*

Throughout his/her career a college student must interact with a variety of written texts. A significant number of college students, however, find it difficult to utilize reading as an effective learning tool. A number of educators successfully incorporated textbook annotations as an effective and efficient study strategy for college students. In this paper I report the use of textbook annotations as an assessment tool. I evaluated 40 major (biology) and non-major college students enrolled in two introductory biology courses for the quality and consistency of their textbook annotations. No meaningful correlation between pretest scores and textbook annotation quality and consistency was observed. Pre-test/post-test comparison showed a positive correlation between the increase in students' learning and quality and consistency of textbook annotations.

Podcasting Biology Text Figures: Student Opinions; Kay Grimnes, *Alma College*

In fall 2006, we developed 3-10 minute audio podcasts for a selection of difficult figures in the Campbell and Reece "Biology" text for our first year majors class. The podcasts were designed to explain the figures in greater detail than possible during class, to relate the figures to past and future content and to help students understand the consistent illustration "grammar" used by the text illustration team. Podcasts were posted each week in a "just in time" manner, and students were able to subscribe through an iTunes link. Twelve students commented at the end of the term; 100% found them helpful, with such comments as "Great addition!" and "Podcasts rock!" Ongoing assessment during the term indicated that over 50% of students were utilizing the resource. In contrast, during the following fall, the podcasts were posted all at once and students could access them at leisure throughout the term. Regular use declined significantly, down from 50% to about 10% of students. We conclude that if these resources are not delivered in a way that interrupts the ambient "noise" of students' lives, they will remain underutilized and minimally effective.

Earth Day Organization: An Alternative Teaching approach; Montante J[1], Bee M[2], Clark K[2], Lanigan K[2], Grabowski G[2]; [1] Macomb Community College, Macomb County, MI, [2] University of Detroit Mercy, Detroit, MI

Alternative teaching styles provide a unique and rewarding approach to reinforcing student knowledge and developing social skills. An approach that we implemented required students from the ecology class to organize and present information at the university wide Earth Day celebration. The event included displays from several environmental groups, local and state agencies, student groups, student research, and a live band. Students' perception of the event, the knowledge they obtained, the impact it had on themselves, other students, and the community was significantly greater after the

event compared to before ($p<0.001$). We highly recommend this approach to other faculty.

Using Web-based Student Portfolios to Assess Program-Level Learning Outcomes in the Biology Major; Karen Klyczek, Mark Bergland, and E. Katherine Miller Biology Department, University of Wisconsin-River Falls

We have used web-based student portfolios to assess learning outcomes in the UW-River Falls Biology major for several years. Students begin their portfolios in a 1-credit course for incoming Freshman, and present the finished portfolios in as part of a 1-credit course for Seniors. Throughout their academic career, they select artifacts from their courses to link to their portfolios in order to demonstrate that they have met the various program outcomes. The portfolios therefore provide several direct measures of achievement. The portfolios also provide students with an opportunity to learn web page techniques, as well as to reflect on their coursework and other experiences such as undergraduate research and internships.

CONCURRENT PAPER SESSION IV

Science Faculty Learning Communities Promote Scientific Teaching: The Participant Assessment of Learning Gains Survey (PALG); Karen Sirum, *Bowling Green State University*
Science Faculty Learning Communities (FLCs) help faculty employ their scientific skills to consider what teaching strategies and environments best promote learning. The FLC group works together to provide feedback and support as participants design and implement new, non lecture-based, interactive teaching strategies based on teaching and learning research and using principles of scientific teaching. The web-based Participant Assessment of Learning Gains (PALG) survey was designed based on the Student Assessment of Learning Gains survey and implemented to assess the impact of FLC participation.

The PALG survey provides evidence that science FLCs have a direct impact on what faculty participants do in their classrooms, and it reveals how these activities impact student learning. FLC participants say they value most the opportunity to share ideas and activities about teaching and learning with colleagues. Significantly, participants report increases in the quality of student engagement/class discussion, student interest, motivation, class atmosphere, deeper learning, performance on tests, and attendance.

In this session, the FLC approach will be modeled and participants will learn how to:

- approach science faculty, and through FLCs, open the dialogue to talk about teaching and initiate pedagogical and curriculum reforms.
- customize the PALG survey for assessment of professional development programs.

Anatomy and Physiology with Instrumentation for Engineering and Biomedical Technology; Robert Aron, Abour Cherif, Dianne Jedlicka, Bill Phillips, Robert Lundak, *DeVry University*

In this presentation we will describe the development and the implementation of a unique course that integrates Anatomy, Physiology and Bioinstrumentation with a hands on approach. The course was developed specifically to meet the needs of students in the Biomedical Engineering Technology bachelor's degree program at DeVry University. It presents the basics of human anatomy and

concentrates on the physiology of the major organ systems. Unlike traditional A&P courses, the laboratory component delves much more deeply into the electronic concepts of obtaining signals from a human subject. The goal is to provide the student with a substantive introduction to the technical aspects of the instrumentation without losing the fact that this is A & P course. Devices using intuitive graphical programming languages are introduced to complement the electronics concepts and familiarize students with the skills needed to capture data via analog to digital and digital interfaces with a computer. This course begins the sequence of major courses in the Biomedical Engineering Technology curriculum. We feel that a course such as this, with its pedagogical approach, would also be effective in preparing physiologists or biologists for human, animal physiology or biology research as well. In the presentation we will share our experience of designing, developing, and implementing the course. We will also discuss student's evaluation and the outcome of the course.

Simplifying and Refining General Education Learning Outcomes in Introductory Biology Courses; Bobby Ann Lee, *West Kentucky Community and Technical College*

After the first year of implementing general education learning outcomes in 2006-2007, the learning outcome measurement was refined and simplified to one assignment in select biology courses. The second year rubric and student handouts were reviewed both by the Southern Association of Colleges and Schools Visiting Team in fall 2007 and were given positive feedback. After using this instrument for two semesters in 2007-2008, a comparison is presented between the simplified instrument and the first year learning outcome strategy. Student data and an improved rubric especially for evaluating critical thinking are shown.

Are My Exams as Bad as Students Say? A Three Semester Analysis of General Biology Exams; Chad Scholes, *Rockhurst University*

I assessed student performance on General Biology II exams over three semesters. All exam questions were labeled as "A" (comprehension/knowledge), "B" (application), or "C" (analysis/synthesis). Performance on two question types, 1) "A", "B", and "C" as described previously and 2) multiple-multiple choice, multiple choice, or essay/problem were compared by the final grade earned in the class. Overall, students performed at a higher level on multiple-multiple choice exam questions than on other types, despite their expressed dislike of these questions. Students who earned an A in the class performed better on essay, "B" (application) and "C" (analysis/synthesis) questions than students who earned lower grades. Generally, students who earned a B in the class performed better overall on exams than students with lower grades, and so on. A class with 23 students was marginally too small for me to detect differences between some of the question types.

CONCURRENT WORKSHOP SESSION II

Using *Physarum polycephalum* for Independent Research Projects for First Year Students; Janice Bonner, *College of Notre Dame of Maryland*

The acellular slime mold *Physarum polycephalum* is an ideal organism for independent research projects for first-year students. Its life cycle includes several distinct stages that can easily be distinguished and it can be induced to move from one stage to another by manipulation of nutrition and light. *Physarum* is easily grown on 2% non-nutrient agar, fed oatmeal flakes, and maintained at room temperature. Students can often design their own experimental apparatus from PVC pipe and plastic storage containers. Typically, the entire experiment of a research

team can be stored in a medium-sized box. Because *Physarum* is used extensively in developmental research, there is an extensive literature base. At College of Notre Dame of Maryland, first-year biology students design and conduct semester-long research projects involving *Physarum.* Students present their results in a formal symposium and in a 10 to 12-page laboratory report. Because the same organism has been used by first-semester students at the college for many years, its use has become a "rite of passage" for students in the department, linking students within the major. This workshop will provide participants with an opportunity to observe *P. polycephalum* and to learn how it can be used for first-year student independent research

Biology 135 (Basic Anatomy and Physiology) A Course Revision Process: Covering All the Bases and Heading for Home; Sharon Fugate, Marlena West, and Terry Tillen, *Madisonville Community College*

This presentation highlights a Teaching Community approach to the planning, implementation, and assessment of a course restructuring of Biology 135, Basic Anatomy & Physiology. The course restructuring utilized Title III resources and consisted of three semesters of planning and implementation with evaluation of results/ closing the loop into the summer and beginning of the fourth semester. The restructuring was a part a Title III grant project and the college's Quality Enhancement Plan (QEP) which addressed the restructuring of gateway courses selected for technical programs emphasizing uniformity of learning outcomes across the sections taught.
Biology 135 is the gateway Science course of the Integrated Nursing Program at Madisonville Community College. The Integrated Nursing Program allows LPN and RNs to take the same classes during the first two semesters of the program. LPNs may then exit while RNs continue on with further coursework to reach their endpoint. Biology 135 is a four credit hour course consisting of 3 hours of weekly lecture and 2 hours of lab. The course has no prerequisites.
The major purpose for the restructuring was to identify specific learning outcomes that address the needs of the Integrated Nursing Program student and to develop assessments with the goal of promoting consistency across multiple sections of the same course.
The presentation will emphasize hands on activities that will illustrate the process of course redesign.

Inquiry-based Laboratory Modules for Teaching and Assessing Basic Laboratory Skills in an Introductory Cell Biology Laboratory Using Zebrafish; Melissa Daggett, *Missouri Western State University*

Inquiry-based laboratories have been shown to improve student engagement and analytical skills in biology and biochemistry laboratories. However, a significant number of students still struggle with learning and retaining the most basic hands-on introductory lab skills, such as the proper use of the microscope, micropipettors, and balances. In this workshop, I will present the materials and methods being developed at Missouri Western State University in order to incorporate specific performance-based assessments into a set of inquiry-based laboratory modules using zebrafish. These inquiry-based modules and the corresponding assessments are intended to improve the learning and retention of basic laboratory skills required for student success in subsequent upper level biology and biochemistry courses.

Where Have All Those Good Cars Gone? Using the History of Cars as an Analogy to Introduce the Concept of Change Over Time by Natural Selection; Jeremy Dunning[1]; Gerald Adams[2]; Abour H. Cherif[3],

[1]*Indiana University,* [2]*Columbia College Chicago,* [3]*DeVry University*

In this presentation we will use concrete examples from the history, the development, and the design of the automobile as analogy for biological evolution.

- The automobile has changed over time.
- Selection (artificial) can create new varieties of automobile.
- The growth in population of automobiles has limits.
- Internet, printed materials, and museums provide a record of the past history of automobiles and clearly show that modern automobiles develop from early model.
- Comparative analysis of automobile's engines and driving mechanism shows relatedness among all automobile models and types.
- Patterns of change in automobile models and makes provide strong, direct evidence for change over time in automobile populations.

We will also provide critical analysis of the strengths and the weaknesses of the analogy between automobile and biological evolution.