

# Association of College and University Biology Educators

## 47<sup>TH</sup> Annual Meeting

October 9-11, 2003

Truman State University  
Kirksville, MO

## *Biology for Contemporary Living*

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*About the cover...*

Thanks to Winston Vanderhoof, Senior Graphic Designer, Truman State University, for our Cover and Poster Design. The biologic illustrations are from original steel engravings from the mid 19<sup>th</sup> century.



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### *Biology for Contemporary Living*

*Thursday, October 9<sup>th</sup>*

2:00 - 5:00 PM	<b>Pre-Conference Field Trip: Crinoid fossil quarry</b>	<b>Meet in Violette Hall foyer</b>
3:00 - 5:00 PM	<b>Steering Committee Meeting</b>	<b>Conference Room Student Union</b>
6:00 - 8:00 PM	<b>Registration and Reception</b> <i>Heavy hors d'oeuvres</i>	<b>Violette Hall foyer</b>
8:00 - 9:00 PM	<b>Opening Session</b>  <b>Welcome to ACUBE:</b> ACUBE President: <b>Margaret Waterman</b> , <i>Southeast Missouri State University</i>  <b>Welcome to Truman State University:</b> President, Truman State University: <b>Dr. Barbara Dixon</b> Division of Science Chair: <b>Scott Ellis</b> <i>Truman State University</i> Program Chair: <b>Lynn Gillie</b> <i>Elmira College</i> Local Arrangements Chair: <b>Nancy Sanders</b> . <i>Truman State University</i>  <b>OPENING ADDRESS</b> (Public Welcome to Attend)  <b>When the Exotic Becomes Invasive: Familiar Questions wit' Stwange Anthers</b>  <b>Dr. Michael Kelrick</b> , Division of Science, Truman State University	<b>Violette Hall</b>
9:15 - 10:15 PM	<b>Steering Committee Meeting</b>	<b>Conference Room Student Union</b>

## ***Friday, October 10<sup>th</sup>***

7:00 AM - 5:00 PM	<b>Registration table</b> - Open all day. Please check your membership status; Inquire about audiovisual needs; General information	<b>(all locations are in the Student Union unless otherwise indicated)</b>
7:00 - 8:00 AM	<b>Buffet Breakfast</b> (by Interest Group)	<b>Georgian Room</b>
7:30 - 10:30 AM	<b>Field Trip: Early Morning Birding with Dr. Peter Goldman, Professor Emeritus, Truman State University</b>	<b>Meet outside Georgian Room</b>
9:00 AM - Noon and 2:00 - 5:00 PM	<b>SUSTAINING MEMBER EXHIBITS</b> Refreshments provided	<b>Activities Room</b>
8:15-9:45 AM	<b>CONCURRENT WORKSHOP SESSIONS I</b>  1. Easy Ways To Do Physiology Labs with Products from iWorx/CB Sciences <b>Steve Andre</b> , iWorx/CB Sciences, Inc.  2. Investigative Activities and Cases from Microbes Count! <b>Ethel Stanley and Margaret Waterman</b> , Beloit College and Southeast Missouri State University  3. The Non-target Effects of Bti Toxin on Aquatic Insects <b>Julie J. Shaffer and William W. Hoback</b> , University of Nebraska at Kearney	<b>Pickler Memorial Library Room 103</b>  <b>Pickler Memorial Library Room 203</b>  <b>Student Union Room 309</b>
9:50-10:20 AM	<b>POSTER SESSION I</b>  Refreshments provided  1. Developing a Three-Tiered Test to Diagnose Misconceptions in College Biology Students <b>Barbara Gaddis and Sandra Berry-Lowe</b> , CU-Colorado Springs  2. Improving Information Literacy for Biology Majors <b>Vaughn Gehle</b> , Southwest Minnesota State University  3. Using Baker's Yeast <i>Saccharomyces cerevisiae</i> as a Model for Molecular Genetics <b>Laura Salem</b> , Rockhurst University  4. The NASA Astrobiology Academy. <b>Morgan Perrone, Crystal Gammon, Anne Dekas, and Steve Mitchell</b> , NMSU, Washington University, Harvard, and U of Maryland-College Park  5. Student Projects in a Team-taught, Mixed-Major Field Course <b>Lynn Gillie, Robert Erdman, and Todd Egan</b> , Elmira College  6. Investigations: An Animal Model of Diabetes. <b>John J. Rutter</b> , Truman State University  7. The Use of Service Learning to Meet Learning Objectives in	<b>Activities Room</b>

General Biology Courses.  
**Lisa Felzien**, Rockhurst University

8. Plaque Assay and Nucleic Acid Analysis of Lytic Coliphages from Creek Water and Domestic Sewage.

**Omokaro Obire and Michael Lockhart**, Rivers State University of Science and Technology, Port Harcourt, Nigeria and Truman State University, Kirksville

10:30 - 11:15 AM	<b>CONCURRENT PAPER SESSIONS I</b>	<b>Student Union</b>
	1. Limitations of Simulations: Objectives Met Only With Genuine Labwork, With a Focus on Animal Dissection <b>John Richard Schrock</b> , Emporia State University	<b>Room 307</b>
	2. Seeing Plants as Doing Plants: How to Teach Students to See Plants by Using Taxonomy <b>Suzanne Martin</b> , Moberly Area Community College	<b>Room 308</b>
	3. Microbial Ecology Activities from <i>Microbes Count!</i> <b>Ethel Stanley</b> , Beloit College	<b>Room 309</b>
	4. The Undergraduate Research Program at Truman State University <b>Jeffrey M. Osborn</b> , Truman State University	<b>Governor's Room 310</b>
11:20 - 12:05 AM	<b>CONCURRENT PAPER SESSIONS II</b>	<b>Student Union</b>
	1. Gardens as Classrooms: Using Gardens for Teaching and Research <b>Steve Carroll</b> , Truman State University	<b>Room 307</b>
	2. Integrating the Scientific Method into Anatomy and Physiology Laboratories <b>Karyn Turla</b> , Friends University	<b>Room 308</b>
	3. A Web-based Resource for the Teaching of Evolutionary Biology as an Applied and Investigative Laboratory Science <b>Joanna Vondrasek, Janis Antonovics, and Doug Taylor</b> , University of Virginia	<b>Room 309</b>
	4. Teaching Biology Courses in the Face of Poverty and Ignorance <b>Omokaro Obire</b> , Rivers State University, Nigeria, and Truman State University	<b>Governor's Room 310</b>
12:15 - 1:00 PM	<b>Luncheon and First Business Meeting</b>  <i>First and Final Call for Nominations!!</i>  <i>Out of this World Teaching Idea contributions</i>	<b>Georgian Room</b>
1:00 - 1:45 PM	<b>LUNCHEON PROGRAM</b>  <b>The Challenges Ahead in Educating 21<sup>st</sup> Century Biologists</b>  <b>Dr. Judith Dilts</b> , Dr. Burnell Landers Chair of Biology and Professor, William Jewell College	<b>Georgian Room</b>

2:00 - 5:00 PM	<b>Field Trip: Restored Prairie – a walk through Union Ridge Missouri Conservation site with naturalist Greg Gremaud</b>	<b>Meet outside Georgian Room</b>
2:00–2:45 PM	<b>CONCURRENT PAPER SESSIONS III</b>	<b>Student Union</b>
	1. Can a New Dog Learn Old Tricks?: A Junior Faculty Member puts NSF's Recommendations for Science, Math, Engineering, and Technology (SME&T) Education to Task <b>Peter White</b> , Colby-Sawyer College	<b>Room 309</b>
	2. Development of a Research-Based Course for Undergraduates in RNA, DNA, and Protein Extraction, Purification, and Characterization <b>Tom Tauer</b> Coe College	<b>Room 308</b>
	3. Unclassifying Classical Physiology Laboratories <b>Gregory Grabowski</b> , University of Detroit Mercy	<b>Room 307</b>
	4. Introducing Epidemiology in Microbiology Labs Using a Model of a Smallpox Epidemic Started by a Bioterrorist <b>Alicia Wilson</b> , AKL Informatics	<b>Governor's Room 310</b>
2:50 - 3:20 PM	<b>POSTER SESSION II</b> Refreshments provided  Posters from the morning session still available for review	<b>Activities Room</b>
3:30 - 5:00 PM	<b>CONCURRENT WORKSHOP SESSIONS II</b>	
	1. IOptimize Integrated Learning System (utilizing the power of onsite-online interface in Teaching and Learning) <b>Abour Cherif, Stefanos Gialamas and Lin Stefurak</b> , DeVry University	<b>Student Union Room 309</b>
	2. An Introduction to Working with Nucleic Acid and Protein Databases <b>Brent Buckner and Diane Janick-Buckner</b> , Truman State University	<b>Pickler Memorial Library Room 103</b>
	3. AMCBT's/ACUBE's Golden Anniversary Ideas! Memories! Accomplishments! <b>Margaret Waterman</b> , Southeast Missouri State University	<b>Student Union Governor's Room 310</b>
5:05 - 5:45 PM	<b>Web Committee Meeting</b>	<b>Conference Room</b>
6:00 – 6:45 PM	<b>Social</b> Still National Osteopathic Museum and historic medicinal garden (resumes of candidates available for review)	<b>Tinning Education Center, Kirksville College of Osteopathic Medicine (KCOM)</b>
6:45 - 9:00 PM	<b>“Western’s” Dinner and Second Business Meeting</b> (two-minute speeches prior to dinner; balloting after)	<b>The Commons, KCOM</b>
	<b>EVENING PRESENTATION</b>	
	<b>Kirksville's Harry Laughlin (1880-1943): Applying</b>	<b>McCreight Auditorium, KCOM</b>

**Classroom Genetics for the 'Betterment' of Humanity**

**Dr. Philip Wilson**, Penn State College of Medicine

*Presentation of the 2003 Out of this World Teaching Idea*

## *Saturday, October 11<sup>th</sup>*

7:30 - 8:45 AM	<b>Buffet Breakfast</b> (by Interest Group)	<b>Georgian Room Student Union</b>
7:45 - 8:45 AM	<b>Bioscene Editorial Board</b>	<b>Georgian Room</b>
9:00 - 9:45 AM	<b>CONCURRENT PAPER SESSIONS IV</b>  1. Bioscience by Design <b>Bob Aron, Bashar Hanna, and Abour Cherif</b> , DeVry University  2. Biological Andragogy <b>Marya Czech</b> , Lourdes College  3. Shut up and Let the Students Learn: A Flexible No-Lecture Teaching Strategy that Deepens Student Understanding <b>Neil Sabine</b> , Indiana University East  4. NASA Ames Astrobiology Academy 2003: Astrobiology at Deep Sea Vents. <b>Morgan Perrone, Crystal Gammon, Anne Dekas, and Steve Mitchell</b> , NMSU, Washington University, Harvard, and U of Maryland-College Park	<b>Student Union Room 309</b>  <b>Room 308</b>  <b>Room 310 Governor's Room</b>  <b>Room 307</b>
10:00 - 10:45 AM	<b>CONCURRENT PAPER SESSIONS V</b>  1. iBench: Instruction in Basic Equipment Needed for Chemistry and Biology <b>Tom Tauer</b> Coe College  2. Utilizing Technology to Link Alums with Undergraduate Learning <b>Austin Brooks</b> , Wabash College  3. Shut Up and Let the Student Learn: Changes in Student Perceptions and Performance in an Active Learning Environment <b>Neil Sabine</b> , Indiana University East  4. Hierarchy Theory: An Underutilized Helpmate for Understanding Complex Concepts in Undergraduate Biology Courses <b>Jon Gering</b> , Truman State University	<b>Student Union</b>  <b>Room 309</b>  <b>Room 308</b>  <b>Room 310 Governor's Room</b>  <b>Room 307</b>
11:00 AM - 12:15 PM	<b>Luncheon and Third Business Meeting</b>  <b>BUSINESS MEETING</b> Resolutions: <i>Dick Wilson, Rockhurst University</i> Executive Secretary Report: <i>Pres Martin, Hamline University</i> Bioscene: <i>Ethel Stanley, Beloit College &amp; Tim Mulkey, Indiana State University</i> Presidential Address: <i>Margaret Waterman, Southeast Missouri State University</i>	<b>Georgian Room</b>



2004 Meeting:  
*Austin Brooks, Wabash College*

12:30 - 3:00 PM	<b>Steering Committee Meeting</b> Includes newly elected Steering Committee members!	<b>Conference Room</b>
12:30 – 4:00 PM	<b>Post conference Field Trip</b> Open-air flea market, game birds and the Mennonite store	<b>Meet outside Georgian Room</b>

## ABSTRACTS of PRESENTATIONS

### Concurrent Workshop Sessions I

8:15-9:45 am

Friday, October 10, 2003

#### **Easy Ways to do Physiology Labs with Products from iWorx/CB Sciences.** *Steve Andre, iWorx/CB Sciences*

Physiology teaching kits and Labs on CD/Labs on Line from iWorx/CB Sciences make it easy to do human and animal physiology experiments includes cardiovascular, neuromuscular, and respiration exercises. Teaching kits include all the hardware (except computer), software, and courseware needed to do over 45 experiments and multiple exercises. Data collection and analysis can easily be accomplished with the “click” of a button or two. Users can also complete experiments of their own design with the same “click and play” ease.

The same types of experiments can be done without the need for any hardware, besides a computer, in lab with Labs on CD or over the Internet with Labs on Line. With Labs on CD/Labs on Line products from iWorx, students record and analyze data just as they would with a physiology teaching kit. Animations, illustrations, and digital movies compliment each lab exercise in Labs on CD/Labs on Line.

Participants in this workshop will be able to collect and analyze data with Labs on CD/Labs on Line and do the same with iWorx physiology teaching kits.

#### **Investigative Activities and Cases from *Microbes Count!*** *Ethel Stanley and Margaret Waterman, Beloit College and Southeast Missouri State University*

Interactively investigate new activities from *Microbes Count!* (2003). In the first two activities, we will use online bioinformatics tools to track the source of the West Nile virus in the 1999 New York outbreak and explore evolution using HIV patient data. The investigative case - *The Farmer and the Gene* - will also be introduced. All materials will be made available to participants.

#### **The Non-target Effects of Bti Toxin on Aquatic Insects.** *Julie J. Shaffer and William W. Hoback, University of Nebraska at Kearney*

The use of chemical insecticides to manage problem insect species has resulted in the mortality of non-targeted species including vertebrates creating unexpected ecological problems. Recent advances in molecular biology have allowed for the development of natural insecticides. One such insecticide designed to control mosquito larvae is a toxin from the bacterium Bacillus thuringiensis israelensis (Bti). Bti toxin exhibits specific activity against dipteran larvae. This toxin can be purchased commercially and used in the classroom to demonstrate the concept of non-target killing. In this laboratory exercise, students test the sensitivity of various aquatic insect larvae to the effects of Bti toxin. Students compare survivorship of mosquito larvae and other aquatic insect larvae to several concentrations of Bti toxin to determine lethal concentration and non-target killing. This exercise is appropriate for classes such as general biology, environmental biology, and microbiology. It teaches students about the use of natural insecticides and is safe and inexpensive.

## Poster Session I

9:50-10:20 AM

Friday, October 10, 2003

### **Developing a Three-Tiered Test to Diagnose Misconceptions in College Biology Students.**

*Barbara Gaddis and Sandra Berry-Lowe, CU-Colorado Springs*

Even after successfully completing science courses, many college students exit the classroom with the same misconceptions with which they entered. Exposure to correct scientific principles generally decreases misconceptions, but does not eliminate them, as misconceptions continue to be held by college seniors, graduate students, community college professors, and pre-service teachers. Based on review of the literature and surveys of college biology faculty, the authors developed a computer-based three-tiered diagnostic test to assess misconceptions. The development of this test, the assessment of misconceptions through clicker interactive technology, and preliminary research results will be described. This project was supported by NSF.

### **Improving Information Literacy for Biology Majors.** *Vaughn Gehle, Southwest Minnesota State University*

The biology major at Southwest Minnesota State University requires a capstone presentation on any aspect of biology. To eliminate the too frequent "Disease of the Week" and "Why I like Biology" presentations, we instituted a requirement that students locate and integrate at least two peer-reviewed research papers into their presentations. This led to the discovery that our students were information illiterate: they could not locate research papers and didn't know what to do with the papers once found. Our remedy was a revamping of our curriculum to include two seminar courses and more extensive writing of lab reports. The first seminar course is targeted at sophomores and teaches how to find and access scientific databases, how to distinguish between news, review, and research articles, and how to read research articles. Lab courses that students would typically take between sophomore senior years reinforce those learned skills by requiring students to write numerous lab reports that incorporate supporting literature citations. The final seminar course, populated by seniors, teams each student with a faculty mentor who helps the student narrow their topic, critically evaluate the published literature, and prepare a poster presentation. The presentations are given to all faculty and students enrolled in both seminar courses. Our current method of assessing the quality of these presentations will be discussed. These curricular changes, instituted three years ago, appear to have improved the information literacy of our students.

### **Using Baker's Yeast Saccharomyces cerevisiae as a Model for Molecular Genetics.**

*Laura Salem, Rockhurst University*

Saccharomyces cerevisiae (Baker's yeast) is an ideal eukaryotic organism for biological studies. The power of yeast genetics has become legendary and is the envy of those who work with higher eukaryotes. The complete sequence of its genome has provided important tools for bioinformatics. Although yeasts have greater genetic complexity than bacteria, they share many of the technical advantages of molecular genetics of prokaryotes. This poster will present experimental advantages and techniques involving the use of Saccharomyces in the laboratory. Experiments utilizing genetic, molecular, and biochemical approaches will be addressed.

**The NASA Astrobiology Academy. *Morgan Perrone, Crystal Gammon, Anne Dekas, and Steve Mitchell, NMSU, Washington University, Harvard, and U of Maryland-College Park***

The NASA Astrobiology Academy is a unique summer institute of higher learning whose goal is to help guide future leaders of the U.S. Space Program. It provides research opportunities in state-of-the-art Astrobiology laboratories coupled with broad-based views into the inner workings of the space program. The Academy is an intense summer experience with little free time. A significant portion of the student's time will be spent as a group or a team working on projects, listening to and debating lectures, and traveling together. These avenues help to develop the leadership, teamwork, and critical thinking skills that are important to our nation's future in space. In addition to the rich intellectual environment, students will be assigned to a Principal Investigator to work independently on a technical project. The mentor relationship that evolves gives the RA's insight into the trials and rewards of primary scientific research. The Academy students also tour each NASA center in California as well as local space industries and academic programs. Overall, the Academy provides the students with an unhindered view into the space program.

**Student Projects in a Team-taught, Mixed-Major Field Course. *Lynn Gillie, Robert Erdman, and Todd Egan, Elmira College***

A travel/field course in Marine and Island Ecology can be used to introduce science majors and non-science majors to biological diversity and ecological field methods. Mini-projects in botany and zoology have been useful tools in guiding and assessing student learning. Students are grouped according to experience, with no more than one science major per group. Some examples of projects completed include analysis of vegetation profiles in different habitats, kite diagrams of intertidal community diversity, and construction of behavioral time budgets. Students design the project, then meet with the instructors for revisions to the proposal. After data collection and analysis, students present results to their peers. The success of a mixed majors/non-majors course that uses projects will be discussed.

**Investigations: An Animal Model of Diabetes. *John J. Rutter, Truman State University***

An understanding of the pathophysiological conditions that arise as a result of disease states provides valuable insight into the processes that serve to maintain homeostasis. As a supplement to lecture inclusion of such material, we have developed an investigative laboratory exercise that centers around an animal model of diabetes. Briefly, a hyperglycemic (high blood sugar) condition can be induced in rats via a single injection of streptozotocin. This compound selectively destroys the  $\beta$ -islet cells in the pancreas that produce insulin; as such, this treatment produces symptoms that arise in Type 1 diabetes in humans. In spite of the metabolic imbalances that arise as a consequence of this disease state, the animals can be kept viable for a period of several weeks following administration of the toxin, enabling students to measure a variety of end points reflective of the early stages of diabetes.

**The Use of Service Learning to Meet Learning Objectives in General Biology Courses. *Lisa Felzien, Rockhurst University***

Service learning involves working with students to provide service to the community that requires students to meet learning goals related to coursework. The three major components of effective service learning experiences are developing clear learning objectives, completing a meaningful project in the community, and reflecting on what was learned from the project. Service learning was used in a general biology course to show students the importance of promoting scientific education within the community and to help students learn about challenging course topics by having them teach others about those topics. Students were

required to develop learning objectives, design and complete a community service exercise, and write reflection papers to assess their learning and development. Undergraduate students worked with community students of either grade school or high school ages, providing learning experiences relating to the topic of photosynthesis. Undergraduates worked in groups of four, and collaborations between groups were required to complete the projects. Information gathered through reflection papers showed high student satisfaction in the areas of contributing to the learning of others, of contributing to their own learning, and of supporting the mission of the university.

**Plaque Assay and Nucleic Acid Analysis of Lytic Coliphages from Creek Water and Domestic Sewage. Omokaro Obire and Michael Lockhart, Rivers State University of Science and Technology, Port Harcourt, Nigeria and Truman State University, Kirksville**

Assessment of water quality in agricultural and industrial waterways generally focuses on chemical and bacteriological indicators. Many pathogenic bacteria harbor phages (bacterial viruses) which establish a symbiotic relationship in the host known as lysogeny. In contrast, the lytic phages infect and destroy the host bacterium by producing a high number of viral progeny and lysing the host cells similar to that of viral infections of plants and animals. The occurrence of lytic phages in coliform bacteria is predicted to shorten their lifespan and reduce their numbers in the environment and act as a natural biological control. In this study, we assessed the presence and concentration of lytic viruses of *Escherichia coli* and *Enterococcus faecalis* in Bear Creek (Missouri) and domestic sewage in a rural lagoon (near Kirksville, MO). We used the plaque assay method to quantify the number of phages in water samples. Phage DNA was isolated and the relative sizes, in base pairs, of phage genomes were analyzed by gel electrophoresis. A characterization of the lytic phages of coliform bacteria isolated from creeks and sewage should lead to identification of phages which could be used in the biological control of pathogenic bacteria which frequently contaminate agricultural water sources. This work was supported by Truman State University, Kirksville, MO, USA and Rivers State University of Science and Technology, Port Harcourt, Nigeria.

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## **Concurrent Paper Sessions I**

**10:30-11:15 AM**

**Friday, October 10, 2003**

**Limitations of Simulations: Objectives Met Only With Genuine Labwork, With a Focus on Animal Dissection. John Richard Schrock, Emporia State University**

The main arguments made by the animal rights and computer community against animal labwork are summarized. Objectives not met by simulations are detailed and include: A)experience base to make concepts “meaningful,” B)genuine interactivity, C)use of the sense of touch or “palpation,” D)learning how to observe, E)understanding abnormality and imperfection in anatomy and development, F)test truthfulness, G)open ended experiments beyond those programmed into a simulation, H)confirmation that science results are genuine and universal, I)real consequences that command the students’ attention and generate excitement, J)greater “respect” for complex internal anatomy as soft, wet machinery, K)normalization of students’ attitude to blood, feces, etc., L)recruitment into the medical or academic profession, and M)the economics of reality-based labs over most computer simulations.

**Seeing Plants as Doing Plants: How to Teach Students to See Plants by Using Taxonomy.**  
*Suzanne L. Martin, Moberly Area Community College*

Using the example of plant taxonomy, this paper shows how learning science in a deep way can take place by non-science majors in the lower tiers of the college population by embodying assumptions about the subjective, experiential, evaluative, communicative, communal nature of science in the action of learners. As Heinz von Foerster stated, students who wish to learn to *see* plants must learn how to *act*. Students don't see what the instructor sees--no matter how botanical terms are described or illustrated. The students don't "get the point" until they have a framework of experience. In the context of field and lab activities, introductory botany students experience seeing as a result of a process of interaction with plants. In order to act, they learn through experience and through conversation that plant morphology terms are created for convenience in identifying plants and that the terms are constructs rather than intrinsic properties of plants—that the plants "don't read the text." The students gain an insight into science as a way of seeing and as a system for communication rather than a collection of facts. In the process, how they see and interact with the world changes.

**Microbial Ecology Activities from *Microbes Count!*** *Ethel Stanley, Beloit College*

Learn more about new models and simulation activities from *Microbes Count!* (2003). In this session, several activities featuring microbial ecology will be introduced. This includes demos of wine fermentation, control of a resistant mold, microbial growth in Biosphere 2, and development of hypoxia zones. (Windows and Mac compatible)

**The Undergraduate Research Program at Truman State University.** *Jeffrey M. Osborn, Truman State University*

Abstract not available at press time.

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## **Concurrent Paper Sessions II**

**11:20-12:05 AM**

**Friday, October 10, 2003**

**Gardens as Classrooms: Using Gardens for Teaching and Research.** *Steve Carroll, Truman State University*

High-quality natural areas are not always conveniently located or easily accessible during the one to three hours typically available for labs. One solution to this predicament is to teach all labs indoors, but another is to use existing gardens, or to plant new gardens, in order to create your own study sites. I will describe how my students and I have used a variety of gardens for teaching and research. These gardens have included (1) a planting of alternative crops (e.g., sesame, amaranth) at the Truman State University farm that is used by students in Ecology, Economic Botany, and other classes; (2) a small prairie garden that has been used by students conducting independent research on pollination; (3) a prairie planting on public school property that will serve as the site of a prairie festival for the city's second-grade classes; and (4) a 19<sup>th</sup> century medicinal garden that was designed and planted as an independent research project by a Truman student who has since gone on to graduate school in landscape design. This last garden will be the site of the Friday evening social. I will show slides of these and other gardens and will encourage discussion of how we can improve our teaching and research by using gardens that are already in place; gardens that we may choose to install; or gardens that students can help design and plant.

**Integrating the Scientific Method into Anatomy and Physiology Laboratories.** *Karyn Turla, Friends University*

Many students learn the scientific method through prescribed labs where the experimental setup is described for them, the reagents they will need to use are listed, and the actual experimental design is laid out for them step by step. The students can get an idea of what the scientific method is, but do not obtain a full appreciation for the complexities of the scientific method by using this approach. I have developed a lab in my Anatomy and Physiology course that to my surprise was challenging and very educational for the students. The lab exercise is designed to get the students to test parameters that affect the rate of diffusion and osmosis; a subject that is relatively simple for these junior level students. However, in this lab the students receive only a list of equipment and reagents available to them. They are required to develop four experiments; two to test factors affecting diffusion and two to test factors affecting osmosis. For each experiment, they are to define the variables, describe their experimental setup, collect data and discuss their results in a lab report that mimics the format of a research paper. The students seem to struggle with the lab, many stating that they have never had to design an experiment before. Many students begin to appreciate the importance of defining all the controlled variables when they conduct an experiment without an important variable controlled. I have found that once the students have gone through this lab, they have a better understanding of the scientific method, and how to conduct an appropriately controlled experiment.

**A Web-Based Resource for the Teaching of Evolutionary Biology as an Applied and Investigative Laboratory Science.** *Joanna R. Vondrasek, Janis Antonovics, and Doug Taylor, University of Virginia*

Recently, evolutionary biology has developed into a vibrant, investigative science with great relevance to societal issues. The teaching of evolutionary biology, however, is still largely taught as a theoretical, dialectical discipline. Rarely is it taught as an experimental, analytical science of applied relevance on par with physiology or molecular biology. As part of an NSF Curriculum Development Grant, we have created a website intended to be a resource for instructors of undergraduate evolutionary biology classes. The website includes a complete sample syllabus of laboratory and recitation exercises designed to actively engage students in the practice of evolutionary biology. In addition, we have collected and listed numerous evolution-based laboratory and field exercises from other sources. Examples of the resources available on the website will be presented.

**Teaching Biology Courses in the Face of Poverty and Ignorance.** *Omokaro Obire, Rivers State University, Nigeria and Truman State University, USA.*

I teach courses in virology and environmental microbiology to undergraduate and graduate students at Rivers State University in Port Harcourt, Nigeria. The typical biology course provides four hours of lecture and one laboratory period each week. The bi-semester system is modeled after the American System. In many developing countries the policy makers are opportunists and barely literate. The education of children and college students is low on the list of priorities. The most basic educational aids such as books and facilities are generally of low quality and in many cases lacking. The college preparedness among students is highly varied and many of the successful ones have ‘cheated’ to gain admission to university. I will share my own experiences and some creative ways we manage to teach science courses with limited funding, limited facilities, unreliable utilities, student unrest, and political instability.

## Concurrent Paper Sessions III

2:00-2:45 PM

Friday, October 10, 2003

### **Can a New Dog Learn Old Tricks?: A Junior Faculty Member puts NSF's Recommendations for Science, Math, Engineering, and Technology (SME&T) Education to Task.** *Peter White, Colby-Sawyer College*

In a 1996 report, Shaping the Future: New Expectations for Undergraduate Education in SME&T, the National Science Foundation assembled several specific recommendations for curricular and pedagogical improvement in SME&T disciplines. These recommendations included (italics added) 1) incorporating *new knowledge* into lower level courses more rapidly and more thoroughly, 2) introducing SME&T concepts by examining *current issues* for which students have a personal context, 3) organizing courses (or course modules) to address *real world problems*, and 4) developing curricula that expose students to key *interdisciplinary connections* stressing concepts as much as facts. Just as these recommendations parallel the theme of ACUBE's 47<sup>th</sup> Annual Meeting, they also constituted the framework for two seemingly unrelated courses taught by the presenter in the past year; Process of Discovery, a required course for all students with high freshman and sophomore enrollment, and Cellular Pathophysiology, an upper-level elective for biology majors. For both courses, classical case-based learning was used to introduce and explore current issues and concepts. The successes and limitations of this approach will be the main focus of the session. Curriculum design, specific examples of course content, and qualitative and quantitative student feedback will also be discussed.

### **Development of a Research-Based Course for Undergraduates in RNA, DNA, and Protein Extraction, Purification, and Characterization.** *Tom Tauer, Coe College*

Undergraduates are enrolling in courses that discuss molecular biology at a greater depth than ever before. It is imperative that these students are provided the opportunity to conduct research using the molecular biology they have studied. Some undergraduate courses expose the students to various molecular biology techniques, but are 'canned' exercises that do not reflect the true inquiry-based learning/hypothesis-driven experimentation that research encompasses. I have developed a course that incorporates the extraction, purification, and characterization of RNA, DNA, and protein for undergraduates. The course incorporates biology, physics, chemistry, statistics, and computer concepts, in addition to introductory bioinformatics. I will discuss the course curriculum, expenses, and outcomes.

### **Unclassifying Classical Physiology Laboratories.** *Gregory M. Grabowski, Travis McGrady\*, Megha Patel\*, Inna Shcherbinina\*, and Anthony Smykla\*, University of Detroit Mercy;*

*\*Undergraduate research assistants*

As physiology lectures become more focused on the cellular basis of homeostasis, physiology laboratory manuals remain steeped in classical laboratories that focus on decades old concepts of organ-based homeostasis. The challenges of a cellular based physiology laboratory include time limitations, expense, and specialized equipment. These challenges are especially difficult to overcome when investigating the physiologic role of second messenger systems, however these can be met using a colorimetric assay for determining phosphate concentrations in 1.5 ml centrifugation tubes and a spectrometer set at 750 nm. Using phosphotyrosine as a substrate, homogenate from organs (rat liver, heart, muscle, lung, and kidney) or various Xenopus tadpole stages can be assayed for phosphotyrosine phosphatase activity within a three



hour laboratory session. Phosphate freed from phosphotyrosine is precipitated with molybdate to form a color complex. Absorbencies are contrasted with known phosphate standards, which are standardized to the protein concentration of each sample. Assays are also run in the presence and absence of metavanadate (phosphotyrosine phosphatase inhibitor). Students learn to standardize data and utilize controls for determining second messenger activity under various physiologic states, and the professor avoids using expensive materials and equipment, as well as avoiding safety problems associated with using phosphate isotopes. (Funded by FGIP #425)

**Introducing Epidemiology in Microbiology Labs Using a Model of a Smallpox Epidemic Started by a Bioterrorist.** *Alicia Wilson, AKL Informatics*

Bioterrorism has become an increasing concern and is of particular interest to nursing students. A Stella model of a smallpox epidemic has been developed with an instructional interface for students taking nursing microbiology. In the case presented in this model, a terrorist enters a community with 200,000 people who may be unvaccinated, vaccinated recently or vaccinated many years ago. By "turning" knobs in the interface on the computer screen, students can explore the effects of varying the vaccination status of these people. Some serious risks of vaccination are discussed. In addition, there are 2000 people in the community who have severely impaired immune systems and should not be vaccinated with the live vaccine used for protection against smallpox. The effects of the vaccination status of the rest of the community on the smallpox mortality in the immune suppressed group provides a dramatic demonstration of herd immunity. The effects of efficient isolation (or quarantine) are also explored. This lab exercise provides some basic introduction to epidemiology, especially the idea of the SIR model. Actual literature values were used to create the model when they were available, although smallpox was eradicated before AIDS, modern chemotherapy for cancer patients, kidney dialysis and organ transplantation created a substantial group of people with seriously impaired immune systems. Although the focus of the lab is biomedical, social and ethical issues can be considered during class discussion. In addition, the 30% mortality rate for unvaccinated people with smallpox makes the lab results memorable.

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**Poster Session II**

**2:50-3:20 PM**

**Friday, October 10, 2003**

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**Concurrent Workshop Sessions II**

**3:30-5:00 PM**

**Friday, October 10, 2003**

**IOptimize Integrated Learning System (utilizing the power of onsite-online interface in Teaching and Learning).** *Abour H. Cherif, Stefanos Gialamas and Lin Stefurak, DeVry University*

In this presentation we will present DeVry University's Model of iOptimize Integrated Learning System utilizing the power of onsite-online interface. In addition we will present the necessary elements for designing, and implementing this Integrated Learning System. Finally we will share our experience on re-designing more than 300 course, training more than 1600 faculty

and academic administrators, preparing more than 11,000 students, and adopting technology that is reliable and powerful enough to implement the DILS. The DILS was developed based on the review of related literature, action research within DeVry University, the continuing assessment of the effectiveness of various teaching and learning strategies, and the continuing assessment of the effectiveness of the Integrated Learning System within DeVry University. We will explain how we use the knowledge and information from all these sources to develop the iOptimize Integrated Learning System.

For example, the related literature indicates the following categories of modes of educational delivery: (1) Face to face delivery mode of learning; (2) Face to face with Internet access delivery mode of learning; (3) Online delivery mode of learning; (4) Closed circuit system mode of delivery of learning. (5) Hybrid delivery mode of learning; (6) Independent project mode of learning; (7) TV/Textbook independent delivery mode of learning; (8) Team Work Independent Project. The iOptimize Integrated learning System comes under the Hybrid Delivery Mode of Learning.

The literature review also indicated that “Hybrid”, “Blended”, and “Optimize” are three most frequently used terms in literature for teaching learning materials using more than one mode of delivery. However, there is no consistency in literature on the meaning for and the use of each of these terms. For example, a literature review has indicated that the meaning of “Hybrid Course” has several interpretations to different professionals based on the goals and the objectives in the minds of those who used the term in their research studies and/or educational institutions. Furthermore, literature review also indicated that there are Institutional Initiatives as well as Individual Faculty Initiatives to design and implement one type of another of the hybrid mode of delivery.

In summary we will present a model of instruction that integrates onsite and online modalities in supporting the various components of teaching and learning. We believe this model corresponds to the emerging dominant reality of the workplace, which combines onsite and online modes of interaction directed at the accomplishment of organizational objectives. Moreover, we believe this model will optometry support student learning, by combining once a week onsite classes with support of faculty and fellow students through online interaction throughout the week.

To accomplish implementation goal of the Integrated Learning Experience in DeVry University a user-friendly common course management system for all online and onsite courses has been designed, developed and implemented. Key to the effective implementation of this Paradigm is the preparation, training and development of faculty and their academic leaders. In addition, preparing students to understand, and accept the DeVry University Integrated Learning Experiences is a necessary condition for the success of this University-wide initiative. The cornerstone of the course conversions, and faculty training and support, is the delineation of the relative and complementary strengths of the onsite and online modalities as applied to the components of the teaching and learning process.

**An Introduction to Working with Nucleic Acid and Protein Databases. *Brent Buckner and Diane Janick-Buckner, Division of Science, Truman State University***

An ever increasing number of organisms’ genomes have been completely sequenced. These genomic sequences are incredible resources of data and information which can be utilized in the primary research and educational efforts of nearly all of the contemporary subdisciplines of biology. It seems essential that scientists, educators and students, especially biology majors, be able to access, manipulate and understand the sequence information available in gene and protein databases. Participants of this workshop will learn the basics of navigating and searching select databases at the National Center for Biotechnology Information (NCBI). Participants will

learn how to search for, and retrieve, a sequence of interest (i.e., a query sequence) using Entrez (a retrieval system for searching databases) and to perform a variety of BLAST (Basic Local Alignment Search Tool) searches including: nucleotide-nucleotide BLAST searches (blastn), pairwise nucleotide BLAST searches and translated BLAST searches (blastx uses a nucleotide query to search the protein database and tblastx uses a nucleotide query to search the translated nucleotide database). Emphasis will be placed on concise explanations of how these programs work and on how the data outputs are interpreted. The workshop leaders will then assist the participants in performing the same type of searches with a query sequence of the participants' choosing. Lastly, time will be spent helping participants plan integration of these skills into their existing curriculum.

**AMCBT's/ACUBE's Golden Anniversary Ideas! Memories! Accomplishments! *Margaret Waterman, Southeast Missouri State University***

ACUBE will soon be celebrating its fiftieth anniversary as an organization dedicated to excellence in college biology teaching. In this session, you are invited to brainstorm and help shape this major event. In what ways can the spirit of ACUBE (formerly known as the Association of Midwest College Biology Teachers) be represented? What kinds of memorabilia exists? What speakers, exhibits, stories, presentations, and themes might be appropriate? How can we publicize this important meeting to bring ACUBE more public attention? A panel of four ACUBE members, some newer, some of long standing, will be present to share their perspectives on the organization and to facilitate the brainstorming.

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## **Concurrent Paper Sessions IV**

**9:00-9:45 AM**

**Saturday, October 11, 2003**

**Bioscience by Design. *Bob Aron, Bashar Hanna, and Abour H. Cherif, DeVry University***

The purpose of this presentation is to describe the instructional technology which DeVry University is using for its new bioscience curriculum. The healthcare and biotechnology industries are demanding specialized engineering technologists and informaticists. DeVry has programmatic strength in engineering technology and information technology. Recently, DeVry acquired the Ross University medical and veterinary schools, recognizing the growth in demand for medical professionals. Healthcare, medicine and medical technology is a new biomedical concentration for DeVry. Courses in the biosciences are core to all the DeVry biomedical programs. DeVry uses a learning model that emphasizes problem solving and application, not at the expense of theory, but ensures that graduates are immediately employable, as well as equipped for advancement in their careers. This application orientated approach extends to the course and lab design from two perspectives: (1) learning has objectives with applied outcomes; (2) labs and learning activities are highly integrated into the curriculum. This instructional design approach affords highly efficient instructional methods without compromising quality or safety. Examples of DeVry's new Chemistry and Biology course will be introduced.

**Biological Andragogy. *Marya Czech, Lourdes College***

With the steadily increasing number of nontraditional age (25+ years) students in the ranks of undergraduates comes the task of meeting the diverse learning needs of yet another population. Adult learners are highly motivated, serious about their studies, but often lack solid study skills and are too far removed from their secondary school background to bring a

significant repertoire of fundamental knowledge to their biology courses. After sharing descriptive studies and strategies, the presenter would like to engage other educators in conversation about the andragogical needs of science learners:

How are frameworks like Gardner's "Multiple Intelligences" applicable to the science learning of adults? How can a "constructivist" framework be effectively implemented with adult learners? Can textbooks change shape and size? Can publishers decrease the size of texts and increase the depth of learning? Can ancillaries be developed with attention to the needs of adult learners?

**Shut Up and Let the Students Learn: A Flexible No-Lecture Teaching Strategy that Deepens Student Understanding.** *Neil Sabine, Indiana University East*

A set of active learning strategies that place the responsibility for mastering course content mostly on students will be presented. The principal components of instruction are directed readings, group discussion, question-answer sessions, and daily evaluations. Formal student-teacher interactions are limited to question-answer sessions where the instructor only answers questions posed by the students. Students are evaluated over the material they were responsible for immediately after the instructor interview ends. The presentation will focus on presenting: 1) a mini-model of the learning environment, 2) the important components and flexible nature of the classroom format. Faculty generally preferred this learning environment to lecturing but their effectiveness was related to the amount of overall teaching experience they had and the amount of teaching experience they had in this learning environment.

**NASA Ames Astrobiology Academy 2003: Astrobiology at Deep Sea Vents.** *Morgan Perrone, Crystal Gammon, Anne Dekas, and Steve Mitchell, NMSU, Washington University, Harvard, and U of Maryland-College Park*

An apparatus comprised of multiple metal and tile plates with varying compositions was designed and assembled to be sent to a deep sea hydrothermal vent aboard the Russian MIR deep sea submersible. The apparatus spent two days on the ocean floor in the Snake Pit area (along the Mid-Atlantic rift zone near the Azores) accumulating biological material and corroding. After a retrieval dive, the apparatus was returned to the surface and preserved for analysis at Ames. Analyses used to identify and characterize microbial corrosion included diamidophenylindole (DAPI) DNA staining, energy dispersive X-ray spectrometry (EDS), and scanning electron microscopy (SEM). Results were uncertain, as DNA staining offered evidence of widespread microbial colonization. SEM and EDS did not confirm the presence of life on the metal surface. The project also featured a substantial outreach program, made available on various Space Grant websites. This program focused on grades 5-9 and the Girl Scouts. For teachers and students, lesson plans involving the group project and astrobiology in general were created. In addition, an Astrobiology badge program was created for Girl Scouts. Overall, the experiment and outreach has provided an excellent learning experience for the Academy students.

## **Concurrent Paper Sessions V**

**10:00-10:45 AM**

**Saturday, October 11, 2003**

### **iBench: Instruction in Basic Equipment Needed for Chemistry and Biology.** *Tom Tauer, Coe College*

Introductory biology and chemistry students typically have little experience with the equipment they will be using in the college laboratory. A pre-lab instructional activity that actively engages students will allow students to make more effective use of scheduled time in the lab. Properly designed computer modules are an ideal method for learning about and "virtually practicing" with new equipment. Unfortunately, current computer-based instructional activities in this area fail to intellectually engage students. We are developing a suite of online modules, named iBench, which will introduce students to relevant concepts and equipment before entering the introductory biology/chemistry laboratory. These modules are designed to be intellectually, as well as physically, interactive and allow students to "virtually practice" with each piece of laboratory equipment. I will demonstrate and discuss our progress with iBench.

### **Utilizing Technology to Link Alums with Undergraduate Learning.** *Austin Brooks, Wabash College*

In recent years technology has provided instructors with a new arsenal of teaching strategies. For the biology teacher these include lectures that are not only extremely well illustrated but often include animations, movie clips and vicarious visits to biologically interesting locales via the World Wide Web. Laboratories as well have been impacted by new technologies. Data sharing between lab teams is now very easy, as a result of campus networks. Document cameras allow lab instructors to demonstrate delicate dissections as well as common laboratory techniques. Digital photomicrography can provide students with an accurate record of their laboratory observations. Simulations and case studies likewise are enhancing learning for our students. On-line discussion boards are, for some students, yet another way to become involved with a particular class. For the past several years I have been using, with good success, on-line discussion boards to engage the student who is reticent to participate in classroom discussions. Last fall I invited a group of Wabash alumni doctors to participate in my Freshman Tutorial, "Images of the Physician in Literature and Film." The alumni response was very positive and the course was enriched as a result of the alumni-undergraduate interaction. Most often the main contact alums have with their alma mater is through the advancement or admissions offices. There are too few opportunities for alums to become involved with the academic life of the college and share their experience with undergrads. In this session various aspects of creating and administering an on-line discussion board involving Wabash alumni doctors and college freshman will be described.

### **Shut Up and Let the Students Learn: Changes in Student Perceptions and Performance in an Active Learning Environment.** *Neil Sabine, Indiana University East*

A set of active learning strategies that place the responsibility for mastering course content mostly on students will be presented. This session will focus on 1) data on student perceptions of and academic performance in this learning environment, 2) perceptions and performance of faculty teaching in this learning environment, and 3) presenting opportunities and obstacles associated with this learning environment. Data gathered over multiple sections of upper and lower level biology indicates that most students in this learning environment were strongly motivated to perform well, rated the overall learning experience very favorably, and believed

they learned more in this learning environment than they would have if they had been lectured to. Faculty generally preferred this learning environment to lecturing but their effectiveness was related to the amount of overall teaching experience they had and the amount of teaching experience they had in this learning environment.

**Hierarchy Theory: An Underutilized Helpmate for Understanding Complex Concepts in Undergraduate Biology Courses.** *Jon Gering, Truman State University*

Hierarchy theory emerged in the 1960s as a bridge between the physical and biological sciences. A fundamental concern of (and motivation for) hierarchy theory was to simplify and explain complex systems such as middle-number phenomena in ecology, evolutionary interactions, and the intricacies of metazoan architecture. Although it successfully explained the nuances of large businesses management, its utility within the biological sciences has never been fully realized. For example, only two hierarchical systems are mentioned in most introductory biology textbooks: the hierarchy of biological organization (atoms → molecules → organelles → cells, etc.) and the taxonomic hierarchy (species → genus → family, etc.). But these are organizational hierarchies; they do not capture the full potential of hierarchy theory to explain the function and behavior of biological systems. The thesis of this presentation is that hierarchy theory – when properly integrated with standard biological pedagogy – can serve as a useful helpmate in students’ efforts to understand the function of biological systems. I’ll demonstrate the utility of hierarchy theory in clarifying typical biological topics such as DNA replication and translation, ecosystem function, and biogenesis; and its importance for understanding recent developments in macroevolutionary theory, community ecology, and developmental biology.

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## **Biographies of Keynote Speakers**

### **Opening Address**

**8:00-9:00 PM**

**Thursday, October 9, 2003**

### **When the Exotic Becomes Invasive: Familiar Questions Wit' Stwange Anthers.**

*Dr. Michael Kelrick, Division of Science, Truman State University*

Michael Kelrick is a Professor on the Biology faculty at Truman State University. He has a B.A. in Geological Sciences from Harvard University, and his Ph.D. in Biology/Ecology from Utah State University, Logan. Michael has a diversity of teaching and research interests and responsibilities, including ecology, field experiences, evolutionary biology, biometry and introductory biology. Michael writes this about his summer experiences: "Recently liberated by the end of my 16th year of university teaching, I look forward to spending the remainder of the summer in the backcountry of the central Colorado Rockies, monitoring exotic plant species in the Snowmass/Maroon Bells Wilderness with a small group of students attending the Rocky Mountain Biological Laboratory. This visceral experience will provide the psychic recharge necessary to power me through the next school year. My return to the withering humidity of the heartland in late August will be assuaged by the tomatoes waiting warmly for me in my garden."

### **Luncheon Program**

**1:00-1:45 PM**

**Friday, October 10, 2003**

### **The Challenges Ahead in Educating 21<sup>st</sup> Century Biologists**

*Dr. Judith Dilts, Dr. Burnell Landers Chair of Biology and Professor, William Jewell College*

Dr. Judith A. Dilts is Dr. Burnell Landers Chair of Biology and Professor at William Jewell College, where she serves as chair. Dilts earned her doctorate at Indiana University in genetics. Recipient of both advising and teaching awards, she teaches genetics and microbiology, courses in general education, and tutorials in the Oxbridge Honors Program. Dilts has an active undergraduate research program studying the molecular biology of bacterial endosymbionts in paramecia, and has had students present the results of their research at national meetings. Dilts was, for six years, a biology councilor for the Council on Undergraduate Research, and has served as a consultant for biology, general education, and the sciences for a number of colleges. Active in PKAL since 1990, Dilts has served as Scientist-in-Residence, was Dean of the eight F21 Leadership Institutes, and co-directed and presented the leadership initiatives at the PKAL Summer Institutes. Dilts' session abstract: A recent NRC report, BIO2010: Transforming Undergraduate Education for Future Research Biologists, builds on research in biology and how students learn to make specific recommendations for the education of 21st century biologists. The report highlights the need not only for involving students in biological research, but also for a biology curriculum that integrates concepts from the other sciences in a significant way. The focus of this session is how biology departments might meet the challenges inherent in such curricular demands.

**Evening Presentation**  
**8:00-9:00 PM**  
**Friday, October 10, 2003**

**Kirksville's Harry Laughlin (1880-1943): Applying Classroom Genetics for the 'Betterment' of Humanity.**

*Dr. Philip Wilson, Penn State College of Medicine*

Philip K. Wilson, M.A. (Johns Hopkins), Ph.D. (London) is a historian of science and medicine in the Department of Humanities at Penn State's College of Medicine in Hershey, Pennsylvania. Resonant of current academic and popular concerns, he is interested in the historical perspectives of how the nature-vs- nurture controversy has shaped humanity. His survey of the nature side of this controversy appeared as a five-volume edited series, *Childbirth: Changing Ideas and Practices in Britain and America, 1600 to the Present* (Garland, 1996), and he is currently preparing a monograph on *Perfecting Heredity: Eugenics as Panacea for Disease in Early 20th-Century America*. His previous publications include *Surgery, Skin & Syphilis: Daniel Turner's London (1667-1741)* (Amsterdam and Atlanta: Rodopi Press, Wellcome Institute of the History of Medicine Series, 1999). Wilson has previously taught at Yale University, the University of Hawaii, Truman State University, and Shimer College, and he continues to serve as the consultant biomedical and health editor for *Encyclopaedia Britannica*. Currently, he is in the midst of a three-summer Templeton Foundation Fellowship in Oxford where he and 34 other scholars around the globe are exploring the historical and current intersections between science and religion. His Templeton research project, *Glaciers, God, and Geography: Neuchatel's Arnold Guyot (1807-1884)* at Princeton, explores this 19th-century earth-scientist's success in incorporating both science and religion into his pursuits to understand the history, composition, and meaning of both the earth and its human inhabitants.



**Notes...**





