American Society for Microbiology

CONFERENCE FOR UNDERGRADUATE EDUCATORS

Emory University
Atlanta, Georgia
June 3-5, 2005

Poster Session & Abstracts

An Educational Program of
AMERICAN SOCIETY FOR MICROBIOLOGY
EMORY UNIVERSITY
2005 ASMCUE Poster Presentations

Saturday, June 4
2:00 – 9:30pm
WHSCAB Plaza

All posters will be available for viewing from 2:00 –9:30pm. Authors will present their posters in one of two sessions: A or B. The presentation times are:

#-A – 4:00-6:30pm          #-B – 8:00-9:30pm

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*Natalie Kuldell. Massachusetts Institute of Technology, Cambridge, MA.

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John Lennox. Penn State Altoona College, Altoona, PA.

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Jennifer L. Holzman1,2, Gerda Louizi3, Steven C. Fowler3, Elizabeth Lindsey4, Jennifer J. Harrigan5, Preetha Ram6, and Ashwin Ram6. 1Dept. of Physiology, 2Graduate Program in Biochemistry, Cell, and Developmental Biology, Emory University, Atlanta, GA. 3North Springs High School, Fulton County School System, Atlanta, GA. 4Graduate Program in Population Biology, Ecology, and Evolution, Emory University, Atlanta, GA. 5Dept. of Chemistry, Emory University, Atlanta, GA. 6College of Computing, Georgia Institute of Technology, Atlanta, GA.

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*Toye J. Ekunsanmi. University of Wisconsin, West Bend, WI.
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Heather G. Stanley and Christopher K. Yost. University of Regina, Regina, SK, Canada.

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Heather G. Stanley and Christopher K. Yost. University of Regina, Regina, SK, Canada.

19-A
*Halobacterium* sp. NRC-1, A New Model Microbe for Teaching
Priya Arora DasSarma¹, Carol Schmidhauser², Meredith Durmowicz² and Shiladitya DasSarma¹. ¹University of Maryland Biotechnology Institute, Baltimore, MD and ²Villa Julie College, Stevenson, MD.

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*David B. Kushner* and Benjamin J. Tiede. Dickinson College, Carlisle, PA.

21-A
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*Caroline O’Farrell*¹², Jennifer Murdoch², Rachel Hobson¹, Judy Kantor². ¹Oral Roberts University and ²ATCC, Manassas, VA.

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Anne Y. Tsang, Sabrina Kramer, and Ann C. Smith. University of Maryland, College Park, MD.

23-A
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Lisa K. Lyford¹ and S. Catherine Silver Key². ¹Biotechnology Program, North Carolina State University and ²SPIRE Program and Department of Biology, University of North Carolina at Chapel Hill.

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Safety Implementations and Protocol Changes in an Undergraduate Teaching Laboratory Following Accidental Isolation of a BSL3 Microorganism
Jean A. Cardinale. Alfred University, Alfred, NY.

25-A
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Kim L. Mogen. University of Wisconsin-River Falls, River Falls, WI.

26-B
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Anne Hanson. University of Maine, Orono, ME.
27-A
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28-B
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29-A
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Brad Goodner. Hiram College, Hiram, OH.

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Milutin Erbeznik. Albion College, Albion, MI.

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Benjamin N. Wise. Keene State College, Keene, NH.

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Nicole Lee, Margot Hall, and Mary Lux. University of Southern Mississippi, Hattiesburg, MS.

33-A
Use of Instant Wireless Response Systems in Large General Microbiology Lecture Classes
*Michele Shuster. New Mexico State University, Las Cruces, NM.

34-B
Writing about Microbes: Strategies to Improve Writing and Critical Thinking Skills
Jacqueline Peltier Horn. Houston Baptist University, Houston, TX.

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Learning through Teaching: A Self-taught Biology Course for Non-science Majors
Samuel Fan. Bradley University, Peoria, IL.

36-B
Increasing Motivation in a Nursing Microbiology Course by Studying Microbes with Personal Relevance
*Jeanne Kagle. Mansfield University, Mansfield, PA.

37-A
Case History Approach to Teaching Microbial Ecology in a General Microbiology Course
Robert E. Benoit. Virginia Tech, Blacksburg, VA.
1-A
Teaching Undergraduates to be Biological Engineers: A Class to Establish Lab Fundamentals

*Natalie Kuldell. Massachusetts Institute of Technology, Cambridge, MA.

A fusion of biology and engineering is poised to emerge as a distinct and unified discipline just as the merger of chemistry and engineering did 50 years ago. It’s a difficult but exciting task to train students in this new field. What are the tools and intellectual foundation that every biological engineer will need? At MIT, an undergraduate class with four investigative laboratory experiments is being taught to introduce fundamental experimental approaches to prospective biological engineers. The discovery-driven experiments apply design and measurement aspects of engineering to manipulate and model biological systems. They emphasize the interface between biological and inorganic materials, and the structure/function balance of biological substrates. Experimental design, including optimization strategies, quantitative analysis, and instrumentation, are analyzed. Development of this curriculum as well as data collected by enrolled students will be presented.

2-B
Biofilms and the Core Themes and Concepts of the ASM Curriculum Guidelines

John Lennox. Penn State Altoona College, Altoona, PA.

During the first years of the Undergraduate Microbiology Education Conferences many skilled microbiology teachers labored to write a set of curriculum recommendations for introductory microbiology courses covering lecture and laboratory topics. Since that time, these recommendations have been instrumental as planning guidelines for new and experienced microbiology teachers worldwide. But microbiology is a discipline that refuses to remain static. Since the first ASMCUE meetings many subjects, not then anticipated, have assumed significance -- among these are bioterrorism, genomics, and biofilms. Faculty members must struggle to keep their classes current in these and other topics, often with little assistance from contemporary textbooks and laboratory manuals.

This poster will detail specific classroom and laboratory exercises that faculty may adopt in order to introduce the basics of biofilm microbiology into their classes. The following table lists a number of the Core Themes and Concepts of the Curriculum Recommendations and the exercises developed to meet them. These exercises are intended to meet traditional curriculum goals with fresh new exercises related to biofilm microbiology. These and other exercises will be described and available for distribution to faculty members in attendance.

<table>
<thead>
<tr>
<th>Core Theme or Concept</th>
<th>Exercise</th>
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<tr>
<td>Cellular structure and function</td>
<td>Fishing for Microbes</td>
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<td>Growth and division</td>
<td>Flow Cell Construction and Use, Static Biofilm Model System, Biofilm Growth Curve</td>
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<td>Brightfield microscopy</td>
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<td>Chemotherapy</td>
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<td>Microbial transformations &amp; biotechnology</td>
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<td>Isolation techniques</td>
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<td>Estimation of populations</td>
<td>Harvesting and Enumerating Biofilm Populations, Drop Plating, Colorimetric Determination</td>
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<td>Microbial pathogenicity</td>
<td>Cystic Fibrosis: A Case Study</td>
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3-A
A Comprehensive Digital Library Linking Microbial Evolution, Ecology, and Diversity of to Pedagogy

George Rice. Montana State University, Bozeman, MT.

Microbial Life Educational Resources (MLER) http://serc.carleton.edu/microbelife/index.html is a new, freely accessible digital library of educational resources dedicated to the diversity, ecology, and evolution of the microbial world. The primary goal of MLER is to provide an extensive library of high quality information about microorganisms for students and educators, encouraging students to engage in active learning, promote inquiry and discovery, and build interdisciplinary/quantitative skills. Resources are delineated into the categories of K-12, undergraduate, and graduate level as well as the general public, with the aim of connecting information to pedagogy and facilitating the transfer of cutting edge science from researchers to the classroom. Educators are invited to browse cataloged resources and create their own lesson plans and activities, or simply choose from developed educational modules, case studies, special topics, hands on activities, interactive datasets, and WebQuests which exist as layers atop housed resources. These applications can be directly accessed and utilized in the classroom. MLER seeks contributions from the educational and scientific communities while offering teachers an environment to share successful activities. This forum provides researchers a convenient medium to disseminate current scientific discovery from their individual labs to a diverse and receptive audience while fulfilling grant outreach requirements. All cataloged resources and collections are carefully selected and reviewed by the MLER team for quality and scientific accuracy while an external community of interdisciplinary advisors, expert scientists, and educators assess the look, feel, content, and usefulness of the site through formal meetings and user feedback.

4-B
CDROM-based "text" for One-semester Microbiology Course for Health Care Majors

Hemant Chikarmane. Cape Cod Community College, West Barnstable, MA.

The presenter teaches a one-semester 200-level lecture/lab course for pre-med, nursing, and dental hygiene students. To counter the cost of microbiology textbooks and frequent edition updates, a prototype CDROM Microbiology "text" was developed, and distributed free to students. It is available under the Creative Commons License (with attribution); this allows any adopter to use, adapt, and distribute the material at no charge. CDROM content is provided as pdf files, and prints out like a textbook. To ensure that the material remains current, it is updated every semester.

The CDROM material and other teaching resources are available on the accompanying website (natsci.capecod.edu, under the microbiology link).

Students were surveyed for usefulness of content, readability, and relevance to allied health disciplines. They were also asked to compare the current approach to other courses like Anatomy/Physiology where texts are the norm. The survey data indicates that the focused nature of the text material increased comprehension and retention. The regular updates also made the students aware of the dynamic nature of the subject, and led to a greater appreciation of the scientific discovery process.
5-A
A Model for Scientific Teaching in Introductory Biology Courses

Michael H. Hanna, Carl N. McDaniel, Harry Roy, and Brad Lister¹. Biology Department and ¹Anderson Center for Innovation in Undergraduate Education, Rensselaer Polytechnic Institute, Troy, NY.

Our goal is to use research-based pedagogy to teach our combined majors/non-majors introductory biology course. The course covers evolution, genetics, molecular biology, and ecology with emphases on the concepts most relevant to understanding the biological sciences and their impacts on society. The course is computer-technology and multi-media intensive: videos, animations, simulations, web-based activities, and WebCT managed. The pedagogy replaces lecture with a variety of interactive activities where students discover by doing. Biweekly sessions are each composed of pre-class (90 minutes), in-class (150 minutes) and post-class (60 minutes) activities focusing on a major topic. Each section had 60 undergraduates (all with laptop computers), 1 instructor, and 3 teaching assistants. Diagnostics assessing concept understanding were given on the first and last days of class to evaluate learning gains (and on the final exam). Formative student assessments were integrated in several ways: open access reviews for the pre- and post-class activities, in-class concept questions, and student postings on conceptual questions. Summative assessments included three exams, a cumulative final, and a group or individual project. Diagnostic results indicate learning gains in the 15% to 50% range depending upon subject, diagnostic, and whether or not the student studied prior to taking the diagnostic. Summative assessments show identical student performance between sections indicating minimal instructors influence on learning outcome. Classes are highly interactive, animated, and participatory. Both instructors and students enjoy the multiple approaches to teaching and learning. Student evaluations of instructors and courses are similar or somewhat lower than previous evaluations.

6-B
Teaching Veterinary Microbiology Courses To Teachers and Their Students in India

*Sanjay Kapoor and S. K. Kalra. CCS Haryana Agricultural University, Hisar, India.

Veterinary Council of India (VCI) is the statutory regulatory body for veterinary education in India. Veterinary Microbiology department offers four core undergraduate courses (General Veterinary Microbiology, Veterinary Immunology & Serology, Veterinary Virology and Veterinary Bacteriology & Mycology) and two participatory courses on Veterinary Lab Diagnostics. Since 1995, our department has been given Center of Advanced Studies in Veterinary Microbiology by Indian Council of Agricultural Research (ICAR), New Delhi. Our department has conducted 16 Refresher training courses so far for faculty members from various veterinary colleges of India. Of late our department has conducted training courses based on BVSc undergraduate courses as well as courses on SPS, TBT; and accreditation, to meet the challenges of GATS under WTO regime. Higher education is becoming global. It may be brought in the ambit of General Agreement on Trade in Services (GATS). Considering that higher requirements of accreditation would emerge as a big challenge to trade in educational services in the same way, as the higher requirements of SPS and TBT emerged for trade in agricultural commodities, the last two training course was conducted on: i) Management of Microbes as Instrument of SPS Compliance and International Livestock Trade ii) Accreditation and Allied Issues with Focus on Development of Website of Core Courses Of Veterinary Microbiology. These courses were able to create awareness in the faculty coming from various states of India.

Practical manuals for all the four core courses in Veterinary Microbiology and two participatory courses for BVSc students have been prepared. This activity has been very much appreciated by the students as revealed by the semester-end feed back from the students. One problem faced by us is that some of the practical particularly in systematic bacteriology and virology are not feasible in the laboratory. In order to take care of paucity of books, theory lecture notes for the entire core course have been prepared and compiled in the form of a book, 'Lecture Notes on Veterinary Microbiology and Immunology'. Efforts are on to put the entire contents of the theory lectures on the internet on our website.
7-A
Microbial Pathogenesis as an Advanced Microbiology Lecture and Laboratory Class

*Amy J. Reese. Cedar Crest College, Allentown, PA.

A new Microbial Pathogenesis class is being developed (currently in the middle of its first offering) for students who have taken basic microbiology and wish to further study pathogenic organisms and their diseases. Our focus is in answering questions such as: How do some microorganisms, such as Candida albicans, go from being innocent bystanders to being dangerous pathogens? How can some, such as Streptococcus pyogenes, cause a wide range of diseases? Why are there stable vaccines to prevent some diseases such as diphtheria, while others, such as influenza, require yearly changes, and still others, such as HIV/AIDS, remain resistant to vaccine treatments? What role does our immune system play? To answer these questions, we are addressing each body system and associated bacterial, viral, fungal, and parasitic infections. Laboratory exercises are done concurrently with each body system, using traditional culture and microscopy methods alongside rapid clinical tests for comparison. Students are involved in presenting topics for discussions, including microbiology in the media, pros and cons of vaccines, medical microbiology in the future, populations at risk for particular infections, and case studies. These discussions and a case study model were the inspiration for the course. Student assessment consists of three lecture exams, participation in discussions, analysis and presentation of reports on microbiology in the media, four laboratory quizzes, and a final. Based on mid-semester written evaluations, the students find the body system and case study approach helpful in their learning, and they find the material very engaging and relevant to their lives.

8-B
Comparison of Student Evaluations from Web-based and Traditional Sections of a Non-majors Microbiology Course

*Lee E. Hughes and Diana Hanson. University of North Texas, Denton, TX.

Applied Microbiology is an introductory, non-science majors course taken primarily by students majoring in Hospitality Management. Since January 2002, a web-based lecture section has been offered. All course lectures and activities in the web-based section, with the exception of proctored examinations, are given 100% on-line through the WebCT platform. On-line activities include discussion questions and short essay assignments that substitute for the in-class interactions of the traditional section. The same instructor teaches sections in both formats, course content is identical, and examinations are developed from the same question database. Preliminary data indicate that there is no significant difference in student performance between the two formats as measured by averages on course examinations.

For this study, results are compared from course evaluations completed by students in each format of the course. Six course sections are included in the study, representing three sections each of web-based and traditional formats. The course evaluation used in the study is the standard evaluation instrument for lecture courses in the author’s department. While both groups of students rated most aspects of the course at or above the “above average” level, significant differences are found between the groups for responses to seven of the fifteen questions in the course evaluation. In each of those questions, students in the web-based sections gave a lower evaluation than did the traditional lecture students. The results for questions where differences in the groups were noted, students’ narrative comments from the course evaluation, and implications for web course improvement will be discussed.
9-A
Interdisciplinary Microbiology Course for Non-majors and Majors

Lori Bergeron and Robert Wallace. Ripon College
Ripon, WI.

Interdisciplinary exercises were used to teach microbiology for biology majors and non-majors. For the non-majors course, students utilized their liberal arts educational to respond to specific scenarios. Teams of students were given a situation to role play including educating the public, presenting facts to the news media, analyzing historical disease constructs and providing a synopsis to politicians. For the major’s course, similar situations as above were used but with a more applied approach. The major’s course explored a variety of diseases, focusing on molecular mechanisms and clinical aspects of these diseases. The students used scenario analysis to predict outcomes of public health situations. Students conducted a project on the lifecycle of the virus, animal hosts, insect or arthropod reservoirs and then presented their findings to the class.

Emerging diseases are a major concern in modern society. Students enrolled in the non-majors course will be community leaders, educators, writers and historians. These citizens hopefully will make better decisions on related issues if they understand this field. For biology majors, this is a way for many areas of biology to come together. Students applied their understanding of ecology, animal behavior, and microbiology to solve these exercises in disease outbreak models. The purposes of these courses were to interest students in infectious disease and increase critical thinking skills. Assessment of these teaching methods reveal that students retain information better when presented in a variety of formats, problem solving exercises, videos, lectures and case study analysis.

10-B
Integration of Bacteriophage Ecology and Genomics Research Experiences into Undergraduate, Graduate, and Secondary School Biosciences Education

S. Monroe Duboise(1), Gail Fletcher(2), Jennifer Jamison(1), Alyson Farrington(1), Adam Curtis(1), Naun Lobo-Galo(1), Victor Serio(1), Karen D. Moulton(1), Regina Herrick(3), Luci Levesque(4), and David Wilkins(5). (1) University of Southern Maine, Portland, ME; (2) Western New England College, Springfield, MA; (3) Dexter High School, Dexter, ME; (4) Capital Area Technical Center, Augusta, ME; and (5) Stearns High School, Millinocket, ME.

A collaborative microbial and bacteriophage ecology research project at the University of Southern Maine (USM) and Western New England College (WNEC) provides a focus for inquiry and discovery-based laboratory activities being incorporated into undergraduate and graduate biosciences curricula and science education outreach in secondary schools. The Maine ScienceCorps, with NSF GK-12 Fellowship support, involves USM bioscience graduate students in enriching laboratory-based learning in Maine’s rural high schools. Virology and molecular biology knowledge gained by graduate students is being reinforced through bacteriophage discovery and characterization activities they are taking into high school classrooms in a new “Virus Hunters” laboratory series.

During these activities, high school students isolate bacteriophages from environmental samples and then partially characterize viral genomes learning basic microbiology, molecular biology, and bioinformatics methods. Revisions in virology and molecular biology laboratory courses at USM that are supporting and synergizing with ScienceCorps outreach efforts represent initial steps toward more closely integrating outreach efforts into the graduate curriculum to facilitate sustaining a long-term partnership between the university scientific community and secondary school educators. The virus discovery portions of the laboratory series were introduced for initial evaluation to participating secondary educators, graduate students, and faculty during the 2004 ScienceCorps Summer Institute. The 2004-2005 academic year has been a period of further laboratory activity development, revision, and initial field testing. Alignment with state content standards has been incorporated throughout and assessments surveying all participants are an iterative process that will be a significant focus during the 2005 ScienceCorps Summer Institute and beyond.
11-A
Reliability of a Rubric to Assess Student Lab Reports


It is challenging to assess student performance in large multi-section laboratory courses and maintain consistency among sections without relying on a rigid checklist-style marking guide that forces students to say the right things at the right time in their reports. Open, inquiry-based exercises that result in reports with a range of manipulated variables being submitted increases this challenge. Because developing a marking checklist for each possible submission isn’t feasible, we developed a rubric for grading laboratory reports. The rubric allows TAs to grade papers from a holistic perspective and can be used for any topic that is submitted. The rubric is formatted into a number of categories for various sections of a lab report (introduction, figures, results, discussion, literature cited, writing skills) that are each ranked from excellent to poor. TAs are given two exemplar papers to assess independently and bring to a standard-setting meeting at which the TAs discuss how well the rubric identifies grading standards for each section. The rubric’s robustness is evaluated as TAs discuss their impressions of the sample papers and compare these to the grade that they assigned using the rubric. Any vague or inconsistent points in the rubric can be identified and modified before the TAs grade student papers. This also identifies the “easy” and “hard” graders and allows the TAs to come to a consensus on grading. As TAs evaluate their students’ reports, they grade a third exemplar allowing us to identify TAs who have strayed from the group consensus. These TAs can then be directed to modify their grading to maintain consistent standards between lab sections. TAs who used the rubric report increased confidence in their marking and we observed an increase in the reliability with which reports are marked. Encouraged by these findings, we are refining the rubric further to improve the assessment of our students.

12-B
Undergraduate Molecular Microbiology Literacy: From Knowledge to Application with Project-Based Learning

L.B. Regassa* and A.I. Morrison-Shetlar. 1Georgia Southern University, Statesboro, GA and 2Univ. of Central Florida, Orlando, FL.

One of the biggest challenges that students face in molecular microbiology is understanding how and when to use the techniques that they learn to answer novel scientific questions. Teaching molecular biology techniques in a sequential fashion allows students to learn the individual techniques (e.g. DNA isolation, PCR, DNA sequencing), but they often have difficulty moving beyond this rudimentary understanding. The purpose of this two year NSF-funded project is to help students bridge the gap between basic knowledge and application using hands-on, project-based learning. Students participate in the application of molecular biology within a relevant, real-world problem (i.e. a cloning project). During the semester, students subclone the genes that produce bioluminescence, or biologically produced light, into a common laboratory strain of *Escherichia coli* using modified course material adapted from the NSF-sponsored *Unraveling DNA* text. Adaptations for this course include integration of the laboratory and lecture components, and modification of all laboratory exercises to use more current or cost-effective techniques. After completion of the subcloning project, students prepare a mini-grant proposal by applying the techniques to a novel scientific question with experiments that they could pursue. Preliminary assessment data indicates that this approach has been successful for our student body with is dominated by rural, first generation college students from largely underrepresented groups.
13-A
Collaborative Case-based Learning via Molecular Biology Computer Simulations and Internet Conferencing

Karen Klyczek and Mark Bergland. University of Wisconsin-River Falls, River Falls, WI.

Case It! is an NSF-sponsored project to develop molecular biology computer simulations for case-based learning in biology. Our previous grant focused on development of cases involving DNA analysis (PCR, Southern blot, dot blot), with an emphasis on human genetic diseases. The results of five years of class testing demonstrated that the project improved student learning of the biological basis of genetic testing and the nature of mutations. This poster highlights the new protein analysis features and infectious disease cases. Concepts addressed in these cases include disease transmission, diagnosis, and treatment. We are initially focusing on HIV/AIDS, in order to include ethical and social issues associated with this disease, and have developed cases taking place in the U.S. and Africa that we are using in an introductory biology course for non-science majors. Students work in teams as they use the Case It software to analyze blood samples by ELISA and Western blot for HIV-specific antibodies, and test viral load levels by PCR. They construct web page posters to report the test results using the Case It web editor. They then play the roles of family members and AIDS counselors as they ask and answer questions concerning these tests via the integrated discussion board, interacting with students in their own class and at other campuses, including the University of Zimbabwe. Assessment of student understanding of the biology of HIV and AIDS, and attitudes regarding ethical/social issues, includes pre- and post-testing, surveys, and rubrics to analyze the web posters and discussion messages.

14-B
Encouraging Mentored Undergraduate Research Using a Student-customized, Modular-format Laboratory Course

Donald P. Breakwell and Sandra H. Burnett. Brigham Young University, Provo, UT.

Undergraduate microbiology students at Brigham Young University are required to take a one credit hour laboratory class designed to foster student participation in research. Several faculty members teach specialized modules to emphasize a variety of laboratory methods. The modules include tissue culture, bacterial isolation and identification, immunohistochemistry, PCR, antimicrobial sensitivity testing, flow cytometry, antibody detection methods, parasitic nematology, computer modeling of the lac operon, and plasmid construction and gene expression.

From this list and based on individual interests, students select three or four modules. Consequently, students do not take every module offered. At the end of the semester, a student consultant on teaching from BYU's Faculty Center polled the students regarding their perception of the course. Of twenty students responding, fifteen had prior research experience. Sixty-five percent, including 100% of those with no previous research laboratory experience, gained interest in doing so. Sixty percent favored the flexible nature of the course, and 95% appreciated that modules could be taken simultaneously. All students favored the opportunity of completing course work early in the semester. Students enjoyed the low student-to-teacher ratio and the hands-on experiential laboratory work. On the contrary, some modules were perceived as lacking structure, that material was presented too fast, and that excessive out-of-class work was required. In conclusion, the poll results indicate that a student-customized modular format is a useful approach to encouraging undergraduate research. Student perceptions from a second semester as well as the need to facilitate placement of students into a lab will also be reported.
Casebook: A Problem Based Learning Online Environment for High School Microbiology

Jennifer L. Holzman1,2, Gerda Louizi3, Steven C. Fowler3, Elizabeth Lindsey4, Jennifer J. Harrigan5, Preetha Ram5, and Ashwin Ram6. 1Dept. of Physiology, 2Graduate Program in Biochemistry, Cell, and Developmental Biology, Emory University, Atlanta, GA. 3North Springs High School, Fulton County School System, Atlanta, GA. 4Graduate Program in Population Biology, Ecology, and Evolution, Emory University, Atlanta, GA. 5Dept. of Chemistry, Emory University, Atlanta, GA. 6College of Computing, Georgia Institute of Technology, Atlanta, GA.

More often that not, students question the relevance of the material they learn in their classes to their lives. Problem-based learning (PBL) is an educational approach that allows students to cultivate their problem solving skills and enhance their ability to perform critical thinking tasks.

With advances in technology, both teachers and students are finding themselves increasingly dependent on computers for their teaching and learning experiences. Casebook is an interactive computer system that incorporates PBL into the K-16 curriculum and allows students to have a guide as they work through cases. Through a simple web-based interface, teachers may enter and edit their case materials, as well as view work that the students have done as they complete sections of the case. Students are prompted through the exercise as they read case scenes and work through each scene in a three-stage process in which they analyze, learn, and reflect. Students may work on a case independently, or a small group of students may work together and share a Team Notebook, which is used to record facts, ideas, and issues about the case as they progress. Students are then assessed using traditional tests and quizzes, as well as more creative assignments, such as the presentation of a report about the water-borne pathogens in other countries. Furthermore, students are evaluated on their work as a team and as individuals through self and group reflection. In this poster, we will present an initial report of the use of Casebook for a microbiology case in a high school classroom.

We feel that the Casebook program allows for easy integration of PBL and case-based learning methodologies into the classroom. As the technological capacity of both the students and their classroom increase, it is only appropriate to use this technology to implement novel methods of teaching that will give students the skills they need post-graduation.
An Integrated Laboratory Session To Demonstrate Bacterial Sensitivity To Plant Extracts and Antibiotics

*Toye J. Ekunsanmi. University of Wisconsin, West Bend, WI.

In addition to the traditional use of conventional antibiotics to demonstrate antibiotic sensitivity, two herb extracts were included in the present lab protocol. The antibiotics used were BBL discs of kanamycin, novobiocin, neomycin, cloxacillin and tetracycline. Plant extracts were from Licorice - *Glycyrrhiza glabra*, and Garlic: *Allium sativum*. The control were sterile discs dipped in sterile distilled water. Representatives from students groups weighed, blended and filtered garlic cloves and licorice roots. Each group dispensed and loaded the extracts onto sterile BBL paper discs as instructed. Broth cultures of *Escherichia coli*, *Klebsiella pneumonia*, *Staphylococcus aureus* and *Mycobacterium smegmatis* were supplied. Students spread the cultures on Mueller-Hinton Agar and took turns to apply each antibiotic and plant extract discs. Zones of inhibition were measured and recorded after 48 hours incubation at 35°C.

Overall, students scored garlic as being equal to, or less in activity than the antibiotics for most bacteria. Licorice was found to be ineffective against the bacteria, except *Staphylococcus aureus*.

A questionnaire was applied to test if students had learned how to make simple plant extracts, had better awareness of the possible antimicrobial uses of plants’ secondary metabolites, and generated interest in further related research. Scores showed increased awareness of the therapeutic possibilities of plant extracts and greater enthusiasm for related research. Response to their ability to make plant extracts varied widely. This is attributed to direct participation by only group representatives in that aspect.

Transposon-mediated Mutagenesis of *Rhizobium leguminosarum*

Heather G. Stanley and Christopher K. Yost. University of Regina, Regina, SK, Canada.

To emphasize important concepts discussed in lecture and to expose students to lab techniques relevant to modern microbial genetics, we developed a project based lab. In this exercise, we present an experimental problem for the students to approach. We found this problem based approach engages students by giving them ownership of the project. The lab exercise was developed to maximize the likelihood of success and thereby provide the students with ample opportunity to analyze their results. In this laboratory exercise, we use transposon mutagenesis to study gene regulation in *Rhizobium leguminosarum*, an agronomically important microbe.

The multi-week exercise covers principles ranging from a wet-lab mutagenesis approach to bioinformatics. Using a genetically engineered version of Tn5 that contains both a promoter-less *nptII* (neomycin resistance) and a promoter-less green fluorescent protein (GFP) gene, we screened for genes in *Rhizobium leguminosarum* 3841 that are up-regulated during growth on nutrient poor media. This screen produces a large pool of mutants thereby ensuring students will have success in isolating a mutant of their choice. The transposon was delivered into *Rhizobium* on a suicide plasmid vector using a conjugation technique (reinforcing plasmid principles discussed in lecture). To identify mutant genes we used a Polymerase Chain Reaction (PCR) strategy known as TAIL PCR, DNA sequencing and subsequent bioinformatics analysis.

This experiment gives students valuable hands-on experience creating and screening a mutant library and using bioinformatics to predict gene function. Students appreciated the “real-world” appeal of the lab project. Furthermore, it enables students to understand how bacterial physiology can be studied using both classical and molecular genetics approaches. Although we used *Rhizobium* as the model organism, the experiment could be adapted for use with a number of other Gram negative bacilli.
18-B
Assaying the Diversity of Nitrogen Fixing Bacterial Communities in Saskatchewan Soils Using Classical Microbiological and Molecular Techniques

Heather G. Stanley and Christopher K. Yost.
University of Regina, Regina, SK, Canada.

This comprehensive and versatile laboratory exercise, which is taught in a senior undergraduate bacterial genetics course, uses classical microbiological techniques and modern molecular and bioinformatic methods to address fundamental questions in microbial ecology and molecular genetics. These methods could then be applied to studies of diversity in microbial ecology.

Students collected soil samples and used classical microbiological enrichment techniques to isolate species of the genus *Azotobacter*, free-living nitrogen fixers capable of converting N2 to ammonia. In microbial ecology, morphological differences are too few, and biochemical tests to distinguish microbes are time-consuming and result in mistakes in classification. Methods to identify diversity at the DNA level have advanced studies in microbial ecology tremendously. Polymerase Chain Reaction (PCR) techniques have been developed that can differentiate bacteria without prior knowledge of DNA sequences. Therefore, genomic DNA was prepared from the isolates obtained by students and the diversity among strains was subsequently characterized using two of these PCR techniques: randomly amplified polymorphic DNA-PCR (RAPD-PCR) and amplified 16s rRNA DNA restriction polymorphisms (ARDRP).

Feedback from students suggests that this comprehensive problem-based learning approach to characterize the diversity of a bacterial community within a given environmental sample, and between samples from distinct geographical locations, was perceived as worthwhile and relevant. Collaboration with other universities to include data from other locales would increase the impact of the exercise.

19-A
*Halobacterium* sp. NRC-1, A New Model Microbe for Teaching

Priya Arora DasSarma¹, Carol Schmidhauser², Meredith Durmowicz² and Shiladitya DasSarma¹. ¹University of Maryland Biotechnology Institute, Baltimore, MD and ²Villa Julie College, Stevenson, MD.

Basic ecological, environmental, microbiological, and genetic concepts are most effectively conveyed through hands-on laboratory experiences. Because of the potential to expose students to harmful microbes, challenges in maintaining sterility of cultures, cost of scientific materials, and length of preparation and laboratory time required, laboratory experience is often difficult to achieve. As an alternative to standard laboratory models, we are developing a new model microbe, *Halobacterium* sp. NRC-1, an extremely halophilic Archaeon. This microbe is safe and easily cultured, growing well at temperatures ranging from room temperature to 45 ºC, in inexpensive and simply prepared medium that supports the growth of few other organisms. It has a 6 hour generation time, which facilitates teaching laboratory schedules meeting two or three times a week. Moreover, *Halobacterium* sp. NRC-1 is found ubiquitously throughout the world, and has well developed microbiological and molecular genetic methods, as well as a publicly accessible, completely sequenced and annotated genome. The DasSarma laboratory at UMBI, which has a long-standing interest in the biology of *Halobacterium* sp. NRC-1, and Villa Julie College, a coeducational private college, have forged a novel collaboration, developing a curriculum restructuring for a core group of biology courses. The use of a single model system provides greater student comfort, a more consistent framework for the application of a variety of techniques, and a project-based approach to investigating biological concepts. A comprehensive set of laboratory exercises using *Halobacterium* sp. NRC-1 and related halophiles is being developed and marketed through Carolina Biological Supply Company for use in teaching. The effectiveness of these exercises will be tested via student surveys at VJC and from feedback on our web site (http://halo.umbi.umd.edu/~haloed).
20-B  
Microarray Analysis in the Microbiology Laboratory: Completing Both Experimentation and Data Analysis in as Little as Six Weeks

*David B. Kushner and Benjamin J. Tiede. Dickinson College, Carlisle, PA.

DNA microarrays have significantly impacted the study of gene expression on a genome-wide level but also have forced a more global consideration of research questions. The Genome Consortium for Active Teaching http://www.bio.davidson.edu/projects/GCAT/gcat.html provides microarrays and related resources to educators to bring genomics to the undergraduate laboratory. One of the challenges of performing DNA microarrays in this setting is the time required; it is not unusual to spend half a semester designing and executing the experiment, which leaves little time for data analysis when also attempting to complete numerous other labs during a semester. Over the last two years, a streamlined approach to using DNA microarrays has been developed in an upper-level course in microbiology. In yeast cells, gene expression changes have been monitored in response to yeast gene deletion, expression of a virus, or both. Students are responsible for transformation of yeast, RNA isolation, cDNA synthesis, and cDNA and fluorochrome hybridization to the arrays (a limitation of the streamlining is the instructor must grow and harvest the transformed yeast and perform optional northern blot analysis of the isolated RNA outside of scheduled lab meetings). Students then spend one lab period gridding and generating red-green expression ratios using MAGICTool (GCAT). A combination of MAGICTool, Excel, and SAM followed by use of several databases allows for data analysis via differing methods.

Detailed methods will be presented. Students indicate that being able to both perform array experiments and thoroughly analyze data enriches their understanding of genomics and the complexity of biological systems.

21-A  
Adapting a Survey of Antibiotic Resistance in Serratia Species to Undergraduate Curriculum

*Caroline O’Farrell1,2, Jennifer Murdoch2, Rachel Hobson1, Judy Kantor2,1. Biology Department, Oral Roberts University and 2ATCC, P. O. Box 1549, Manassas, VA 20108

A group of gram-negative bacteria, the Serratia species, have been implicated in hospital-acquired, often lethal infections. This group can also be found in the environment in soil and water samples, and they are a useful pathogen to study the widespread prevalence of antibiotic resistance mechanisms. From the Bacteriology collection at the ATCC, 29 clinical and environmental isolates collected from different geographic locations over the past 118 years were analyzed for the presence of antibiotic resistance genes and class I integron genes, which have been implicated in antibiotic gene transfer. PCR analyses did show the presence of class I integron along with several other biologically important sequences from a majority of the isolates. The challenge now is to adapt these fascinating studies to the undergraduate level. Integrating the important topic of antibiotic resistance and PCR into our biology courses, including molecular biology, genetics, and microbiology, is our objective. Therefore, we are currently optimizing these methodologies with the goal of incorporating this type of analysis, representing problem-based learning methods, into several of the laboratory courses. Based on the ATCC work, several of the same PCR experiments were chosen to be adapted by two undergraduate students. They will test the same primers and Serratia DNA samples to show that the same studies performed at the biotech level can be done by undergraduate students. Once the experiments are optimized, they will then be incorporated into the Microbiology and Molecular Biology laboratory courses to not only teach the concept of PCR technologies, but to involve a current medical challenge such as mechanisms of antibiotic resistance.
22-B
Can Undergrads Make Transgenic Plants?
Comparison of Two Agrobacterium-mediated
Gene Transfer Lab Protocols and their
Effectiveness at Teaching Concepts of Bacterial
Genetics and Biotechnology

Anne Y. Tsang, Sabrina Kramer, and Ann C. Smith.
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Two protocols for the transformation of plants using Agrobacterium tumefaciens were adapted for use in a General Microbiology lab.

In protocol 1, Arabidopsis thaliana seedlings are grown, root tissue harvested, and roots soaked in Agrobacterium cultures to allow transfer of an antibiotic resistance gene. The root tissue are induced to form callous tissue and subsequently transferred to media to induce shoot formation and select for transformants. In protocol 2, juvenile Nicotiana benthamiana leaves are infiltrated with the Agrobacterium culture using a 1ml syringe. Plants are observed 48 hours later for expression of a transferred Green Fluorescent Protein gene.

Protocol 1 results in the production of a stable transgenic plant, but the procedure takes weeks and requires exacting technique to minimize mold contamination. This technique more closely matches material presented in the associated lecture course.

Protocol 2 requires a much shorter wait time between gene transfer and expression of the transgene, but does not result in the production of a stable transgenic plant line, only the transient expression of the transgene.

Details of each method and results of a comparison of the two methods will be presented. Included will be a comparison of: 1) the amount of pre-lab preparation required; 2) student reactions to the labs, with particular emphasis placed upon how well the lab engaged the students in the study of gene transfer and biotechnology; and 3) the level of student understanding of bacterial genetics and biotechnology as a result of completing the lab.

23-A
A Laboratory Course Module for Teaching Mutagenesis and Gene Knockout Technology in Microorganisms

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The concepts of genetic engineering, gene knockouts, and site-directed mutagenesis can be difficult for students to grasp. A combined lab/lecture course was developed for undergraduate and graduate students in site-directed mutagenesis and gene knockout techniques, and offered in the Biotechnology Program at North Carolina State University. This two-credit, half-semester module was designed not only to teach the practical techniques of mutagenesis, but also basic biological processes such as homologous recombination, DNA replication and protein translation, and the microbiological processes of purine synthesis in yeast (Sacchoromycyes cervisiae) and lactose metabolism in Escherichia coli. The overall course design allows students to apply their newly acquired skills to design their own site-directed mutagenesis strategies using computer-based DNA analysis programs.

The wet-lab component is comprised of three ongoing laboratories involving PCR technology and two easy-to-interpret results: whole organism color changes on solid media or altered restriction mapping patterns. Students learn biotechnology laboratory skills including 1) DNA purification and quantitation, 2) PCR and primer design, 3) agarose gel electrophoresis, 4) restriction mapping, and 5) growth and transformation of E. coli and yeast cultures. In addition to learning how to create point mutations versus complete gene deletions, students observe mutagenesis in both prokaryotic and eukaryotic systems. Effective learning was evaluated using pre- and post-lab testing, critical thinking questions, and student evaluations. Finally, students have the opportunity to discuss ethics of these biotechnological procedures and the impact of biotechnology on society.
24-B
Safety Implementations and Protocol Changes in an Undergraduate Teaching Laboratory Following Accidental Isolation of a BSL3 Microorganism

Jean A. Cardinale. Alfred University, Alfred, NY.

At Alfred University, there are three microbiology courses with laboratory components, taught to either upper level Biology majors, or freshmen non-science majors. During the fall 2002 semester, a student in the upper level course General Microbiology isolated a possible *Pseudomonas* sp., which further testing suggested was *Burkholderia mallei*, a BSL3 pathogen. This poster describes immediate and long-term responses and changes following identification of this pathogen. Within our division, we have undertaken significant changes and formalization of standard laboratory procedures for working with microorganisms, especially as pertains to undergraduate handling of pathogens and of environmental isolates with potential pathogens. All traditional procedures for handling microbial cultures in the absence of biological safety cabinets have been evaluated for safety risks, and adaptations made to reduce aerosol formation and potential pathogen exposure. Classroom, laboratory and undergraduate independent research settings have been evaluated, and a set of guidelines developed for the use of microorganisms, especially as pertains to undergraduate handling of pathogens and potential pathogens. These policies, guidelines and adaptations of traditional culture handling protocols may be easily adapted to any microbiology course where access to biological safety cabinets is limited. The guidelines serve to provide an additional layer of safety for undergraduate students who are beginning their microbiological training.

25-A
Teaching Microbial Ecology by Student Investigations of Streptomycetes

Kim L. Mogen. University of Wisconsin-River Falls, River Falls, WI.

A typical general microbiology laboratory activity entails enumeration of soil microbes. Students are exposed to soil microbial diversity and usually observe the antibiotic-producing capability of some of soil’s common inhabitants. We expand this simple investigation to greatly enhance the student's experience with microbial ecology. Students use an enrichment protocol to select streptomycetes found in the rhizosphere of particular plants. The streptomycetes are collected and purified using sterile toothpicks and stock spore collections are made. These simple procedures expose students to microbiological techniques outside of typical eubacterial labs. Each streptomycete is challenged against other streptomycetes in their collection to obtain antibiotic resistance and inhibition data. As each student's streptomycetes have been isolated from the same rhizosphere, this allows the students to readily grasp the ecological idea of competition. Students also test the resistance or susceptibility of their streptomycetes to commercial antibiotic disks and determine the ability of their isolates to inhibit the growth of various eubacteria. Data analysis provides a profile of phenotypic diversity of streptomycetes collected from each site.

Additionally, this project is used as a model to demonstrate how scientific discoveries are used to advance human concerns. Students are divided into groups which give short oral reports relating their work to topics such as: the plant rhizosphere/soil microbiology; historical perspectives of streptomycete antibiotic discovery and current antibiotic diversity; streptomycete genetics; or industrial antibiotic production. The project is completed within three weeks of part-time lab work. Student comments suggest a greater appreciation and understanding of microbial ecology and diversity.
Hands-on Projects

26-B
Facilitating Students’ Problem Solving Skills Needed to Identify Pathogens in Clinical Samples by Using Weekly Practice Unknowns

Anne Hanson. University of Maine, Orono, ME.

Pathogenic Microbiology is an upper level microbiology lab, required by microbiology and clinical lab science majors. During the first half of the semester, students learn the traditional biochemical identification techniques used to identify common pathogens. The students are required to apply these techniques, during the second half of the semester, to identify pathogens in mock clinical unknowns based on body site. It is difficult for students to make the transition from the organism presentation of the different groups of pathogens, to identifying these pathogens in mock clinical samples with normal flora. To try and integrate the two approaches, we introduced the weekly practice unknowns. They consist of a mock clinical sample containing pathogen and normal flora, plated on media used in culturing pathogens from that body site. On a weekly basis during the first half of the semester, a set of microbes, including all pathogens covered up to that point as well as the new microbes covered that week, is presented to the students. Each student must observe the results, predict what the pathogen might be and describe what tests must be done for a positive ID. These are designed to be done rapidly and to test the student’s problem solving skills. Although challenging at first, the students are proficient by mid-semester in rapid and accurate identification of pathogens from these mock samples. Since implementing this change, the students are more successful in identifying their clinical unknowns and less overwhelmed by the lab practical given on this information.

27-A
“Cookbook to Koch”– Integrating Research Design into an Immunology Lab to Stimulate Meaningful Learning


Advanced labs in microbiology have a goal of introducing new and sophisticated techniques to students. Often the temptation is to move through these in a cookbook fashion. As part of an HHMI funded endeavor to engage students in meaningful learning of host pathogen interactions, we have transformed the design of an advanced immunology lab course from cookbook to active engagement. Our design has three specific aims:

1. Learning of standard immunological techniques
2. Understanding the theory and use of the methods
3. Application of the methods to a research problem

Aim 1 is achieved by teaching methodologies as is typically done in a lab course. Aims 2 and 3 are achieved by placing the use in the context of research design – either from published articles or as developed by the students. Throughout the semester students are given introductory sections of three research papers from which they identify the research questions. They propose techniques (from those that they had learned) that would be appropriate to address the questions. After each, students discuss their ideas and then read the complete article assessing the approach taken by the authors. To culminate this experience and further satisfy Aim 3, student groups receive an authentic research problem. Students define a research question and apply their understanding of methods by developing and implementing a research design. Students present projects in a poster session. We will report on our teaching approach, and the assessment of student learning, engagement, and understanding of methodologies in context of host-pathogen interactions and research design.
28-B  
**Nature’s Remedies**

Anna Lincoln, student  
Jasmine Kirk, student  
Ariana Walker, student  
Cynthia Lincoln, RN, Science Teacher  
Northwest Arctic Borough School District, Kotzebue, Alaska

Young scientists from 6-12 grade created and collaborated with Clinical Laboratory Scientists at the Maniilaq Health Center Clinical Laboratory to conduct research in the clinical laboratory. The goal was to learn more about the effects of plant and tree extracts on pathogenic bacteria in vitro. Students have been working with botanical products of distillation testing indigenous plants used locally as well as those from around the world.

These projects are a culmination of three year’s work by students. The first year, the purpose of the research was to investigate effects of essential oils on bacteria; because some types of bacteria are becoming resistant to different antibiotics that are used today, students wanted to know if essential oils (especially indigenous plants of stinkweed and tundra tea) would inhibit different types of bacteria growth more so than antibiotics. During the second year, students tested several different bacteria, as well as yeast, with the most effective essential oils from year one. This year’s research was to investigate the effects of essential oils on common bacteria in an effort to replicate data from prior research. Also, because seal oil was commonly used as a traditional Eskimo remedy to relieve ear infections and earaches, students wanted to test seal oil on several common bacteria. In most cases, essential oils that were tested worked better than the antibiotics at inhibiting bacterial growth. Students write that, “We believe this research may help scientists find different, more effective medicine to treat bacterial diseases.”

29-A  
**Course-based Research on the Cheap: Undergraduate Annotation of Microbial Genomes**

Brad Goodner. Hiram College, Hiram, OH.

A great course should connect students to the current state of understanding, encourage them to take more control of their own learning, and promote problem solving and interdisciplinary learning. Integrating original research into a course is an effective way to accomplish these goals, but not everyone has the necessary facilities, equipment, and supplies. However, we all have computer access to the Internet and we all in some way connect what we teach about metabolism, cell structure, evolution, and pathogenicity to the basics of gene structure and regulation. Add a little training in bioinformatics and your students are prepared to make significant contributions to the annotation of microbial genomes.

I will present the results of two recent efforts at Hiram College where annotation of the *Chromohalobacter salexigens* genome and 3 *Agrobacterium* genomes were integrated into molecular and cellular biology, genetics, microbiology, and biochemistry courses. Working in teams, students complemented the usual automated first-pass annotation (gene localization and identification through similarity) by reconstructing biochemical pathways to verify gene-protein relationships and to identify novelties and redundancies, by predicting regulatory networks based on gene order and shared noncoding sequences, by identifying possible instances of lateral gene transfer based on gene phylogenies, and by comparing large gene sets across genomes to test various hypotheses. Along the way, students reinforce their learning while contributing to larger projects. Team efforts were monitored at several points throughout the semester, allowing for feedback and extra help. Teams presented their work in poster sessions to their colleagues, their instructors, and visiting collaborators. Finally, I will show how these virtual efforts can transition into wet-lab research projects within courses.
30-B
Role-Playing to Actively Learn About Extremophiles

Milutin Erbeznik. Albion College, Albion, MI.

Role-play is recognized as a valuable active learning tool for a variety of classroom subjects, including undergraduate microbiology. By participating in a role-play, students identify with the objects they study and are more likely to develop an active interest in them. Some microbiological concepts are challenging for undergraduates because they are complex, or esoteric, or both. In an attempt to enhance learning about extremophilic microorganisms at Albion, I designed and implemented a role-play presentation in my Environmental Microbiology course. Student teams of two or three randomly selected one type of extremophile (e.g. barophile, hyperthermophile, etc.) and were given detailed instructions to help prepare the presentation. One or two people in each team played the role of the chosen extremophile, while another person identified her/himself with a scientist studying this microbial group. Students were required to use primary and secondary literature to prepare a 15-min skit. In their performance, the protagonists talked about their "experiences" to each other and to the audience and their acts were accompanied by PowerPoint slide shows with images of microbes, their habitats, and techniques used to study them. Student examinations on these extremophiles, activity assessment scores, and enthusiasm during the performances all clearly indicated the success of this learning activity, suggesting its applicability for learning about other types of microorganisms.

31-A
Microbe Masterpieces

Benjamin N. Wise. Keene State College, Keene, NH.

As a final laboratory project, the students in my General Microbiology course last Fall were asked to design and execute works of visual art using pigmented bacteria to provide their "palette" of colors. The students prepared original designs sketched within the outline of a 150mm diameter petri dish. In order to render their designs in full color, these intrepid artists used their own cultures of pigmented bacteria which they had isolated from mixed suspensions early in the course and maintained as pure cultures. Placing fresh, large TSA plates over their sketches, they applied these invisible "living paints" using cotton swabs, transfer loops and needles, depending on the "brush strokes" required to accurately render their designs. The suspense was great as the artists waited for their paintings to incubate and emerge in glowing color. These living masterworks were then exhibited in a hallway display case in our new Science Center, catching the attention of many a passerby, including the College Information Office photographer and interested members of the Fine Arts faculty. Everyone was impressed with the variety, originality and vividness of the results. Awards in several categories were made and each student artist won recognition for her or his unique achievement.

As an added learning activity, the students also did some literature research on the chemical nature of the bacterial pigments, and included this information in the display.

I think this served as a good way to celebrate the end of the semester, give the students a chance to use their plating techniques in a creatively challenging way, learn something about bacterial pigments and growth, and promote public awareness of microorganisms as objects of interest and beauty. Life-size photographs of their microbial artworks will be displayed in the poster.
32-B
Probiotics: A Topic to Introduce Beneficial Aspects of Microorganisms

Nicole Lee, Margot Hall, and Mary Lux. University of Southern Mississippi, Hattiesburg, MS.

Probiotics is the use of live microorganisms administered in adequate amounts to confer a beneficial health effect on the host. Probiotics is best known as a treatment for antibiotic-associated diarrhea, but recent clinical studies have demonstrated additional applications for probiotics. Many community college and baccalaureate degree programs for health-related professionals require a course in microbiology. There is a tendency in these courses to emphasize pathogenic aspects of microorganisms to the relative exclusion of the many and diverse beneficial roles that microorganisms play in patient health. The inclusion of probiotics is one of the many topics that can be used to balance the students’ perceptions of the positive functions that microorganisms perform to promote patient health.

To facilitate acquisition of knowledge of probiotics, a 20 minute presentation was prepared. Students from 4 diverse classes were given a pretest to evaluate their knowledge of probiotics. The students who participated were enrolled in the following courses: 2 sections BIO 2924, a community college microbiology course with a majority of the students pursuing a health-related profession; 1 section of CHS 622, a graduate epidemiology course with a majority of students pursuing an MPH degree; 1 section of UNV 101, a general orientation course limited to first year university students. The total number of students participating was 54. The average score on the pretest was 44%. Following the probiotics presentation, the average score was 95%. Students from a variety of backgrounds demonstrated an enhanced knowledge of probiotics following presentation.

33-A
Use of Instant Wireless Response Systems in Large General Microbiology Lecture Classes

*Michele Shuster. New Mexico State University, Las Cruces, NM.

Large lecture courses present unique challenges to instructors, particularly in the areas of student engagement and performance. Recently, wireless instant response and feedback technologies ("clickers") have become increasingly available to address active student participation in large lecture courses. Clickers provide an opportunity for students to respond to in-class questions, with the results being instantly available to the entire class (and the instructor). Students can thus assess their own understanding of the material, and instructors can instantly assess the level of comprehension of the entire class.

I used the einstruction system for the first time last semester in our introductory majors biology courses, and am currently using the system in our general microbiology course (a 300-level course). This is the first time the clicker system has been used in an upper division biology course in our curriculum. Based on voluntary and anonymous student surveys that were conducted in the introductory courses, several modifications have been implemented. In contrast to last semester, both participation and "accuracy" points are being assigned based on the clicker, more questions per lecture are being posed, and each lecture has both simple review as well as application questions. Student-student interactions are also encouraged with each question. Student opinion surveys will be carried out, as well as a comparison of overall student performance this semester to that in the previous semester I taught this course, in order to assess the potential value of the clickers in our majors introductory microbiology course.
34-B
Writing about Microbes: Strategies to Improve Writing and Critical Thinking Skills

Jacqueline Peltier Horn. Houston Baptist University, Houston, TX.

Students must learn to express themselves clearly and concisely. A student truly understands the material when he can explain it to another. Memorizing information is an important skill but the material must be applied to be fully comprehended. By writing their ideas, students are given an opportunity to organize and assimilate their thoughts.

In this advanced level general microbiology course for majors, students are given several opportunities to practice their writing skills. Focus assignments ask the student to write a response to a question involving critical thinking. This allows the student to use previous lecture material to formulate a response. Active learning exercises involve visiting websites on a chosen topic and answering questions in a clear, concise manner. This exercise teaches the student to identify pertinent information and present those details in a scientific manner. Another writing activity involves the use of news articles to focus the students in thinking microbiologically. The students are asked to identify microbiology news articles, summarize them and discuss their importance in the world. This activity allows the students to view their memorized facts in real world scenarios. Examples of the students’ work and evaluation of the assignments will be presented. Feedback from the students indicates that the mix of reading and writing found in these assignments has improved the students’ writing and critical thinking skills. The students find this important not only for their classes, but also in preparing for the MCAT and GRE.

35-A
Learning through Teaching: A Self-taught Biology Course for Non-science Majors

Samuel Fan. Bradley University, Peoria, IL.

Through personal experience, we developed the conjecture that those who teach a set of information are condemned to learn, understand, and retain it. A course was developed to test and exploit this conjecture. Panels of illustrious scientists, public servants, and religious leaders were designed to discuss eight current topics in microbiology and molecular biology, with the instructor as moderator. Students take turns playing the role of panelists, and must gather the requisite information to play the roles convincingly. Those not playing a role in a panel are reporters, with the reports constituting the major assessment tool. Thus almost every student will have some interaction with almost every topic. Students playing scientists must study the basic science behind the issues, and explain it during the discussion. Students playing the role of reporters must record the discussion, gather supplemental information, and present them as a news report, to be understood by the lay public. Other learning assessment tools are exams (on basic science issues only), performance as expert witnesses, and an investigative report on a heritable disease. Course assessments are by standard college or departmental forms, and sometimes a supplemental form. The scores were approximately 1.0 point (on a 5 points scale) higher than the instructor’s average for other courses! To afford the students time to prepare their roles, 4 cost effective laboratory sessions were arranged to begin the class. These were designed for them to discover the ubiquity and diversity in the microbial world around us, and to determine whether DNA confers traits on microbes. Started as a once weekly course for Masters students in liberal studies, this class is now offered in various forms to undergraduates. In addition to the laboratory sessions, topics, and roles, modification of the course to suit scheduling will also be presented.
36-B
Increasing Motivation in a Nursing Microbiology Course by Studying Microbes with Personal Relevance

*Jeanne Kagle. Mansfield University, Mansfield, PA.

Curiosity is motivation to learn. Fostering curiosity in a required class, however, can be a challenge. To cultivate students’ curiosity about microbiology, two semester-long projects (one in lecture, one in lab) were developed for Microbiology for Health Sciences. These projects allowed students to explore basic principles of microbiology through microbes which were personally relevant.

The lecture project consisted of three papers on a pathogenic microbe of the student’s choice. The topics discussed in each paper paralleled topics concurrently covered in lecture. This project culminated in poster presentations by each student. During these presentations, students demonstrated their expertise on their organism as well as learned about microbes investigated by their classmates.

The laboratory project was a modification of the classic unknown identification. Students first isolated an organism from their own microbial flora. As various metabolic and physiological tests were covered, students performed these tests on their isolates. Using identification keys, they hypothesized what organism their isolate was and designed confirmatory experiments to test their hypotheses. Through this project, the students experienced the complete identification process of an isolate, designed experiments, and became quite familiar with one inhabitant of their own body.

Several students have indicated that the projects, particularly the papers, have generated interest in their chosen microbes as well as microbiology in general. A survey following completion of the projects was designed to examine the relationship between factors such as method of microbe choice, prior interest in the subject, enthusiasm for the projects, and performance in the course.

37-A
Case History Approach to Teaching Microbial Ecology in a General Microbiology Course

Robert E. Benoit. Virginia Tech, Blacksburg, VA.

Microbial ecology often gets a short shift in the general microbiology syllabus. The intellectual cause is right but the time is short. Students are demanding the short cut to pathogenesis. Furthermore, microbial ecology is difficult to teach in a traditional manner given: the complexity of the subject, the unfamiliarity of the research techniques, the chemical and physical heterogeneity of habitats, and the diversity of the microbial communities. A case history approach allows an efficient intellectual treatment that quickly moves to the heart of the subject without lost of student interest. Success requires visual exposure to the field (if possible) or videos from the Unseen Life Series or PBS resources. Ecological problems include: toxic waste bioremediation, bioremediation of freshwater and soils, rumen ecology, drinking water failures, failures of hospital infrastructure, etc.

Lecture time is reduced and students are expected to use on-line resources to find problem solutions. Team work assignments are useful especially if the teams are mixed major based. An effective field based microbial ecology exposure can be exciting as finding the cause of the next pandemic.

A dozen students with overall grade points averages > 3.5 were allowed to select writing assignments for part of the grade. This experiment was repeated 3 times. All students in the class were required to take traditional multiple choice exams but this select group of students was permitted to substitute writing assignments for 50% of these grades. One of the required writing assignments was the following: Which of the following was more effective in presenting the principles of microbial ecology in this class: the textbook or the case history approach used in lecture? Defend your choice. Among 90% of the students preferred the case history approach, 6% had no preference and 4% preferred the textbook. Thirty-six students participated in this experiment during the 2002 -2004 academic years.
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Duboise, S.M. 10-B  
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Hanna, M.H. 5-A  
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*Kagle, J. 36-B  
*Kapoor, S. 6-B  
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*Kushner, D.B. 20-B  
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**Presentation times:**

*Bold* - Submitting Author  
*Travel Grant Recipient*