# Bioscene

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**Cover image:** The trumpet creeper (*Campsis radicans*) is a deciduous woody vine with showy clustered reddish-orange flowers. It grows in low woods and thickets and flowers from July-September. Photograph courtesy of Diane Prentice.

# Articles:



# News & Views:

# Bioscene: Journal of College Biology Teaching

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**Deadlines for Submissions**

**November 1, 2002 for the December 2002 Issue**

**February 1, 2003 for the March 2003 Issue**

# Cooperative Learning: Moving from Theory to Practice in a Class of 80 Students

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***ABSTRACT**:* A team of faculty changed what was formerly a large lecture course to one focused on small group learning. Students work in structured teams of 4 to understand papers from the current biological literature and demonstrate their understanding by completing a challenging team worksheet in class each week. We see great improvement in students' abilities to apply their knowledge to new situations and to propose appropriate experiments to answer questions or test hypotheses. We think our model may be useful for others and in this paper describe components of the course and the process we went through in designing it.

***KEY WORDS***: small group work, cooperative learning, active learning, capstone course, biological literature

## INTRODUCTION

Biological Interactions (Biocore 333) is the capstone course for a four-semester, cross-college introductory honors sequence at the University of Wisconsin-Madison. It is intended to give students opportunities to integrate and build on the material (evolution, genetics, ecology, cell and molecular biology, plant and animal physiology) they have learned over the previous three semesters and to prepare them for advanced work in any area of biological science. It is a semester-long, 3 credit class that enrolls about 80 students per year from a variety of biological science majors.

The course had been taught for many years as a traditional lecture class by faculty drawn from departments across campus. We were motivated to change the design because we were frustrated by the number of students who were unable to apply what they were being taught to new situations or to propose appropriate experiments to answer questions presented to them in hypothetical scenarios on assignments and exams. I worked with two teams of faculty in revamping the course. The first team, Lynn Allen-Hoffmann, Nansi Colley, Jeff Hardin, and Amy Moser, designed the new version of the course and taught it for 4 years. The second team, Richard Burgess, John Fallon, Anne Griep, and Donna McCarthy, took over the class in 2001 and successfully adopted the first team's model.

Much research on teaching and learning has shown that an effective way to enhance learning is to put students in small cooperative groups and have them work together on appropriate intellectual tasks (summarized for college math and science courses by Cooper and Robinson, 1998). All of us who teach have experienced the phenomenon of learning something much more deeply when we have to teach it. The idea behind cooperative learning is to help students teach each other. Someone who has just mastered a difficult concept is often better than the instructor at explaining it to a peer because the instructor has so thoroughly integrated the idea into her/his conceptual framework that she/he has forgotten what makes it difficult. Furthermore, part of learning is translating ideas into one's own language; discussing them with peers allows this to happen.

The effectiveness of this approach is well supported by data. The authors of a meta-analysis commissioned by the National Institute for Science Education reviewed a large number of college science, mathematics, engineering, and technology studies and found that small group learning methods are more effective than lectures in promoting academic achievement as well as positive attitudes towards science; they also reduce attrition (Springer et al., 1999). One study that compared two versions of an analytical chemistry course, a "responsive lecturing" version that emphasized well-taught lectures and a "structured active learning" version that emphasized small group work, is particularly notable for the thoroughness of its assessment of student outcomes. A team of unbiased faculty interviewed each of the students to judge his/her competence in chemistry. They perceived that students from the structured active learning course had better reasoning, problem-solving, and communication skills than those from the responsive lecturing course (Wright et al., 1998).

Our revised Biological Interactions course emphasizes small group work and gives students much more responsibility for their own learning. We see great improvement in students' abilities to apply their knowledge to new situations and to propose appropriate experiments. This paper describes components of the course and the process we went through in designing it.

## COURSE DESIGN

The process of planning the revised course confirmed for us the power of cooperative learning. None of us knew how to do this but we figured it out together! We met many times to discuss various models for small group learning (an earlier version of Johnson et al., (1998) was particularly helpful) and to talk with colleagues who had implemented cooperative learning in their own courses. We particularly appreciated those who shared with us their failures as well as their successes, thus helping us to avoid many potential problems. We learned, for example: (1) the importance of having a well-defined structure for the course as well as a framework for the teamwork, (2) the necessity for individual accountability to assure that all team members are prepared for group work, and (3) the merits of incorporating honest feedback about team functioning by the team members.

The plan we developed is for students to work in structured teams of 4 (see Table 1) to understand papers from the biological literature and to demonstrate this understanding by completing a challenging group worksheet in class each week. The faculty team chooses four topics each semester, and each member takes charge of one. We select topics that we think will engage students, that introduce them to current tools and methodologies, and that draw from more than one area of biology. Some examples of topics we have used: breast cancer, molecular mechanisms in infectious disease, and obesity. It is preferable for faculty not to choose their own area of research because they tend to assume too much prior knowledge when they do this. Each faculty member selects mainstream papers from the current literature (usually 1-2 per week) and then prepares study guides, individual quizzes, and team worksheets for each week. The faculty then study each other's materials and meet many times over the months preceding the course to provide constructive criticism. Although this makes extra work, it results in much more effective materials and better integration and connections among the units, and both teams of faculty have continued to use this process each year.

We wanted our grading system to reflect our course goals and decided on an absolute grading scale (rather than a curve) so that no one is penalized by helping another. The worksheets are a key part of the course and count for 45% of each student's final grade. The remaining 55% is from individual work, including quizzes and two exams.

***Figure 1***. *Teams of Biocore 333 students working together on worksheets.*

## STRUCTURE FOR EACH WEEK

The class meets for 50 minutes three times per week in an ordinary lecture hall, bolted seats and all (Figure 1). We would much prefer a more congenial room arrangement but none are available for a class this large. The Monday class consists of a lecture introducing the topic and providing background material. The Wednesday class consists of "open book" worksheets that student teams complete in class while the faculty leader and TAs circulate and answer questions. (The faculty gain insight into students' understanding of the concepts as they answer their questions and observe their approach to the worksheet questions.) An example of a worksheet is shown in Figure 2. The Friday class consists of an interactive discussion of the worksheet answers led by the faculty leader, who calls on reporters from several teams to report their answers. He/she then gives a preview of the next week's paper(s). In addition, each student attends a small TA-led 50 minute discussion section on Tuesdays. To encourage all team members to study the assigned papers and background references ahead of time, there is a short individual quiz each week during the discussion sections. Students are on their honor not to reveal quiz questions or answers to those in other sections.

We deal with illness, out of town trips, and personal emergencies by allowing each student to drop his/her lowest quiz and lowest team worksheet score.

Teams spend 5 minutes at the beginning of class each Friday assessing how well their group functioned that week and discussing what and how they want to improve during the next week. We structure this with a short form that they complete in class. An example is available on the web site described below (http://www.wcer.wisc.edu/nise/cl1/CL/story/burgessa/TSABA.htm).

## COURSE MATERIALS

Students purchase a reading packet at the beginning of the semester that includes study guides for each week and all of the assigned papers. Each study guide gives the learning goals for the week, lists terms and concepts students should review in their textbooks, defines new technical terms, briefly describes unfamiliar procedures, and supplies information that is sometimes missing from figure legends. It also poses questions to stimulate students' thinking, e.g., "If you had been a reviewer of this manuscript and believed you should ask for one more experiment, what would that be?"

The short weekly quizzes consist of straight-forward questions designed to be easy to answer by those who have reviewed the background material and read the week's papers. An example of one of John Fallon's quiz questions from the week devoted to telomeres and cloning is, "The nuclei for the cow and sheep cloning experiments were in the same part of the cell division cycle. What was it?"

Worksheet questions, on the other hand, require discussion and thought and often have more than one correct answer. Often they ask students to propose hypotheses and/or experiments to test them. An example of a worksheet from the cloning week is shown in Figure 2. We provide only one worksheet per team because we want all team members to discuss each question and work together on a consensus answer.

Every year students ask to have multiple copies of the worksheets, but the one time we experimented with allowing this, most teams split up the questions rather than working together. They say that it is difficult to read the questions because the paper is upside-down for some of the team, so we compromise by projecting an overhead of the worksheet at the front of the room.

The two exams (midterm and final) are completed individually and consist of essay questions that draw on the main concepts and approaches from the papers rather than the specific details.

Examples of a study guide, quiz, worksheet, and team feedback form can be found on the National Institute for Science Education's Collaborative Learning web site http://www.wcer.wisc.edu/nise/cl1/CL/story/burgessa/TSABA.htm.

## TEAM MEMBER ROLES

We assign students to teams of 4 and attempt to balance ability levels and gender. Specific roles (see Table 1) rotate each week in a specified manner. All members of the team are responsible for being sensitive to the feelings and level of understanding of the others, promoting group interaction, and being prepared for group meetings. Team members sit together during class meetings and are strongly encouraged to meet outside of class to answer each other's questions and to go over the figures for that week's papers. Many, but far from all, do so, and this seems to vary from year to year. We have been open to rearranging teams at mid-semester; however, even students who start out unhappy with their team have wanted to stay together when given the opportunity to switch at mid-semester.

## TEACHING ASSISTANTS

Graduate teaching assistants are a very important part of the team. In addition to leading the Tuesday discussion sections, which focus on answering students' questions (as soon as the quiz is over), they provide feedback to the faculty prior to the final versions of the quizzes and worksheets, circulate to answer questions during the Wednesday worksheet sessions, grade the worksheets in consultation with the faculty, and assist in preparing and grading the exams. A weekly on-line newsletter produced by the lead TA helps to create a sense of community for all involved. Graduate students who plan to become college teachers find the opportunity to be involved in a cooperative learning course particularly valuable; the experience has helped several to obtain desired positions.

*Biocore 333 Spring 2001 - John Fallon*

Include only those present:

Team No. _________

Facilitator:________________________

Monitor:______________________

Recorder:_________________________

Reporter:_________________________

**Worksheet for Week 13**

Stein GH, Drullinger LF, Soulard A, and Dulic V. (1999) Differential roles for cyclin-dependent kinase inhibitors p21 and p16 in the mechanisms of senescence and differentiation in human fibroblasts. *Molecular and Cellular Biology* **19**:2109-2117.

1. A. (4 points) Using Figure 1 of Stein et al., describe the relationship of p27 and p21 to the data on population doubling and cell density over the course of the experiment.

B. (4 points) Considering the data in Figure 1, what is the hypothesis that Stein et al. put forward about p27 and p21?

2. (6 points) Using Figure 1, what is the relationship of p21 and p16 at initial senescence and what is it at late senescence?

initial: ____________________________________________________________________

late: ______________________________________________________________________

3. How do the authors show that cyclin D associated phosphorylation of pRB at Ser-780 fails to occur in senescent fibroblasts and what is the importance of the observation?

| Method (2 points) | Why important (4 points) |
|---|---|
| | |

4. (6 points) You were asked to think about why p21 would appear during phase II (young cells). The authors do not really address this issue. **Considering information available in clonal analysis of HDFs**, propose an explanation why p21 appears during phase II and give an experiment to test your explanation and the predicted results if your explanation is correct.

| Explanation | Experiment | Predicted Results |
|---|---|---|
| | | |

5. (12 points) Stein et al. propose that the action of p21 results in the observed G1 block **in early senescent cells.** Propose two **in vitro** experiments that would test this hypothesis using HDFs that have a total of 60 population doublings (PD) and the expected results if the hypothesis is correct.

| General approach (or category) of experiments | Expected result - Early in experiment at 35 PD | Expected result - Late in experiment at 50 PD |
|---|---|---|
| | | |
| | | |

6. (12 points) p16 is proposed to continue the G1 block late in senescence, at which time p21 declines. Propose two **in vitro** experiments that would test the hypothesis that p16 is responsible for the late senescence G1 block and the expected results if the hypothesis is correct.

| General approach (or category) of experiments | Expected result - Early in experiment | Expected result - Late in experiment |
|---|---|---|
| | | |
| | | |

***Figure 2****. John Fallon's worksheet for the week on telomeres and cloning.*

***Table 1.*** *Team Member roles.*

| | |
|---|---|
| **Facilitator** | Makes sure everyone understands each worksheet question before the team begins to discuss it, encourages everyone to participate, encourages cooperative behavior, helps the group to reach consensus, and arranges out-of-class meetings. |
| **Monitor** | Keeps everyone on task, monitors time, and moves the group along to assure that the tasks get done in the allotted time. |
| **Recorder** | Writes down the group's consensus answers to the worksheet questions, hands in the worksheet at the end of the Wednesday class, and picks up the graded worksheet at the end of class the following Monday. |
| **Reporter** | Picks up a copy of the team's worksheet at the beginning of class on Friday, reports the team's answers on Friday when called on, makes sure the team discusses how it functioned that week, and turns in the team's feedback form each Friday. |

## STUDENT BOARD OF DIRECTORS

We want student input in accomplishing the course goals and ask each discussion section to choose a representative (and alternate) at the beginning of the semester to serve on the Board of Directors. Board members receive suggestions and concerns from class members and meet briefly to discuss them with the faculty leader and TAs after class each Friday. This gives us the opportunity to address problems together and also to explain the reasons behind certain course policies (e.g., providing only one copy of the worksheet per team to assure that they work together).

## CONCLUSIONS

The present structure of the course makes us much more aware of students' level of understanding than we previously were. The first time we taught it in this manner we were surprised to discover that students did not understand many concepts that had been "covered" in previous courses. One of the most important roles this course now serves is to give students a chance to revisit important concepts and integrate them into current biological questions. We deal with the need for review by emphasizing the importance of understanding the terms and concepts listed at the beginning of each study guide (putting some of them on the quiz gets the message across quickly!) and by adding a bit more background to the overview lectures.

The course brings most of the students to the point where they begin to understand the current literature. They also learn that even experienced scientists make errors in their papers or sometimes fail to include the proper controls. Students are able to comprehend complex papers after working through them with their teammates. They are much better than those in the previous version of the class at making connections between different parts of the course and at suggesting hypotheses to explain findings and appropriate experiments (including controls) to test them. They demonstrate these abilities on the worksheets and exams.

Although most students are quite skeptical about our approach at the beginning of the semester, most are very enthusiastic about the class by the end. On the last spring's course evaluation questionnaire, we asked whether they felt they learned more, about the same, or less compared with a traditional lecture course. 85% returned the questionnaire and of these, 69% checked "more," with many adding "much" or many stars or exclamation points in front of "more." 25% checked "about the same" and 6% checked "less." Some illustrative comments are shown in Table 2.

Class participation and attendance are much higher than they were in the previous version of this course. We are convinced that the revised course helps students acquire deeper thinking and analytic skills and better prepares them for future careers, which are very likely to involve teamwork.


### ACKNOWLEDGEMENTS

I particularly want to acknowledge the enormous contribution of the team of faculty who worked with me to develop this course: Professors Lynn Allen-Hoffmann, Department of Pathology, Nansi Colley, Departments of Ophthalmology and Genetics, Jeff Hardin, Department of Zoology, and Amy Moser, Department of Human Oncology. I think the large part of the success of the course is due to the planning and mutual constructive criticism that went on ahead of time.


A partial description of the second year of the revised course can be found on the National Institute for Science Education's Collaborative learning web site http://www.wcer.wisc.edu/nise/cl1/CL/default.asp.
The web site includes examples of a study guide, quiz, worksheet, and team feedback form.

***Table 2***. *Student comments from the Spring 2001 Biological Interactions course evaluations*

- *The format in which this semester was taught should be used for the other semesters. I learned more this semester than the other three semesters combined!*
- *I think we actually learned a new way to learn this semester. I feel we covered much less material than the other semesters, but I may take more away from this semester than the others.*
- *Understanding and analyzing the papers with some instructor help enabled us to think beyond the spoon-feeding box.*
- *This class was very useful, it taught me [to] think on my own and come up with unique and interesting ideas.*
- *The group learning experience was very good. The first real productive group learning experience I've had here. Our meetings out of class were the best learning tool of the class.*
- *I really enjoyed reading the papers, learning more about how to think like a scientist.*
- *Reading actual papers was very helpful; it helps you apply concepts/techniques in order to actually retain information.*
- *It was harder to know what knowledge we were supposed to master for this course.*
- *Working in teams is a great idea because that is how we'll work in our careers. Combining brainpower is good.*
- *This course tied everything together from 4 years of science at UW. Also, it helped to give us a great skill of interpreting and understanding journals.*

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## Call for Nominations

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# Providing Students the Opportunity to Think Critically and Creatively Through Student Designed Laboratory Exercises

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***ABSTRACT*:** We designed a course that challenged students to design, write up, and carry out their own physiology laboratory experiments. Each group designed an experiment, wrote it up as a laboratory exercise, and then allowed the other group to carry out the laboratory exercise. Each group also provided a critique of the other's laboratory exercise. This method of instruction required students to design ways to use the equipment available to them and to solve problems that were unique to their particular experiment. Additionally, this provided students the opportunity to better their technical writing skills, oral presentation skills, and provided them some insight into the "real world" of scientific investigation. We believe that such a course design is applicable not only to the science of physiology, but could be utilized in a number of science disciplines.

***KEY WORDS***: physiology laboratory, student laboratory design, investigative laboratory

## INTRODUCTION

College students frequently take physiology courses as part of their required or recommended curriculum. Although the exposure to physiology is beneficial, we have found that students often view physiology as a requisite to graduate-level training in one of the health fields, rather than as a science in and of itself. We have also found that students often are more interested in grasping what is testable material than in grasping the purpose of a laboratory experience. The former approach short-circuits independent thought and critical thinking on the student's part.

This paper describes an experimental course developed at Emporia State University to challenge upper level and graduate college students to develop and carry out laboratory experiments in physiology. Laboratories in the sciences are typically used to give students a hands-on approach to science. Too often, students do not understand the purpose of actually performing a laboratory exercise and seem to be more interested in simply obtaining the desired results. Additionally, the cookbook mentality of many laboratory exercises also leads students away from thinking the procedures through, or thinking about why they are carrying out the laboratory exercise (Schamel and Ayres, 1992). This limits the amount of understanding needed to carry out the experiment. The idea behind a course in which students design and carry out their own laboratory experiments is to stimulate students to deepen their understanding of physiology by creating their own successful laboratory experiments. (The "you don't know it until you teach it" doctrine!). We also wanted to provide students with the chance to be creative in their design of laboratory exercises. Additionally, this would provide students the opportunity to better their technical writing skills, oral presentation skills, and provide them some insight into the "real world" of scientific investigation. Additionally, as the student designed experiments were not "canned experiments", students were required to design ways to use the equipment available to them and to solve problems unique to their particular experiment. This meets with the characteristics common to all investigative laboratories (Sundberg and Moncada, 1994). Previous papers have described investigative laboratories for college students (Woodhull-McNeal, 1989; Rangachari, 1991; McNeal and Murrain, 1994; Ahern-Rindell, 1999). However, many of these investigative laboratories are part of project-oriented courses for beginning students requiring specific techniques. Other investigative laboratories require students individually to undertake a research project in a very specific discipline. Our approach differs from the above approaches in that we challenge students to work in groups to design novel and creative experiments that could be used in an introductory human anatomy and physiology laboratory. This approach, like previously described investigative laboratories, requires students to identify and solve their own problems. In addition, it challenges students to write technically, work as a group, present data orally, and defend their experimental designs in front of their peers. We believe that such a course design is applicable not only to the science of physiology, but most science disciplines.

**COURSE DESIGN**

Prior to designing Experiments in Physiology, we discussed competencies that we would like all our biology students to have when they graduate. We compiled a list of eight competencies that we believed would benefit any biology student (Table 1). This is not an all-encompassing list, but one that would serve most students well.

***Table 1****. Competencies compiled by the authors for graduating seniors in the biological sciences*

| | |
|---|---|
| 1. | Be able to ask answerable scientific questions |
| 2. | Design and carry out experiments |
| 3. | Analyze data |
| 4. | Present data in a clear and meaningful manner |
| 5. | Write a scientific paper based on collected data |
| 6. | Constructively critique scientific papers |
| 7. | Become proficient with research equipment |
| 8. | Be able to work in a team |

Using these desired student competencies, we began to design a course that would challenge students to gain eight desired skills. On a small scale, we decided that having laboratory based experiments that students design, carry out, write up, present orally, and critique would meet our objectives. In addition, we decided to ask students to design and carry out a simple research project. At the end of the semester, they would write a scientific paper over their research and present their findings orally as done at scientific meetings.

We titled our course "Experiments in Physiology" which was offered for one hour credit, meeting for two hours per week.

Emporia State University is on a semester system with sixteen weeks per semester. Our tentative schedule for the course is shown in Table 2. We decided that during the first four weeks, the instructors would review with the students various types of equipment and protocols by having the students perform laboratory exercises that required such equipment and protocols. During this time, students were reminded that they would need to carry out an original research project. During the fifth week, each group of students designed laboratory experiments using one or more of the pieces of equipment and protocols discussed during the previous four weeks. The sixth week of the semester was used by each student group to trade its laboratory experiments and carry out each others experiment. After each group had carried out the other group's experiments, they would critique the experiment and provide a grade for the experiment. During the seventh through tenth weeks, we worked with the students, covering exercises that used additional types of equipment and protocols. Also during the seventh week, students were required to turn in a research proposal for their original research project. During the eleventh week, students worked to design another exercise, using the skills they had gained during weeks seven through ten. In the twelfth week, students presented their experiments to their peers as previously described for week six. Weeks thirteen and fifteen were used to meet and discuss progress on student research projects. Week fourteen was used to show an additional use of equipment by carrying out a lactate dehydrogenase enzyme assay. The last week of the course, students gave oral presentations over their research projects. By the end of the semester, students turned in a paper over their research project, written in the style of a scientific journal of their choosing.

***Table 2***. *Tentative Schedule for Experiments in Physiology*

| | |
|---|---|
| Week 1 | Orientation and introduction to respiration, pulse, and EKG probes |
| Week 2 | EEG and EMG probes and EKG on non-human subject |
| Week 3 | Calorimetry |
| Week 4 | Working with an exercising animal |
| Week 5 | Design a laboratory experiment |
| Week 6 | Present the laboratory experiments |
| Week 7 | Viscometer and spectrophotometry (**project proposals due**) |
| Week 8 | Computer imaging |
| Week 9 | Statistical analysis of physiological data |
| Week 10 | Design a laboratory experiment |
| Week 11 | Present the laboratory experiments |
| Week 12 | Meet to discuss progress on research project |
| Week 13 | LDH Assay |
| Week 14 | Meet to discuss progress on research project |
| Week 15 | Presentation of research projects |
| Week 16 | Semester research project write-up due |

**COURSE IMPLEMENTATION**

Six students enrolled in the course, three seniors and three graduate students. The instructors divided the students into two groups, one consisting of the undergraduate students and the other consisting of the graduate students. We carried out experiments using computer probes to acquire data on respiration, pulse, electrocardiograms (EKG) (Fig 1), electroencephalograms (EEG), electromyograms (EMG) on humans, and EKGs on snakes during the first few weeks (Figure 2). We also performed experiments using closed system calorimetry on corn snakes and trained rats to run on a treadmill. Data were collected from some of these experiments, and students were asked to use the spreadsheet program Excel to perform simple statistics and graph their data.

Although we did not explicitly require students to use some of the above techniques and equipment in their own laboratory designs, it was our hope that the students would do so. We were surprised that neither group of students used these techniques in its experimental design. The graduate-student group carried out an expanded version of a laboratory performed on reflexes in our sophomore level Human Anatomy and Physiology lab. The undergraduate group was more imaginative, and designed a laboratory to investigate the sense of taste and its dependence on olfaction. No such laboratory is performed in any of the physiology laboratories at Emporia State University. We found the student-designed labs to be well written and the instructions easy to follow. When the groups traded their laboratory write-ups and carried out the other group's exercise, they also found the laboratory protocols easy to follow. However, neither exercise required the use of any physiological equipment with which the students had been exposed in weeks one through four.

***Figure 1***. *Two students measuring EKG.*

We spent three weeks showing the students how to use various types of equipment by having them carry out laboratories that we had designed. In addition, we taught students how to perform a t-test on their data. For the second student-designed exercise, we required the use of image capture and computer analysis of the captured image. The undergraduate group investigated changes in red blood cell size in response to various osmotic conditions. The graduate group focused on tongue flicking behavior in lizards exposed to various olfactory cues. Again, the laboratory exercises were well written, novel, and relatively easy to follow and complete.

With regard to research projects, the undergraduate group opted to determine heart rate from adult corn snakes (Figure. 2). This required the use of EKG probes and computer acquisition software to which they had been exposed to during the first two weeks of the class. Additionally, this experiment required the designing of a snake-restraining system, a paper towel tube closed at one end, and the modification of EKG software that was intended for use on human subjects. The graduate students undertook the investigation of oxygen consumption in mice and corn snakes at room temperature and $10^0$C using closed-system calorimetry (fig. 3). As animals were used in both experiments, students also were required to write an animal use proposal to obtain permission to experiment on animals. Oral presentations were well done and the papers were similar to a manuscript in a scientific journal.

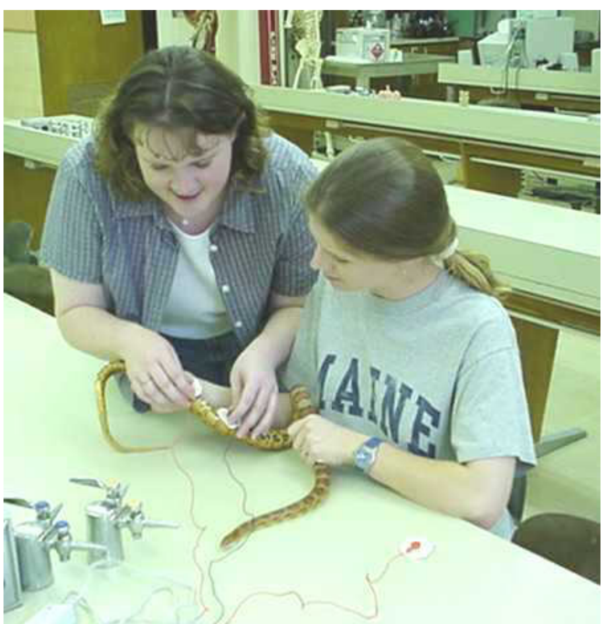

***Fig 2***. *Two students taking EKG of snake.*

***Fig 3***. *A student taking oxygen consumption reading for snake.*

**STUDENT REACTION TO THE COURSE**

We developed a student evaluation form solely for this course that consisted of eighteen questions to which students could respond both numerically, one through five with one being strongly agree and five being strongly disagree, and with additional comments. The questions and mean numerical responses (± SD) are shown in Table 3. The numerical value (2.67) for how our course faired with regard to other courses students had taken suggests that our students did not feel that Experiments in Physiology required more independent thought. However, one student commented that the Experiments in Physiology course required more independent thought than any other course he/she had taken. Additionally, the students that enrolled in our course were highly motivated and had taken other courses at Emporia State University that required class projects

We felt we had some moderate success in preparing students to ask better scientific questions after having this course. When students were asked if they could design quality experiments before taking the Experiments in Physiology course, the mean of their response was neutral (3.33 ± 0.82). After having the course, most students stated that they felt better prepared to design quality experiments (2.33 ± 1.03). Interestingly, all six students strongly agreed that they had a better appreciation for the thought involved in developing laboratory exercises (1.00 ± 0.00).

*__Table 3.__ Student evaluation summaries for Experiments in Physiology. Students were given a choice of 1 through 5 for each question with 1 being strongly agree, 2 being agree, 3 being neutral, 4 being disagree, and 5 being strongly disagree. Data are shown as the mean ± SD. (n=6)*

| | |
|---|---|
| 1. Relative to other lab courses I have had, this course required a similar amount of independent thought. | 2.67 ± 1.51 |
| 2 The time requirement for this course was what I expected for a one credit hour course. | 4.50 ± 0.55 |
| 3. I am better able to ask scientific questions after having this course. | 2.67 ± 0.82 |
| 4. I have a better appreciation for the thought involved in developing lab exercises. | 1.00 ± 0.00 |
| 5. There was inadequate time to prepare laboratory experiments. | 3.00 ± 0.89 |
| 6. After having this class I know when to use a t-test. | 1.67 ± 0.52 |
| 7. There was inadequate guidance to the use of Excel. | 3.50 ± 1.38 |
| 8. I feel more comfortable using Sigma Stat software after having this course. | 2.00 ± 0.63 |
| 9. Prior to this class I could design quality experiments. | 3.33 ± 0.82 |
| 10. After this class I could design quality experiments. | 2.33 ± 1.03 |
| 11. This class helped me know how to present data in a clear manner. | 3.55 ± 0.55 |
| 12. The lab critiques provided by classmates were beneficial. | 3.83 ± 1.17 |
| 13. The experience of critiquing your classmates had no useful purpose. | 3.50 ± 1.38 |
| 14. The faculty were inadequately prepared for this course. | 3.67 ± 0.82 |
| 15. The division of labor in my group was equitable. | 3.50 ± 1.05 |
| 16. Students should be allowed to pick their own groups. | 2.00 ± 0.89 |
| 17. My group functioned well. | 2.67 ± 1.20 |
| 18. I would recommend this course to fellow students. | 3.00 ± 1.26 |

Questions on the student evaluations were also written to assess how the students felt regarding their comfort with using simple statistics, spread-sheet software, and ability to present data. The students in this course responded fairly strongly that they were better able to determine when to run a t-test and to use the statistics software to run a t-test. However, student responses suggest that they were not given adequate guidance in the use of the spreadsheet program Excel. This may have occurred because we were aware that in each group at least one person was proficient with Excel, and we had hoped that she/he would show the other students how to use this program. Likely, to speed up the process, the students in each group that were familiar with Excel were the ones to use the program, without taking the time to show others in the group how to use the spreadsheet software. Students felt that this class did little to help them present data in a clear manner. This may reflect the earlier success of the biology program at Emporia State University in teaching skills rather than a failure of our course to assist students in learning to present data clearly.

We also tried to evaluate how the students felt with regard to the time commitment of the course and working as a team member. Students responded strongly that the expectations were far greater than they should be for a one-credit hour course (4.50 ± 0.55). The students did not have a strong feeling with regard to the amount of time provided to prepare laboratory experiments. Students responded fairly strongly that the division of labor within their group was not equitable and believed that they should have been able to pick their own groups. They were almost neutral with regard to how well they felt their group functioned. Most students did not believe that the laboratory critiques provided by their peers were beneficial, but did feel that the experience of critiquing classmates may have had some value. Students were neutral as to whether they would recommend this course to fellow students (3.00 ± 1.26).

An additional component of the student evaluation of the course was a section in which we asked students to provide a numerical response regarding their comfort level with the equipment prior to and after its use in the laboratory exercises (one being very comfortable and five being very uncomfortable) (Table 4). In general, students felt that they had gained some comfort with all equipment, but most for the computer probes, closed system calorimetry, and computer imaging.

***Table 4***. *Mean comfort level (± SD) with use of various equipment prior to and after having the experiments in physiology course. 1 = very comfortable, 2 = comfortable, 3 = neutral, 4 = uncomfortable, 5 = very uncomfortable*

| Equipment | Prior to Class | After Having the Class |
|---|---|---|
| Computer Probes | 3.0 ± 0.6 | 2.0 ± 1.3 |
| Closed System Calorimetry | 4.2 ± 1.6 | 2.7 ± 1.4 |
| Viscometer | 4.3 ± 1.6 | 3.5 ± 1.8 |
| Spectrophotometer | 4.0 ± 1.5 | 3.2 ± 1.5 |
| Standard Curve Development | 3.3 ± 1.2 | 3.2 ± 1.3 |
| Computer Imaging | 4.3 ± 1.0 | 2.7 ± 1.0 |
| LDH Enzyme Assay | 4.2 ± 1.6 | 3.7 ± 1.2 |
| Protein Assay | 3.8 ± 1.6 | 3.2 ± 0.8 |
| Working with non-humans | 2.5 ± 1.4 | 1.8 ± 1.2 |

**FUTURE DIRECTIONS**

Our maiden voyage with this course taught us as many things as we taught our students. To our surprise, the students did not feel that they had made much gain in presenting research to others. In hindsight, this is not a surprise since our class was exceptional in several ways. All of our students were high achievers and usually expected a great deal of themselves. Also, four of our six students were, or had been, teaching assistants in our anatomy and physiology lab for majors. One of the other students had an emphasis in environmental biology and as part of her emphasis had to conduct a 2 credit hour independent research project. Compared to the typical student, these students had much better presentation skills when they entered the course. The department of Biological Sciences at Emporia State University prides itself on a long history of student involvement in research, and the majority of our students had been involved in faculty research or their own projects prior to taking our course.

We did not expect our students to respond negatively about the amount of work that was required for one credit hour. We did expect much of them for only one credit hour. One of the things most frequently lamented by faculty is that students have little time in their schedules because of the number of hours they spend at a job outside school. For our students, the lack of free time was an issue in coordinating their schedules to accommodate research time outside of class time. The next time this course is offered we will amend it to be a two-credit hour course that meets for two hours twice a week. This will alleviate the hassle of coordinating group schedules.

Probably the thing that surprised us most was group dynamics. In one of our groups, the students did not work well together and complained about some members doing less than others and about some members trying to run everything. This is a problem that can arise in any class. Despite the apparent conflict among members of the group, the students did complete laboratory exercises and research projects that were above average. This experience in itself is an important lesson for the students who must often work together in the "real world" to complete projects.

We found that our graduate group gave lower grades in their critiques than the undergraduate group. This was a source of strife for some of our students, but overall, they found the process of providing criticism a beneficial exercise. We feel that the next time we offer this course, we need to provide guidance in how to give constructive criticism to avoid nit picking in the critiques. It seems important to us that students learn to accept constructive criticism and separate out valuable comments from nit picking comments.

Overall, this was a fun course to teach and the students seemed to enjoy the exercises. We were pleased at the effort our students put into this course and with the quality of their creativity and work.

**ACKNOWLEDGMENTS**

We wish to thank Dr. G. Wyatt, Department of Sociology and Anthropology, Emporia State University, for his help in developing a student evaluation instrument for our course. We also thank G. Sievert for photographing our students during experiments and M. Kearney and N. Palenske for allowing us to photograph them. Additionally, we thank M. Sundberg for his critical review of this manuscript prior to submission.

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Dr. Lynn Gillie, Dept. of Biology, Elmira College
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Voice –(607)735-1859, E-mail – lgillie@elmira.edu

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# Using pGLO to Demonstrate the Effects of Catabolite Repression on Gene Expression in *Escherichia coli*

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***ABSTRACT*:** Many biology students assume that genes are the sole determinants of organismal phenotype. This view ignores the influence of environmental factors on gene expression and their role in determining the overall phenotype of an organism. In this exercise students test the response of the arabinose operon promoter ($P_{BAD}$) from *Escherichia coli* to two different carbon sources (arabinose and glucose). Students transform *E. coli* with a recombinant plasmid (pGLO) that contains a reporter gene, encoding the green fluorescent protein, under the control of $P_{BAD}$. The $P_{BAD}$ promoter is induced by the presence of arabinose in the growth medium but is subject to catabolite repression in the presence of glucose. Students directly observe the effects of these sugars on gene expression by monitoring the ability of the transformants to fluoresce under long-wave UV light. This exercise gives students a practical introduction to the concepts of positive gene regulation and catabolite repression. Furthermore, it provides them with hands-on experience transforming *E. coli* with plasmid DNA and using antibiotics for the positive selection of transformants, both of which are essential techniques in modern gene-cloning technology. Most importantly, however, this exercise involves students in an inquiry process by asking them to propose a hypothesis and then interpret their results. The materials needed are relatively inexpensive and the only piece of equipment that is absolutely required is a long-wave UV light source.

***KEYWORDS***: Green fluorescent protein, transformation, gene expression, positive regulation, catabolite repression, *ara* operon

## INTRODUCTION

A continuing dialogue in modern genetics deals with the overall importance of genotype as the primary determinant of organismal phenotype. Advocates of the soon to be completed human genome project predict a future where genetic screening for hundreds or even thousands of disease-related genes is a routine procedure (Sander, 2000). It is expected that physicians will use this information to calculate personalized genetic-risk profiles for conditions such as Alzheimer's disease, diabetes, cancer, heart disease, stroke, and arthritis, to name but a few.

One problem with such predictions is that they invariably ignore the role of environmental influences on organismal phenotype. The phenotype of any organism, including that of a human being, is not solely determined by its genotype. In nearly all cases, it is the complex interaction of genotype and environment that determines the overall phenotype of an individual (McGee, 1997).

Exactly how the environment affects phenotype is an area of ongoing investigation. Not surprisingly, this topic has been studied thoroughly in prokaryotes. Bacterial cells exposed to changing environmental conditions often respond by altering their shape, form, and/or cellular metabolism (White, 2000). Interestingly, these striking changes in phenotype are rarely the result of a genotypic alteration, such as mutation; instead, bacterial cells utilize mechanisms that allow them to rapidly and efficiently regulate gene expression in response to the external environment.

Cells regulate gene expression for many reasons. For example, when grown in a nutrient poor environment, cells turn off genes that are not absolutely required for survival and thereby lower the overall synthesis of RNA and protein; a sensible strategy given that both transcription and translation are energyexpensive processes. Regulation may occur at any point during gene expression. However, the most common regulatory mechanism in bacteria, and perhaps the most efficient one, occurs during the first stage of gene expression when the messenger RNA (mRNA) is being made. Accordingly, genes that are controlled in this manner are said to be transcriptionally regulated (Snyder and Champness, 1997).

To visually demonstrate the effect of environmental factors on gene expression, an inquiry-based laboratory exercise was developed using an educational kit purchased from Bio-Rad. In addition to demonstrating that genes are regulated by environmental factors and the hierarchical nature of regulatory mechanisms in *E. coli*, this exercise introduces students to the process of bacterial transformation, and the convenience of using green fluorescent protein (GFP) as a molecular tag for studying cellular processes.

The Bio-Rad kit comes with a recombinant plasmid called pGLO that replicates in *E. coli* and carries a gene (*gfp*) that encodes the GFP of the bioluminescent jellyfish *Aequoria victoria* (Shimomura, 1998). When GFP is illuminated with long wave ultraviolet (LW-UV) light it gives off a bright green fluorescence. Therefore, cells that produce large amounts of GFP give off a brilliant green glow when irradiated by LW-UV light. In addition to *gfp*, pGLO carries two other genes, *araC* that encodes the activator protein AraC, and *bla* that encodes a beta-lactamase enzyme conferring ampicillin resistance on *E. coli* (Figure 1).

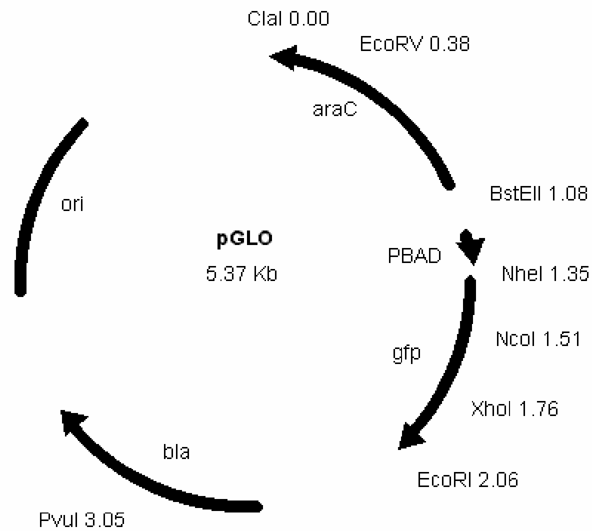


***Figure 1***. *A restriction endonuclease map of pGLO. The circle represents the covalently closed circular DNA of the plasmid. The arrows on the circle represent open reading frames (genes) or promoter sequences, and the direction of their transcription. Restriction endonuclease digestion sites are shown outside the circle. The number beside each indicates the distance of that site (in a clockwise direction) from the first base pair of the ClaI-site, in kilobase pairs. This map was adapted from the one shown on the Bio-Rad web site (www.bio-rad.com) using the pGLO nucleotide sequence as a guide. Abbreviations:* ***ori****, origin of replication;* ***bla****, beta-lactamase gene;* ***gfp****, green fluorescent protein gene;* $\boldsymbol{P_{BAD}}$*, promoter sequence of the E. coli araBAD operon.*

In pGLO, the *gfp* gene lacks the native *A. victoria* promoter and instead has been cloned downstream of a bacterial promoter. In bacteria, a promoter is a DNA sequence that functions, in conjunction with an activator/operator sequence, as a genetic switch determining when a gene is turned on or off. When a gene is turned on, RNA polymerase binds to the promoter and transcribes the downstream DNA into mRNA; the mRNA is then translated into protein by the ribosome. If a gene is turned off no transcription (or very little) occurs from the promoter and thus, almost no protein is produced (Maloy *et al*., 1994).

On pGLO, the promoter sequence controlling *gfp* expression usually regulates the transcription of a group of genes in *E. coli* called the *ara* operon. These genes encode proteins needed to metabolize the sugar L-arabinose. No (or very little) transcription occurs from the *ara* operon promoter (also called $P_{BAD}$) unless the activator protein AraC first binds to a specific activator sequence (*araI*) just upstream of $P_{BAD}$ (Figure 2). AraC is thought to help RNA polymerase bind to $P_{BAD}$ and initiate transcription. However, AraC only binds to the appropriate activator sequence in the presence of the sugar arabinose (Snyder and Champness, 1997).

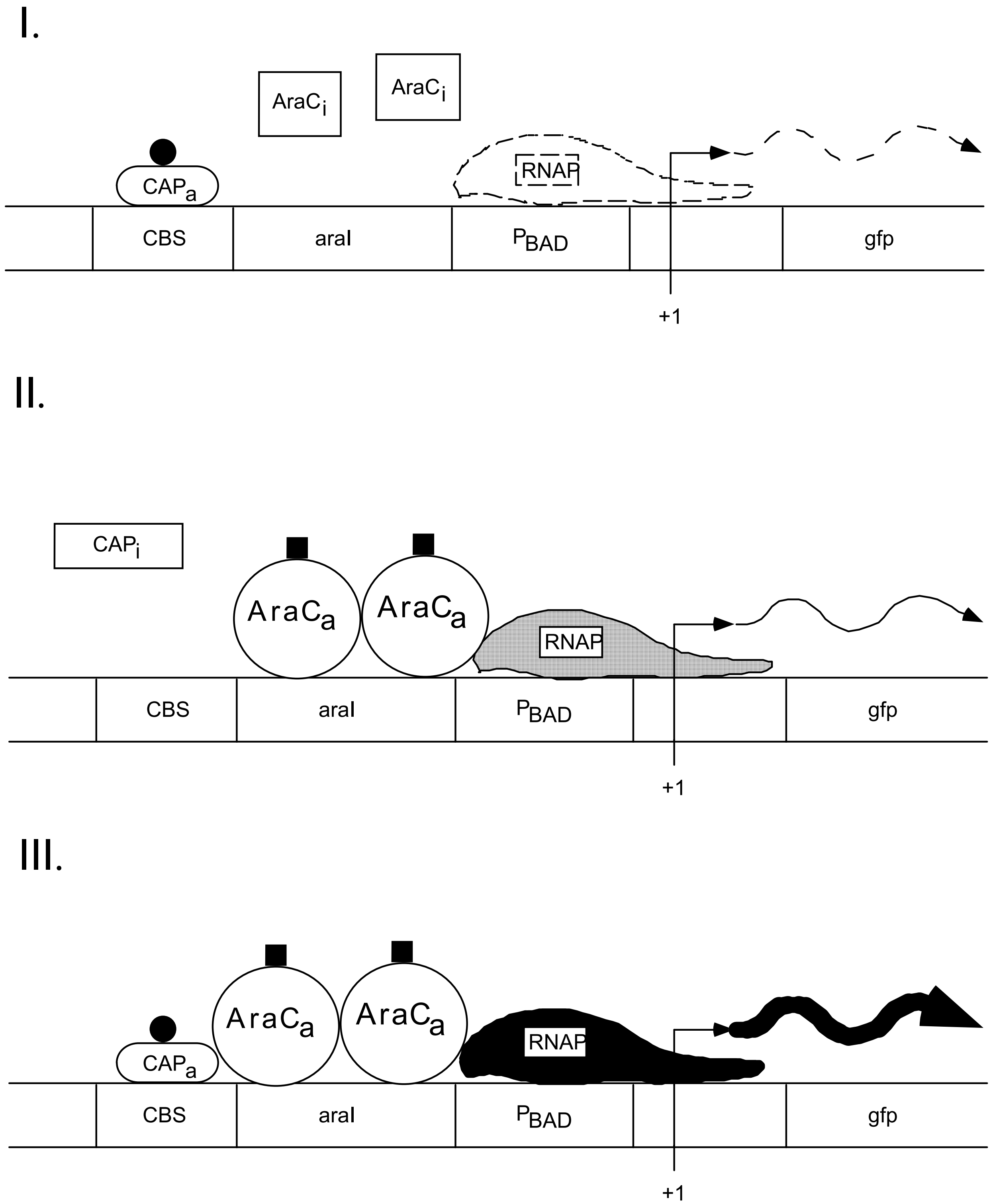


***Figure 2***. *Differential regulation of the araBAD promoter ($P_{BAD}$) with respect to carbon source availability. This diagram shows the transcriptional activity from $P_{BAD}$ when:* ***I.****, neither glucose nor arabinose is present,* ***II.****, both arabinose and glucose are present, and* ***III.****, only arabinose is present. The intensity of the wavy arrow extending from the transcription initiation site (+1) indicates the relative level of transcript produced under each condition. Symbols: ●, cyclic AMP, ■, arabinose. Abbreviations:* ***$CAP_a$****, catabolite activator protein (active),* ***$CAP_i$****, catabolite activator protein (inactive),* ***$AraC_i$****, AraC protein (inactive),* ***$AraC_a$****, AraC protein (active),* ***RNAP****, RNA polymerase,* ***CBS****, cAMP-CAP binding site,* ***gfp****, green fluorescent protein gene.*

AraC is an allosteric protein with two binding sites, the first binds arabinose causing a conformational change in the protein that allows the second site to recognize and bind to *araI*. Thus, in the absence of arabinose $P_{BAD}$ is effectively switched off, whereas, in its presence, the promoter is active. This process is called **positive** regulation because it requires the involvement of an activator protein that only binds to a specific activator sequence in the presence of an effector molecule, in this case arabinose, making transcription possible (Snyder and Champness, 1997).

In addition to the positive control exerted by AraC, efficient transcription from $P_{BAD}$ is dependent on another form of positive regulation mediated by the cAMP-CAP complex. Before RNA polymerase can bind effectively to $P_{BAD}$ two events must occur, first the arabinose-AraC complex must bind to *araI* just upstream of the promoter and second the cAMP-CAP complex must bind to a sequence just upstream from *araI* (see Figure 2; Zhang and Schleif, 1998). High levels of glucose inhibit the synthesis of cyclic adenosine monophosphate or cyclic AMP (cAMP), and without cAMP, the catabolite activator protein (CAP) cannot bind to its target sequence. Without the cAMP-CAP complex, RNA polymerase cannot bind efficiently to $P_{BAD}$ even in the presence of the arabinose-AraC complex and thus, very little transcription occurs. This effect is referred to as catabolite repression, a global regulatory mechanism that controls the expression of many operons in *E. coli*, including the well-characterized *lac* operon (Snyder and Champness, 1997). Thus, as long as arabinose is the only carbon source available to *E. coli*, transcription from $P_{BAD}$ occurs. However, if another more preferred carbon source, such as glucose, is available transcription from $P_{BAD}$ is significantly reduced.

Because fluorescence is easily detected, whereas the gene products of the *ara* operon are not, the cloning of the *gfp* gene sequence directly downstream of $P_{BAD}$ (in place of the *ara* operon genes) in pGLO greatly simplifies the process of studying the regulation of this promoter. Following the introduction of pGLO into *E. coli*, transformants are cultured on media supplemented with arabinose or arabinose and glucose. The effects of these sugars on gene expression may be observed directly by exposing the colonies to LW-UV light and looking for the presence or absence of green fluorescence. Thus, in this exercise GFP synthesis is controlled by $P_{BAD}$.

This exercise has three primary goals. The first is to clearly demonstrate how environmental changes affect gene expression and thus, phenotype. The second is to show that *E. coli* possesses more than one level of gene regulation, which allows it to quickly and reversibly alter its phenotype in response to environmental stimuli of differing quality. The last, and perhaps most important goal, is to give students practice at generating hypotheses and drawing conclusions based on their own results.

On the first day of the exercise, students transform *E. coli* with pGLO DNA and plate the transformants on to selective media supplemented with either arabinose or arabinose and glucose. They then formulate a hypothesis based on what they know about the *ara* operon and catabolite repression, and submit this to the instructor. On the second day students illuminate their plates with LW-UV light and record their results. Students then transfer one of the transformants growing on the arabinose/glucose medium to a medium containing only arabinose. On the third day students conclude the exercise by observing the results of this last experiment, and by preparing a short report that discusses whether their results agree or disagree with their hypothesis and the reasons.

## MATERIALS AND METHODS

**Bacterial strains, plasmid DNA, and growth media**.

A Bacterial Transformation Kit was purchased from Bio-Rad Laboratories (Hercules, CA; Catalog #166-0003-EDU). This kit supplied lyophilized *Escherichia coli* HB101 as a host for transformation, but *E. coli* DH5αF'IQ, originally obtained from Life Technologies (Rockville, MD), was used as the host for all transformation experiments described in this paper. The Bacterial Transformation Kit supplied 7.5 µg of purified pGLO, a quantity that was sufficient for approximately 50 transformations. LB medium (Luria Broth Base, Miller; Difco Laboratories, Detroit, MI) and LB medium solidified with 3% (w/v) agar flake (Difco Laboratories) were used for propagating and maintaining *E. coli*. All media were sterilized before use by autoclaving at 121$^{o}$C and 15 p.s.i. for 20 min. For the selection and maintenance of plasmid-containing cultures, LB medium or LB-agar medium was autoclaved and then supplemented with ampicillin (100 µg/mL). An aqueous stock solution of the antibiotic (100 mg/mL) was prepared by dissolving 1 g of ampicillin (sodium salt; Fisher Scientific, Pittsburgh, PA) in a final volume of 10 mL. The solution was filter-sterilized by passing it through a sterile 0.2-µm pore-size cellulose acetate membrane (Corning disposable sterile syringe filters, 25 mm; Fisher Scientific), divided into small aliquots, and stored at -20$^{o}$C until needed. To induce the expression of *gfp,* LB-agar medium was autoclaved and then supplemented with both ampicillin and 0.25% (w/v) arabinose. To observe catabolite repression LB-agar medium was autoclaved and then supplemented with ampicillin, 0.25% (w/v) arabinose, and 0.25% (w/v) glucose. Aqueous, 20% (w/v) stock solutions of both sugars were prepared by dissolving 20 g of either L-(+)-arabinose (Fisher Scientific) or Bacto-Dextrose (Difco Laboratories) in a total volume of 100 mL; both stock solutions were filter-sterilized and stored at 4$^{o}$C.

All other chemicals were of reagent grade, unless otherwise stated, and available from Fisher Scientific.

**Competent cell preparation and transformation.**

The Bacterial Transformation Kit recommends a rapid procedure for preparing competent cells and supplies all the necessary materials. However, an alternative method based on that of Sambrook *et al.* (1989) and Hopwood *et al.* (1985) was used to obtain higher and more reproducible levels of transformants. A 250-mL culture flask containing 50 mL of pre-warmed LB medium supplemented with 20 m*M* $MgCl_2$, was inoculated with 0.5 mL of an *E. coli* DH5αF'IQ overnight culture, and incubated at 37°C for 2-3 h with shaking (250-300 rpm). These cells were cooled on ice for a least 10 min, and then aseptically transferred, in 10-mL aliquots, to sterile pre-chilled polypropylene culture tubes. The cells were pelleted at 3000 rpm for 10 min in a clinical centrifuge at 4°C. By gently tapping on the tubes, each of the pellets was resuspended in 1 mL of ice-cold, sterile 0.1 *M* $CaCl_2$, made up to 10 mL with ice-cold 0.1 *M* $CaCl_2$, and cooled on ice for 20 min. The cells were then pelleted, resuspended in 1 mL of ice-cold 0.1 *M* $CaCl_2$, and incubated overnight on ice at 4°C. Cells remained highly competent for at least three days using this procedure if they were kept chilled on ice at 4°C. Competent cells, in 100-µL aliquots, were transferred to two pre-chilled sterile microcentrifuge tubes and mixed with either 5 µL (0.15 µg) of pGLO DNA or 5 µL of sterile water as a negative control. These were then cooled on ice for 30 min, and heat shocked at 42°C for 45 sec. The heat-shocked cells were cooled on ice for 2 min, mixed with 0.9 mL of LB-medium, and incubated at 37°C for 45 min without shaking. The tubes were then inverted 2-3 times to resuspend the cells and 150-µL aliquots of the pGLO-transformed cells were spread on plates of LB agar supplemented with either ampicillin, ampicillin and arabinose, or ampicillin, arabinose, and glucose. Likewise, 150-µL aliquots of the control cells were spread on to plates of unsupplemented LB agar or LB agar supplemented with ampicillin. The plate cultures were then incubated overnight at 37°C.

**Observing fluorescence.**

To detect fluorescence, plate cultures with their lids removed were placed in a Chromato-Vue Model CC-20 UV-light box (Ultra-violet Products, San Gabriel, CA) and illuminated directly with LW-UV light. Fluorescence could also be detected with an UV transilluminator, normally used for observing DNA or RNA in ethidium bromide-stained gels; plates were placed inverted, with their lids removed, on to the surface of the transilluminator and then observed directly using proper eye protection. Alternatively, a hand-held mineral light capable of generating LW-UV light could be used, with proper eye protection, to illuminate the surface of the plate cultures directly.

## RESULTS AND DISCUSSION

On the first day of this exercise each student team was supplied with 300-µL of competent cells and two microcentrifuge tubes. One tube, labeled NPC (no-plasmid control), contained 5 µL of sterile water while the other tube, labeled pGLO, contained 5 µL of plasmid DNA. To each tube 100 µL of competent cells were added. The entire transformation procedure took about 75 minutes to complete. Each team concluded the procedure by spreading their transformed cells on the appropriate media and incubating them overnight at 37°C. Prior to leaving for the day, each student was expected to submit a copy of Table 1 showing his or her expected results with regards to growth (G) and fluorescence (F) for each culture condition. This portion of the exercise was especially valuable because it required students to carry out three important steps: review the available background information, correlate this information with the procedure they had just completed, and formulate a hypothesis.

***Table 1***.. *Expected and observed results of plating pGLO-transformed E. coli competent cells and NP (no plasmid) control cells on LB-agar medium and LB-agar medium supplemented with ampicillin, ampicillin plus arabinose, and ampicillin plus arabinose and glucose. Indicate growth with a* ***G****, no growth with a* ***NG****, fluorescence with a* ***F****, and no fluorescence with a* ***NF****.*

| **Medium** | **Growth and fluorescence** | | | |
|---|---|---|---|---|
| | **NP*** | | **pGLO**** | |
| | **Expected** | **Observed** | **Expected** | **Observed** |
| **LB** | G, NF | G, NF | N/A | N/A |
| **LB/amp** | NG | NG | G, NF | G, NF |
| **LB/amp + ara** | N/A | N/A | G, F | G, F |
| **LB/amp + ara + glu** | N/A | N/A | G, NF | G, NF |

* Control (NP) cells were plated only on LB-agar, and LB agar plus ampicillin.

** pGLO transformants were not plated on unsupplemented LB agar.

Abbreviations: amp, ampicillin, ara, arabinose, glu, glucose, N/A, not applicable.

As expected, LB-agar plates spread with cells from the NPC transformation tubes showed confluent lawns of growth after 12-24 hours incubation. In contrast, ampicillin-supplemented LB agar plates spread with the same type of cells showed no observable growth. Culture media that had been spread with cells from the pGLO transformation tube typically possessed 500-1000 colonies per plate. Colonies grown on LB agar supplemented with ampicillin and arabinose emitted a brilliant green glow when illuminated with LW-UV light but those on LB agar supplemented with ampicillin, arabinose and glucose showed no fluorescence. pGLO transformants showed no fluorescence on LB agar supplemented with ampicillin only.

As a follow up exercise, students transferred colonies from cultures grown on LB-agar medium supplemented with ampicillin, arabinose, and glucose to fresh plates of LB agar, supplemented with just ampicillin and arabinose. After incubating these plates overnight at 37$^{o}$C, the subcultured transformants fluoresced brightly when illuminated with LW-UV light. This procedure provided visual evidence that the effect of catabolite repression on *gfp* expression was reversible, and not the result of a genotypic alteration such as mutation.

A number of teaching exercises have been developed that employ the *lac* operon as a classic paradigm for modeling gene regulation in *E. coli* (Atlas *et al*., 1995; Mertens and Hammersmith, 1995; and Moss, 1997). Such exercises typically require indirect methods for observing *lacZ* expression (e.g. spectrophotometry) and make use of chromogenic substrates like ONPG (*o*-nitrophenyl-$\beta$-D-galactoside) and gratuitous inducers such as IPTG (isopropyl thiogalactoside) or TMG (thiomethylgalactoside). Although many of these exercises have the clear advantage of being quantitative, they often require the use and/or availability of organic solvents, water baths, multiple pipetting steps, and spectrophotometers. In contrast, the pGLO system requires only the availability of an inexpensive bacterial growth medium, glucose, arabinose, ampicillin, and a suitable LW-UV light source. Furthermore, GFP is extremely stable and plate cultures can be stored at 4$^{o}$C for at least two weeks without any appreciable loss of fluorescence.

To extend the inquiry approach of this exercise even further, students could design experiments based on their own questions about this system or on questions supplied by the instructor such as the following:

1. Do sugars other than glucose have an effect on $P_{BAD}$ expression?
2. Is the level of expression from $P_{BAD}$ dependent on the concentration of either arabinose or glucose?
3. What is the time course of expression from $P_{BAD}$?

Since the equipment and resources needed are relatively common, students could not only propose their own experiments but perform them as well.

For example, one of my students posed the question: Is catabolite repression dependent on the concentration of glucose in the medium? Based on her knowledge of the *lac* operon in *E. coli,* her hypothesis was that the level of catabolite repression observed would be dependent on the glucose concentration. She predicted that if the arabinose concentration was kept constant and the concentration of glucose in the medium was lowered the level of $P_{BAD}$ expression should increase. She tested her hypothesis by subculturing one of her pGLO-transformants on six LB-agar plates, each containing an identical amount of arabinose but decreasing concentrations of glucose. She then observed and photographed her plate cultures under LW-UV illumination. As expected, the intensity of fluorescence observed appeared to be inversely proportional to the concentration of glucose in the medium.

The simplicity of this system makes it ideal for instructors, whose primary goal is to demonstrate the regulation of gene expression in a qualitative manner, but also for those who would like to include an inquiry component in their curriculum. This exercise is appropriate for both undergraduate microbiology and genetics classes.

## ACKNOWLEDGEMENTS

I thank Dr. Ann Larson for helpful suggestions and encouragement during the preparation of this manuscript. Thanks are also due to the students of Biology 381 (Spring, 2000) for field-testing this exercise.

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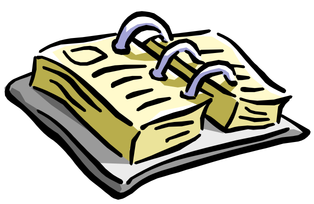

# Housing Preview

## 45th Annual ACUBE Fall Meeting
## Columbia College, Chicago, IL
## September 12-14, 2002

**Lodging:** The following hotels are within walking distance of the meeting facilities at Columbia College. A block of rooms has been reserved at the Best Western Grant Park Hotel for meeting participants. Please make your reservations early

**Best Western Grant Park Hotel**
1100 South Michigan Avenue.
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Phone: 312-922-2900
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Chicago, IL 60605
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**Hilton Chicago and Towers**
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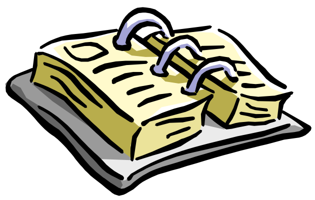

# Travel Preview

## 46th Annual ACUBE Fall Meeting
## Columbia College Chicago
## September 12-14, 2002

| | |
|---|---|
| **BY CAR** | |
| From I-55 (Stevenson) | Proceed to the end of the expressway and take Lake Shore Drive north to Balbo Street. Take Balbo to Wabash; turn right to Harrison. |
| From I-57 to I-94 (Dan Ryan) or I-90/94 (Kennedy/Edens) | Exit on Congress Parkway. Drive east to Wabash; turn right to Harrison Street |
| From I-290 (Eisenhower) | Follow signs for Congress Parkway. Drive east to Wabash; turn right to Harrison Street. |
| Parking | Parking is available on Wabash between Harrison and Balbo and on the corner of Wabash and Harrison. Walk east on Harrison to Columbia College Chicago. Get your ticket stamped at any of our security guard stations for a discount rate. |
| **BY METRA/AMTRAK** | **Amtrak 1-800-872-7245 Metra 312-322-6777** |
| Northwest Station & Union Station | Take the Indiana/Hyde Park # 1 bus from Adams and Canal Street south to Michigan and Harrison. |
| LaSalle Station | Walk five blocks east on Harrison to Michigan Avenue. |
| Randolph Station | Take the # 3 bus from Randolph and Michigan south to Harrison. |
| **By CTA** | **Toll Free 1-888-968-7282** |
| Red Line | **Monday thru Friday** -- Harrison and State stop. Walk two blocks east to Michigan Ave. **Weekends and Holidays** -- Jackson and State stop. Walk two blocks east to Michigan Ave., turn right and walk three blocks south to Harrison. |
| **BY PLANE** | |
| Midway Airport | **Subway "EL"** -- Take Orange Line to Library/Van Buren stop. Walk east to Michigan Avenue. Take right to Harrison. **Taxi** -- Expect to pay around $15 from Midway to Columbia College. |
| O'Hare Airport | **Subway "EL"** -- Take Blue Line to LaSalle stop. Walk east on Congress to Michigan Avenue. Take right to Harrison. **Taxi** -- Expect to pay around $25 from O'Hare to Columbia College. |

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9. **1104 Center** 1104 South Wabash
10. **Theater/Film Annex** 1415 South Wabash Avenue
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12. **24 East Congress Parkway Building** 24 East Congress Parkway
13. **1006 South Michigan Avenue Building** 1006 South Michigan Avenue

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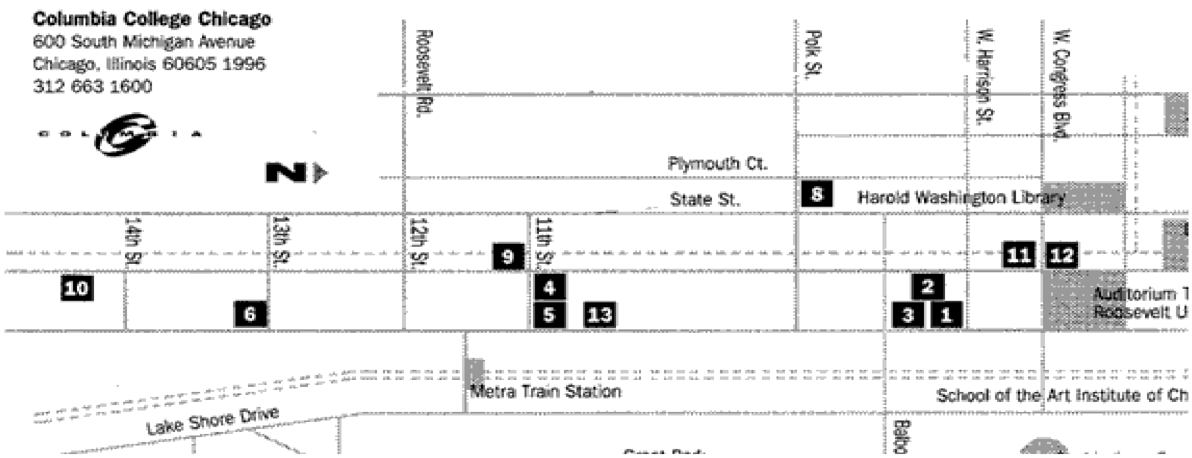

# The Public's Comments About Susan Epperson's Challenge of the Arkansas Anti-Evolution Law: Have Feelings Changed?

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***ABSTRACT:*** There was a strong response by the public to Susan Epperson's historic challenge of the Arkansas anti-evolution law in the 1960s. The public's responses stressed several themes, including that 1) evolution is "only a theory," 2) truth about nature is found in God's word rather than science, 3) people are uncomfortable with sharing a common ancestor with apes, 4) the teaching of evolution produces societal ills, and 5) evolution upsets many people's views of race relations. Many of these responses by the public to evolution remain common today.

***KEYWORDS:*** Creationism, Epperson v. Arkansas, Evolution, Susan Epperson

*I don't think the world changes very rapidly.*
John Scopes, 1966[1]

In 1964, Susan Epperson accepted a job as a biology teacher at Central High School in Little Rock, Arkansas. Soon thereafter, Epperson faced a dilemma: she could either obey the state's anti-evolution law (passed in 1928 in a public referendum) and not teach evolution to her students, or she could teach evolution to her students and commit a crime. Epperson, refusing to compromise her course, decided to challenge the law. Her challenge -- the first legal test of an anti-evolution law since the trial of John Scopes in Dayton, Tennessee in 1925 – culminated in 1968 in the Epperson v. Arkansas decision by the US Supreme Court. Epperson v. Arkansas changed science teaching in public schools by legalizing the teaching of evolution and strengthening academic freedom (for a discussion of the history of the Arkansas antievolution law, see Moore 1999, 2002a). Although Epperson v. Arkansas was decided more than 30 years ago, its lessons remain important for teachers, students, parents, and administrators. Epperson v. Arkansas also allows us to determine how many of the public's perceptions about evolution in the 1960s persist.

Not surprisingly, Epperson was attacked by a variety of fundamentalists and religious groups, despite the fact that her attorney had issued a statement proclaiming that Epperson was a Christian, that her husband Jon was in the military, and that both were "beyond reproach morally" (for details about Epperson v. Arkansas, see Moore 2002a). Hundreds of people wrote to Susan. Before her case ended, Susan received stacks of pamphlets having titles such as Darwin's Confusion, Hell - Is It Real?, The Races of Mankind, Christ Is What You Need, God Was Right - Darwin Was Wrong, Evolution Is The Basis of Communism, Are Evolutionists Intelligent?, Evolution Is Anti-Christian, and Yes - It's a Sick World. Despite her statement and life's work to the contrary, people questioned Susan's religious beliefs. Although most people who wrote to Susan had no understanding of evolution, they somehow *knew* that it was incompatible with their religious beliefs, and was therefore "wrong."

People from all over the country sent articles and letters to Susan, most of which were either positive or neutral:

- I hope you win your case because students should know the truth. - John Roberts, 9 December 1965
- It has always been my firm belief that our schools were instituted to teach the principles of truth. - Floyd E. Nutt, letter to editor, "Teaching Evolution" (Arkansas Gazette, 27 December 1965)
- Teachers ... have the responsibility and obligation to offer information that can help students ... reach intelligent conclusions. - Richard Hoover, letter to the editor, "Evolution

[1] Scopes' comment, made during a rare public interview in which he supported Susan Epperson's challenge of Arkansas' ban on the teaching of evolution, was about the public's perception of evolution (see Monkey trial, 1966).

A Fundamental of Life" (Arkansas Gazette, 3 January 1966)

- Science does not proclaim to have all truth, and we should hope it never does for it would then cease to seek truth and thereby become stagnant and lifeless. - Homer Anderson, for the Quacita County Board of Education, 27 May (no year listed)

Epperson also received many letters that criticized her motives, opposed her actions, vilified her character, and offered advice for salvation. Those letters stressed several themes:

**Truth about nature is found in God's word, not science.**

- All you have to do is go to God's Word. - M.T. Stout, 2 April 1966
- If you have the desire to teach evolution, I suggest you destroy disbelief in evolution with God's word. – Charles J. Green, undated letter
- I doubt very much that you have read the Bible. – I.S. Graves, 2 September 1966
- If you will investigate the Bible thoroughly you will not want to teach this theory. – W.O. Batten, 30 December 1965
- Jesus Christ DID NOT believe in evolution. – Alice Moore, 4 April 1966
- If you will take the word of God you won't need any more books. - Brad Brower, 9 December 1965
- There is enough ungodliness in this wicked world already without creating more … Oh you animals of little mind, so why don't you turn to God wholly? – Don Chesney, 13 December 1965
- When you teach that the bible [sic] lies ... or rather that God Him Selh [sic] lies ... you are treading on dangerous ground. The Bible says ... that 'and the Lord God formed man of the dust of the ground, and breathed into his nostrals [sic] the breath of life; and man became a living soul'. Now what are you going to do with that verse? - Mrs. A.T. Farmer, 2 April 1966
- The theory of evolution tampers with the truth. - Felicia, letter to the editor, Johnson County Graphic (Clarksville), 20 January 1966
- I know you can't teach the Bible in school but you could leave out Darwin's theory. Mrs. R.B. Boland, 4 April 1966
- Why would you want to go to such extremes to teach something which contradicts the truth? Also that would confuse the children. For the truth of creation teach Genesis. - Mrs. R.B. Boland, 4 April 1966

**Evolution is only a theory.**

- If evolution is true, then it should be taught, but since it is only a theory, why teach it? - W.O. Batten, 30 December 1965
- The theory of evolution is only a theory. The Bible and god are facts. - Anonymous
- Evolution is still an unproven theory, while the Bible can be proven as it relates to creation. - Mark Parker, 20 January 1966
- [The Bible] would do our young people a great deal more good than the ever changing THEORY of evolution. "Ever learning and never able to come to the knowledge of the truth." II Timothy 3:7. - Roland C. Parkey, Sr., 31 January 1966
- The theory of evolution is only a theory. The Bible and God are facts. – Anonymous, undated letter.

**People are uncomfortable with -- and even offended by – sharing a common ancestor with apes.**

- ... if you want to claim relation to the ugly apes go right ahead ... - Flo Evans, August 1966
- Go on and visit your kin and swing from the trees with them, but I am proud God created me. – Anonymous, 4 April 1966
- You go right ahead Mrs. Epperson and teach the ugly theory of evolution – because from the way you looked on TV it could be true that man and woman did evolve from apes. – Mrs. William Harshaw, 2 April 1966
- Having seen your picture it is easy to understand why you would want to argue and teach that you evolved from this lineage. – John Jones, undated letter
- No wonder you want Arkansas to let you teach evolution in school; to look at you and your old Dad any one would think you and he both started from a big old baboon. He looks like one and you look like a tailless monkey… American needs Bible teachers not things like you … I pity your Mother for giving birth to such a girl. – Anonymous, undated letter
- I am sure you are not aware of the Havoc you are causing among the young with your Darwin theory, teaching ... As United States is mostly Christians, this is an affront to Christians, and in favor of the atheists, it is about time that Christians rise up and demand recognition for their beliefs. The Bible reading was removed as a affront to the atheists, well this Darwin theory is an affront to the Christian, and we are footing the bills for the nation. Even the Jew would object to being descended from a monkey, as it sure would not fit their religious views. Not knowing you, it could be true, in your case, but why brag about it, you are proving it. - Anonymous, undated letter

**People do not understand evolution.**

- Will you please tell your class why monkeys have quit turning into Human Beings? I would also like to know why. - Mrs. J. Henry Dunn, 9 September 1965
- There is absolutely no foundation whatsoever for the belief in evolution … People still produce people, cats produce a cat, dogs a dog, birds a bird, monkeys a monkey, etc. I beg of you to get down on your knees and cry out to God to give you wisdom and understanding. – Mrs. Parker, 15 March 1966
- Now, if man came from monkey, it seems the monkey would be no more. Or, else monkeys would still be having men and men giving birth to monkeys. - Mrs. Gene Watson, 20 January 1966

**Epperson's legal victory was another bad decision by the U.S. court system.**[2]

- I have no doubt if the matter were referred to the Supreme Court, they are just stupid and wacky enough to support your contention. Surely their decisions seem to more and more favor the criminal element. – Victor Vian, 12 February 1966

**The teaching of evolution will have dire consequences.**

- If freedom is given to discuss [evolution], license to teach it as a fact will be taken. Destroy faith in the Bible and others will follow. - Rev. George Payne, letter to the editor, "Evolution Debate is On Again" (Johnson County Graphic [Clarksville], 16 December 1965)
- Why do you want to ruin the minds of the young? – Anonymous, undated letter
- If you want to not believe in the Bible and go to Hell, well old Monkey Sis, you Just [sic] think that way ... - Anonymous, undated letter
- I cannot stand people who deny and go up against God. Go on, teach evolution and may God have mercy on your soul. We will live to see the day when ... others will [go] to hell and you will go there also. Remember you will stand before God and it may not be long. - Anonymous, undated letter

[2] Epperson v. Arkansas came soon after a variety of other controversial decisions by the Supreme Court, including Engel v. Vitale (370 U.S. 421), which banned state-sponsored prayer, and Abington Township School District v. Schempp (374 U.S. 203), which banned state-sponsored Bible reading. After Epperson v. Arkansas, just as after the 1954 Brown v. Board of Education decision (349 U.S. 294), larger numbers of parents began sending their children to private schools (see discussion in Moore, 2001).

**Many people equated the teaching of evolution with atheism and communism.**

- Communism is laughing on the inside as they see so many Americans like you bringing destruction on our Country of Freedom … Evolution is another attack on God. Jazz and rock and roll music in the house of God … [Your] picture in the paper nauseated God. – Anonymous
- [You are] selling out to atheistic motivators … think of how the Satanic forces of communism must laugh. – Isabelle Larkins, undated letter
- Why do you believe the atheistic nonsense called evolution? – W. E. England, 2 April 1966
- The communists and every other group which wants to destroy our Great Republic, U.S.A., will back you against God … May God have mercy on your soul. – Malcolm Brown, 11 February 1966

**The teaching of evolution upset many people's views of civil rights and race-relations.**

- And as for Faubus - who used National Guard troops to prevent integration of Little Rock Central High School in 1958 -- he probably finds the theory [of evolution] distasteful because, among other reasons, it implies that Negroes and Caucasians came from the same ancestor. - Editorial: Arkansas Begins Fight for Freedom to Teach (Ohio State Lantern, 21 January 1966).
- I can imagine you refer to the Negroes, if so I agree. One of many things makes me mad is the Welfare Dept. pays Negroes to increase their population by leaps and bounds … Should this actually enter court, it will sure scramble the Civil Rights Bill, I hope. - Thurman Pate, 1 May 1966
- If Forrest Rozzell and the rest of them cocoanut-heads [sic] up there want to believe there [sic] forefathers [sic] are monkeys, apes, or gorillas, its [sic] OK, but don't let them shove it down our throat like Johnson did the Civil Rights Law ... If I was a teacher, the first nigger that walked in my classroom I would walk out ... and don't think I wouldn't [sic]. - Anonymous letter, 7 December 1966
- P.S. I'm white too. - David Smith, "Easter Sunday 1966"

These comments about evolution and racism are especially interesting when viewed in the context of Epperson v. Arkansas. Epperson v. Arkansas started at Central High School in Little Rock, Arkansas, site of the infamous racial turmoil surrounding school segregation in 1957-1959. Although the turmoil quieted in 1959 when the school reluctantly admitted a few black students, racial undercurrents were still prevalent when Susan's lawsuit began. The controversy surrounding Epperson's case tapped many people's ideas about racism and was often viewed as an affront to the "Southern Way." To many, Susan was a Yankee carpetbagger trying to force another reconstruction – this one being an intellectual one involving the public schools -- on the South (e.g., see Irons 1988).

The public's comments about evolution and race (see above) provide insights for understanding how some people link evolution, creationism, and race. Indeed, several creationists had endorsed the special creation of blacks as separate from (and inferior to) whites. Such links of creationism to racism have a long history:

- Numerous creationists have used the Bible to "show conclusively that Negroes and the white race do not have a common ancestry" (e.g., Dickey, 1958, Odeneal, 1958).
- The Ku Klux Klan and similar racist groups, which believed that genetic differences between races are biological determinants of value and destiny, gave the antievolution movement powerful support (de Camp, 1968). As noted in the movie <u>O Brother, Where Art Thou?,</u> the Klan wanted to ban the teaching of evolution.
- William Jennings Bryan was, like many in his era, "a convinced white supremist" who endorsed Klansmen in elections, supported by the Klan, and was supported by the Klan (de Camp, 1968, Ashby, 1987, Bryan here Saturday, 1924, Chalmers, 1965). When Bryan died five days after the Scopes "monkey trial" in Dayton, Tennessee, the Ku Klux Klan burned crosses in Bryan's memory, praised Bryan as "The Greatest Klansman of Our Time" (despite the fact that Bryan was not a Klansman), and tried to assume the mantle of Bryan's anti-evolution, pro-creationism cause (Coletta 1969; Cherny 1985; Moore 1998). A separate origin for whites and blacks -- as could be gleaned from creationism but not evolution -- was critical (and remains critical) to the Klan's message (e.g., see discussion in Moore, 2001).
- Prominent fundamentalists and antievolutionists such as Billy Sunday, J. Frank Norris, Bob Jones, Sr., and Bob Shuler were supported by and were supportive of the Ku Klux Klan.
- Edward Clarke, Imperial Wizard of the Ku Klux Klan, proclaimed that by 1927 "there will be lighted in this country countless bonfires, devouring those damnable and detestable books on evolution" (Numbers 1998).
- Racist magazines such as <u>Defender</u> published articles by anti-evolution evangelists such as George McReady Price and William Bell Riley. Today, a significant percentage of US students continue to believe that "the color of a person's skin depends on whether God favored or punished their ancestors" (Lawson and Worsnop, 1992).

Conversely, Henry Morris and other creationists have claimed that racism was produced by evolutionary theory. As Morris noted in <u>The Troubled Waters of Evolution</u> (Morris, 1984),

> <u>As the 19th century scientists were converted to evolution, they were thus also convinced of racism. They were certain that the white race was superior to other races, and the reason for this superiority was to be found in Darwinian theory</u>.

**Recent Events indicate that the antievolution sentiment of the 1960's continue to be held today.**

The public's comments about Epperson's attempt to legalize the teaching of evolution continue to represent the beliefs of many people who oppose the teaching of evolution. Indeed, it is common to encounter people who equate evolution with atheism, reject the fact that humans and apes share a common ancestor, trivialize evolution as "just a theory," believe that evolution produces immorality, and link the teaching of evolution with social ills such as violence and racism. For example,

- In 1999, House Republican Whip Tom DeLay linked the teaching of evolution with school shootings, birth control, and abortion (Mr. DeLay's Power Play, 1999). More recently, DeLay announced that God is using him to promote "a biblical worldview" based on only Christianity offering reasonable answers to questions about origins (Cooperman, 2002).
- Creation science icon Henry Morris (1989) claims that "evolutionism" is responsible for abortion and a decline in morality.
- The Louisiana Committee for Science Standards groups evolution with subjects such as incest, the occult, witchcraft, and drug use as topics that should be banned from the state exit exam for its high school students (Moore, 2002a).
- In Kentucky, topics such as evolution and gun control violate the state's "sensitivity guidelines" and "may not be suitable for assessment items" on the state assessment test (Moore, 2002a).
- In 2001, Louisiana State Representative Sharon Broome introduced a resolution urging the state legislature to "reject the core concepts of

Darwinist ideology" because they are racist (Good, 2002).

The ongoing persistence of these misconceptions (e.g., it's "only a theory") contribute to why so many teachers present evolution poorly (or not at all) in their classes, why most people favor creationism being given "equal time" in science classes, and why many people are so uncomfortable with the topic (e.g., see Moore 2002a, 2002b).

**Acknowledgments**

My interviews with Susan Epperson, Jon Epperson, and Elaine Epperson were conducted on several occasions via telephone and at meetings (e.g., in Colorado Springs, CO and at meetings of the National Association of Biology Teachers). I thank Susan, Jon, and Elaine for discussing Epperson v. Arkansas with me and for giving me access to their papers during the past few years.

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# Call For Resolutions

The Steering Committee of ACUBE requests that the membership submit resolutions for consideration at the 2002 Annual meeting to the Chair of the Resolutions Committee. Submit proposed resolutions to:

Dr. Richard Wilson, Dept. of Biology, Rockhurst University, 1100 Rockhurst Rd
Kansas City, MO 64110, Phone (846) 501-4048, wilson@vax1.rockhurst.edu

# ACUBE 46TH Annual Meeting

September 12-14, 2002

Columbia College
Chicago, IL

# Visualizing and Communicating Environmental Issues

## Preliminary Program

### *Thursday, September 12th*

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| Noon – 6:00 PM | **Field Trip to Mazon Creek**<br>Preregistration ($40.00), includes box lunch | **623 S. Wabash Building** |
| 6:00 - 8:00 PM | **Registration and Reception** | **1104 Conaway Cultural Center** |
| 8:00 - 9:00 PM | **Opening Session**<br><br>**Welcome to ACUBE**:<br>ACUBE President: Malcolm Levin, *University of Illinois – Springfield*<br>**Welcome to Columbia College:**<br>**Dr. Steve Kapelke**, *Provost/Vice President of Academic Affairs*<br>and<br>**Dr. Cheryl Johnson-Odim**, *Dean of School of Liberal Arts & Sciences*<br>Program Chair: **Bob Wallace**, *Ripon College*<br>Local Arrangements Chair: **Abour Cherif** & **Gerry Adams**. *Columbia College*<br>**OPENING ADDRESS** (Public Welcome to Attend)<br>***Waters of Wisconsin to the World — Drop of Life***<br>**David Kuckuk,** Director, *E.H. May Environmental Park* Sheboygan Co., WI | **1104 Conaway Cultural Center** |
| 9:15 - 10:15 PM | **Executive Committee Meeting** | **1104 Conaway Cultural Center** |

## *Friday, September 13th*

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| 7:00 AM - 5:00 PM | **Registration table** | **Hokin Gallery** |
| 7:00 - 8:00 AM | **Buffet Breakfast** (by Interest Group) | **1104 Conaway Cultural Center** |
| 9:00 AM - Noon | **SUSTAINING MEMBER EXHIBITS** (refreshments provided) | **Hokin Hall & Hokin Gallery** |
| 8:15-9:45 AM | **CONCURRENT WORKSHOP SESSIONS I** | |
| | 1. **Developing distance courses in science in compliance with the A.D.A.** Ateegh Al Arabi (*Johnson County Community College*) | **Room 507** |
| | 2. **Implementing computer technologies in the classroom: some new approaches.** Robert Mahoney (*Columbia College*) | **Room 509** |
| | 3. **Investigative cases by community college faculty.** Margaret Waterman & Ethel Stanley (*Southeast MO State University & Beloit College*) | **Room 503** |
| 9:50 – 10:20 AM | **SUSTAINING MEMBER EXHIBITS** (refreshments provided)<br>• **NewSci Publishing Corporation**<br>• **Pearson Custom Publishing** | **Hokin Gallery** |
| 9:50-10:20 AM | **POSTER SESSION I** | **Hokin Hall & Hokin Gallery** |
| | 1. **Trichology: *the science of hair* — an interdisciplinary course for first-year college students.** CANNON Charles, Abour Cherif, Sharron Jenkins, & Karl Larsen | |
| | 2. **Introducing the study of complex systems: building a conceptual and functional understanding using case-based inquiry.** ANTHONY Richard A. & Lynn L. Gillie | |
| | 3. **Enhancing the Freshman/Senior Experience.** BERGLAND, Mark | |
| | 4. **Harmful effects on whales and dolphins by ultra low frequency waves.** CZECH, Natasha & D.M. Jedlicka | |
| | 5. **Dyes, fibers, and paper: a botany lab for non-biology majors.** EGAN, Todd, J.Forrest Meekins, & Diane Maluso | |
| | 6. **Bimodal distributions,** GILLIE, Lynn (*Elmira College)* | |
| | 7. **Math in Art and Nature.** HANSON, Ann | |
| | 8. **Art students can collect valid field data, with a flare!** JEDLICKA, Dianne M | |
| | 9. **Presenting poverty as an environmental problem: an interdisciplinary approach,** NOWICKI, Alan (*Highland Community College*) | |
| | 10. **Student Projects on Environmental Issues..** POROMANSKA, Margarita | |
| | 11. **Recasting your Curriculum Vitae according to the Boyer (1990) of faculty development,** WALLACE, Robert (*Ripon College*) | |
| 10:30 AM - noon | **CONCURRENT WORKSHOP SESSIONS II** | |
| | 1. **Using a webcam to visualize biological processes with pedagogically inconvenient time scales.** Steven D. Brewer (*University of Massachusetts*) | **Not Yet Assigned** |
| | 2. **Cell receptors.** Ann M. Larson (*University of IL, Springfield*) | **Room 503** |

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| | 3. **Preparing faculty for entry level academic leadership positions.** Stefanos Gialamas & Abour Cherif (*DeVry University & Columbia College Chicago*) | **Room 507** |
| 10:30 - 11:15 AM | **CONCURRENT PAPER SESSIONS I** | |
| | 1. **The digital field trip.** Austin Brooks (*Wabash College*) | **Room 203** |
| | 2. **Microbial community profiles of alkaline saline wetlands.** Barbara J. Clement (*Doan College*) | **Room 405** |
| | 3. **Impacts of an inquiry-based Introductory Biology curriculum on student learning and attitudes.** Terry Derting & Claire Fuller (*Murray State University*) | **Hokin Hall** |
| | 4. **Protein Synthesis.** Gregory Grabowski (*University of Detroit–Mercy*) | **Room 509** |
| 11:20 - 12:05 AM | **CONCURRENT PAPER SESSIONS II** | |
| | 1. **Toward a better understanding of the environment.** Ben Ofari-Omoah & Abour Cherif (*University of Wisconsin–Stevens Point; Columbia College*) | **Room 203** |
| | 2. **Study abroad: cultural & natural history of St. Eustatices Island.** Nancy Sanders (*Truman State University*) | **Room 509** |
| | 3. **"Dealing" with functional group recognition.** Michael J. Welsh (*Columbia College*) | **Room 513** |
| | 4. **Student creative final projects as effective tools to maximize learning.** Sharon Doering, Joella Sinda, & Abour Cherif (*Illinois Institute of Art; Columbia College*) | **Hokin Hall** |
| | 5. **Ethical theory & epidemiology: a case study involving the ebola virus.** G.A. Griffith & H.E. Stark (*South Suburban College*) | **Room 405** |
| 12:15 - 1:00 PM | **Luncheon and First Business Meeting**<br>*First and Final Call for Nominations!!* | **Conaway Cultural Center** |
| 1:00 - 1:45 PM | **Luncheon Program**<br>***Gone in 60 Seconds: The Evanescence of Scientific News***<br>**Jeff Lyon,** Professor of Science Journalism, Columbia College & Senior Science Writer, *The Chicago Tribune*; author of *Playing God in the Nursery* | **Conaway Cultural Center** |
| 2:00 - 5:00 PM | **SUSTAINING MEMBER EXHIBITS**<br>(refreshments provided)<br>• **NewSci Publishing Corporation**<br>• **Pearson Custom Publishing** | **Hokin Gallery** |
| 2:00–2:45 p.m | **CONCURRENT PAPER SESSIONS II** | |
| | 1. **Redefining environmental priorities.** David Arieti (*Oakton Community College*) | **Room 405** |
| | 2. **Interspecific competition experiments using fungi and fruit flies.** Chester Wilson (*University of St. Thomas*) | **Room 507** |
| | 3. **Field experience as reinforcement to undergraduate awareness of contemporary environmental problems.** N.C. Heywood et al. | **Room 203** |
| | 4. **Assessing the impact of a Biology curriculum on biological knowledge and skills of undergraduates majoring in Biology.** Greg K. Fitch & Stephen S. Daggett (*Avila University*) | **Hokin Hall** |

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| 2:50 - 3:20 PM | **POSTER SESSION II**<br>*Repeat of Poster Session I* | **Hokin Gallery** |
| 3:30 - 5:00 PM | **CONCURRENT WORKSHOP SESSIONS III** | |
| | **1. Cyber Science: a web-based science class.** Sharron K. Jenkins (*Columbia College Chicago*) | **Room 503** |
| | **2. Distance education like white elephants: insect ID at a distance.** Wyatt Hobach & Leon Higley (*University of Nebraska, Kearney*) | **Room 511** |
| | **3. Roundtable discussion for department chairs.** Tom Davis (*Loras College*) | **Room 507** |
| 5:05 - 5:45 PM | **Web Committee Meeting** | **Room 503** |
| 6:00 - 7:00 PM | **Social**<br>(resumes of candidates available for review) | **Gold Room, Congress Hotel** |
| 7:00 - 9:00 PM | **BANQUET and Second Business Meeting**<br>(two-minute speeches prior to banquet; balloting after dinner presentation)<br><br>**Dinner Presentation**<br>***Teaching & communicating about integrative issues of health & disease***<br>**Helen Davies,** Ph.D., Department of Microbiology, School of Medicine, *University of Pennsylvania* | **Gold Room, Congress Hotel** |

## *Saturday, September 14th*

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| 7:30 - 8:45 AM | **Buffet Breakfast** (by Interest Group) | **Conaway Cultural Center at 1104 S. Wabash** |
| 7:45 - 8:45 AM | **Bioscene Editorial Board**<br>, | **Conaway Cultural Center at 1104 S. Wabash** |
| 9:00 - 9:45 AM | **CONCURRENT PAPER SESSION IV** | |
| | **1. Bioinformatics and environmental problem solving.** Buzz Hoagland (*Westfield State College*) | **Not Yet Assigned**<br>**Room 507** |
| | **2. Ecology through art.** Zachia Middlechild (*Middlechild & Company*) | **Room 203** |
| | **3. An international collaborative course on recombinant DNA technology.** Presley Martin & Cynthia Bauerle (*Hamline University*) | **Hokin Hall** |
| | **4. Toward a better understanding of the environment.** Ben Ofari-Omoah, Abour Cherif, & Senyo Adjibolosoo (*University of Wisconsin–Stevens Point; Columbia College Chicago & Point Lama Nazerene University*) | **Room 405** |
| | **5. Recycling of Non-Biodegradable Plastics to Protect the Environment.** Sam Jody (*Argonne National Laboratory*) | |
| 10:00 - 10:45 AM | **CONCURRENT PAPER SESSIONS V** | |
| | **1. Developing an environmental ethic: perspectives on the use of environmental philosophies in non-majors and majors courses.** Kathleen Marr (*Lakeland College*) | **Room 203** |

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| | 2. **The ongoing popularity of creatinoism among biology teachers.** Randy Moore (*University of Minnesota*) | **Hokin Hall** |
| | 3. **Illusions: the eye, the brain, and the mind.** Peter Insley (Columbia College) | **Room 505** |
| | 4. **Science and technology in forensic science.** A. Karl Larsen (*Illinois Police Forensic Science Laboratory Center, Chicago*) | **Room 405** |
| 11:00 AM - 12:15 PM | **Luncheon and Third Business Meeting**<br>**BUSINESS MEETING**<br>Election Results:<br>*Lynn Gilley, Elmira College*<br>Resolutions:<br>*Dick Wilson, Rockhurst University*<br>Executive Secretary Report:<br>*Pres Martin, Hamline University*<br>Bioscene:<br>*Ethel Stanley, Beloit College & .Tim Mulkey, Indiana State University*<br>Presidential Address:<br>*Malcolm Levin, SIU-Springfield*<br>2003 Meeting: | **Conaway Cultural Center at 1104S. Wabash** |
| 12:30 - 1:15 PM | **Steering Committee Meeting**<br>Includes newly elected Steering Committee members! | **Conaway Cultural Center at 1104S. Wabash** |
| 12:30 – 3:30 PM | **SPECIAL FACULTY DEVELOPMENT OPPORTUNITY**<br>*Open session for local educators & ACUBE Participants***.** | **Not Yet Assigned** |
| 2:00 – 6:00 PM | **Post conference Field Trip**<br>**John G Shedd Aquarium**<br>Preregistration ($20.00) | **Meet at Best Western Hotel at 1:00 p.m.** |
| 5:30–9:30 PM | **DINNER WITH DARWIN !** | **The Hot House: The Center for International Performance & Exhibition** |

**DINNER WITH DARWIN** is a 4-hour social and intellectual event sponsored by the School of Liberal Arts and Sciences at Columbia College Chicago in conjunction with the 2002 ACUBE Conference "Visualizing and Communicating Biological & Environmental Issues;" the official annual conference of The Association of College and University Biology Educators (ACUBE). DINNER WITH DARWIN is open to educators from local colleges and universities as well as ACUBE Conference participants. The event will feature a panel discussion on the influence of The Origin of Species on a wide variety of areas of human endeavor. The panel will consist of highly respected scholars from the following disciplines: history, economics, mathematics, geography, artificial intelligence, art and design, music, photography, anthropology, psychology, literature, and philosophy. The Panel discussion will be moderated by the biologist, Professor Randy Moore, Dean of Arts & Sciences University of Minnesota, and the final remarks will be made by historian, Professor Cheryl Johnson-Odim, Dean of Liberal Arts and Sciences at Columbia College Chicago.

**DINNER WITH DARWIN** will start at 6:00 PM and end at 10:00 PM, Saturday night, September 14, and will cost $30.00. There will be music and other entertainment after the event.

Seats are limited; for additional information, or to reserve seats at this exciting intellectual event, contact Dr. Abour Cherif at Columbia College Chicago (phone: 312-344-7285: fax: 312-344-8075:,e-mail address:acherif@popmail.colum.edu)

*For more conference information &/or special needs (food, transportation, etc.), communicate with:*

*LOCAL ORGANIZERS:* Abour H. Cherif: (312) 344-7285 Fax (312) 344-8075 E-Mail: acherif@popmail.colum.edu.; Gerald E. Adams: (312) 344-7540 Fax (312) 344-8075 E-Mail: gadams@popmail.colum.edu.

*PROGRAM CHAIR:* Robert Wallace:(920) 748-8760 Fax. (920) 748-7243. E-mail: WallaceR@Ripon.edu

*ACUBE PRESIDENT:* Malcolm P. Levin: (217) 206-7875 Fax( 217) 206-7807 E-Mail: Levin.Malcolm@uis.edu

# Abstracts of Oral Presentations, Workshops, & Posters

*The abstracts listed here are those available at the time that this schedule was constructed; they are listed in alphabetical order by the last name of the first author.*

**ALARABI**, Ateegh (Johnson County Community College, Overland Park, KS). **Developing a distance learning science course in compliance with ADA. —PAPER I.1— Abstract:** Do you have the desire to develop your own distance learning course, but you don't know where to start? Through this workshop you will learn about a teacher's experience in teaching science on the web. Pros and Cons will be discussed, along with tips on how to build and manage a difficult course on the web. You will be exposed to several options of the delivery media available to you and some solutions toward laboratory and field trip problems. I will present instruct you how to meet some of the requirements of the American Disability Act.

**ANTHONY** Richard A. & Lynn L. Gillie (Rose-Hulman Institute of Technology, Terre Haute, IN & Elmira College, Elmira, NY). **Introducing the study of complex systems: building a conceptual and functional understanding using case-based inquiry. —POSTER— Abstract.** Studying complexity in biological systems can provide students with a holistic framework for further studies in the biological sciences. However, a functional understanding of complexity demands more than a definition of what complexity is - it requires an ability to dissect and methodically analyze the complexity within a given system. Herein, we present a robust and versatile approach for introducing undergraduate students to the study of complexity. The first of two exercises is designed to provide students with a conceptual understanding of complexity. The second involves analysis of a rich case study with both societal and scientific dimensions, and requires students to produce a diagrammatical model of the complexity inherent in their area of focus. Two variations of the approach are presented and discussed together with a preliminary assessment of student learning. It is our hope that this approach will prove efficacious for providing a broad spectrum of undergraduate students with a conceptual and functional understanding of the complexity in biological systems.

**ARIETI**, David (Oakton Community College, Des Plaines, IL). **Redefining environmental priorities**. **—PAPER III.1— Abstract:** After teaching Environmental Science for over 15 years at colleges around the country, I noticed that very few books cover topics like the priorities of politicians especially when it concerns the environment. Environmental science books cover topics such as water, air, and land pollution in a matter-of-fact way. I feel that in today's world, when politicians on both sides of the aisle in The United States and in other countries are more concerned with polls and image than with very important environmental issues such as global warming and/or air pollution, it is incumbent on environmental science teachers to stress these issues. We as teachers do not have to be partisan, but we should stress these issues which are a matter of life and death for the planet rather than letting humans get bogged down in issues concerning human hatreds like the Arab-Palestinian dispute; the tribal wars in Rwanda and Burundi and the Indian-Pakistan conflict. It is correct that these issues weigh heavily on the minds of various politicians and they should try to resolve them, but I believe that we have to stress environmental concerns as well because if we allow these problems to get out of hand war will break out with devastating results including destruction of major life support ecosystems. We have to realize that if these countries go to war the entire world loses because of environmental destruction.

**BERGLAND**, Mark (Biology Department, University of Wisconsin-River Falls). **Enhancing the Freshman/Senior Experience. —POSTER— Abstract:** The freshman/senior experience in biology has been enhanced at UW-River Falls by two 1-credit courses, Freshman Colloquium (Biology 110) and Senior Colloquium (Biology 410). Biology 110 has been taught in the Biology Department since 1990. The course began as an orientation experience for new majors, and consisted primarily of presentations by faculty on a variety of topics. It evolved over time and now has a career emphasis, with students required to write a career paper based primarily on an interview with a professional working in the field of interest. This paper must be published as a web page, as the first entry in a web-based portfolio which highlights examples of the student's work throughout his or her academic career at UW-River Falls. These examples include other web-based projects (e.g. independent or collaborative research), or anything else that can be linked to a web page. In Biology 110, students learn how to use Dreamweaver, a popular web page editor, and also learn how to convert digital documents to PDF files which can be linked to their portfolio. The course also includes presentations by personnel from the Library, Career Services, and the Biology Department. Students present their completed portfolios to their peers in Senior Colloquium, to better prepare themselves for entry into the job market and/or graduate and professional schools. We have found that the "bookend" nature of these two courses helps students to be better organized and focused on educational goals, and we highly recommend this approach to others interested in enhancing the freshman/senior experience.

**BREWER**, Steven D. (University of Massachusetts, MA). **Using a webcam to visualize biological processes with pedagogically inconvenient time scales. — WORKSHOP II.1— Abstract:** Not yet available.

**BROOKS**, Austin (Wabash College, Crawfordsville, IN). **Virtual field trips. —PAPER I.1— Abstract:** In many biology courses student interests can be stimulated by including field trips that are apropos to the topics covered in the course. These off-campus excursions may involve traditional fieldwork, trips to museums or to commercial sites where biology is being used in practical ways. It is the latter category that I have regularly included in our non-majors, Plants and Human Affairs course. We typically visit a maple sugar camp, a veneering mill and a large plant biotechnology laboratory. Unfortunately some potentially outstanding field trips are not possible since the sites are too distant. While nothing substitutes for a live visit, the advent of high quality, consumer-grade digital video cameras and inexpensive, easy to use digital editing computer programs allow instructors to create virtual field trips that can give students a good sense of a biology-based business or a unique environment. In this presentation, we shall view a virtual field trip to the Taos (NM) Herb Company where plants are processed and formulated to make herbal medicines. The session will also include a segment on Apple Computer's, iMovie 2, the computer program used to edit the raw video footage used to create the trip to Taos Herb Co.

**CANNON** Charles, Abour Cherif, Sharron Jenkins, & Karl Larsen (Columbia College Chicago & Chicago Crime Laboratory, IL). **Trichology: the science of hair — an interdisciplinary course for first-year college students. —POSTER— Abstract:** In this presentation we will discuss an interdisciplinary course for first-year students that is centered around the science of hair: Trichology. In this class, students use human hairs to explore and study the nature of science and core concepts in biochemistry, biophysics, hereditary, forensic science, cosmetics, etc., in an integrated approach. In The *Science of Hair*, we find ourselves exploring human heredity, protein synthesis/structure, health and wellness, solving criminal mysteries, inheritable and non-inheritable hair loss, and spending billions on hair products for personal beautification. In the United States alone, every year, industry and scientific laboratories spend billions of dollars searching and experimenting with new herbs, minerals and chemicals to manufacture new hair products. Business and marketing sectors also spend billions of dollars to make these new products known to us, and in turn, we spend billions of dollars buying products that help us make our hair the way we want. We spend significant time and money, as someone puts it, "cutting, combing, brushing, conditioning, coloring, curling, slicking, spraying, and growing our hair to convey style that has a language all its own." Unfortunately however, Trichology has been the forgotten science in biological education.

**CLEMENT**, Barbara J. (Doan College). **Microbial community profiles of alkaline saline wetlands. —PAPER I.2— Abstract:** Not yet available.

**CZECH,** Natasha & D.M. Jedlicka (Columbia College Chicago). **Harmful effects on whales and dolphins by ultra low frequency waves. —POSTER-- Abstract:** Whales and dolphins are very sensitive to ultra low frequency (ULF) sounds. These ULF sound waves travel well through water. ULF sound waves are emitted from the whale/dolphin and will return to the animal after the waves have reached an object (e.g., bounce back after reaching a school of fish). Modern ships, including naval ships contacting submarines and vice versa, are filling the ocean's waters with there ULF sound waves which may confuse the interpretation of food sources by the whales/dolphins and/or actually may cause damage to the ear. Beaching of whales/dolphins and/or bleeding of the ear could be the results of the increased number of ULF sounds in our oceans. Current literature and personal observations will examine these possibilities.

**DAVIES, Helen Conrad** (University of Pennsylvania, School of Medicine; Past National President, Association for Women in Science) —**Banquet Presentation—** Over the decades of teaching Microbiology, Mechanisms of Infection, and Infectious Diseases to vast numbers of undergraduate, graduate and medical students, this medical school professor has found that reworking lyrics to well known songs is a way to help future scientists and physicians retain crucial information. Even students who can easily retain large amounts of important factual material, find that setting the basic information to music is fun. These students also enjoy teaching others with infectious tunes.

> Helen C. Davies received her Ph.D. in Physical Biochemistry from the University of Pennsylvania (1960), her B.A. (Chemistry) from Brooklyn College, and M.S. (Biochemistry) from the University of Rochester.

The first woman faculty member named to the University of Pennsylvania's Microbiology Department (in 1965), she has been a full professor there since 1982 and Academic Coordinator of her Department for the past 14 years. She also served as Associate Dean for Student Affairs of the School of Medicine from 1991 to1995.

Her primary research is in the field of bioenergetics, and she has worked with her graduate students on reactions of mitochondrial and bacterial cytochromes, using kinetic, immunological, and molecular biological techniques. She has investigated virulence factors of *Streptococci*, and bioenergetics of *Paracoccus denitrificans* and *Haemophilus* organisms. Another field of research that is of importance to her is the recruitment and retention of minority group members and women in biomedical careers. For this work, she was selected the 1999 recipient of the Lifetime Mentor Award of the American Association for the Advancement of Science.

Teaching is very important to her and she has received 19 major teaching awards, including Penn's all-University Lindback Award for Distinguished Teaching; one of the two Distinguished Basic Science Educator Award awards given in the Medical School; and the Trustees Council of Penn Women's Award for Generations of Academic Excellence. Her memorable teaching technique is the performance of original song parodies and light verse encapsulating the basics of infectious diseases, their symptoms and mechanisms. At an award presentation, she was given a plaque that said medical students and undergraduates studying infectious diseases remember for years what she taught "using aids that are mnemonic about the chronic, embryonic, euphonic, and the tonic." She is the first woman to ever receive the American Medical Student Association's National Excellence in Teaching Award (March, 2001). She was interviewed by National Public Radio and Voice of America, (May 2001) on her innovative ways of teaching about emerging infectious diseases.

The first woman faculty member to be designated a Master of a College House at the University of Pennsylvania, she lives with 380 undergraduate students, many of whom have chosen to live in her House because of their expressed interest in either the field of infectious diseases or the history and sociology of women in science.

Out of concern with the advancement of women in academe and in science, she helped to form Women for Equal Opportunity at the University of Pennsylvania in 1969. In 1973, she was appointed by the Governor of Pennsylvania to the Board of Trustees of the Pennsylvania State University for six years, and worked on the Board's Committee on the Status of Women. Not limiting her interest to her own institution and region, Dr. Davies became a founding member of the Association for Women in Science (AWIS) 27 years ago and was elected to be AWIS's National President in 1998–2000.

DAVIS, Tom (Department of Biology, Loras College, Dubuque, IA). **Roundtable discussion for department chairs. —WORKSHOP III.3— Abstract:** This session will be a discussion of the daily challenges and duties of Biology Department Chairpeople. Many of us face similar situations, responsibilities, and reports, but handle them according to the specific circumstances present. However, we rarely have the opportunity to share how we handle these duties with other chairs. Any current, prospective or past departmental chairs are invited to join this informal discussion that could explore topics like current methods of faculty evaluation, successful methods for communicating with Admissions, recruitment of students to your department, marketing department resources to enhance department visibility, grants and funding sources to enhance department equipment or programs, content, success and administration of interdepartmental majors, departmental accountability to the college, and annual assessment strategies of majors. Please contact me prior to the meeting or session if there are other specific topics that you would like discussed in this session.

DERTING, Terry L. & Claire Fuller (Department of Biological Sciences, BL 334, Murray State University, Murray, KY). **Impacts of an inquiry-based introductory biology curriculum on student learning and attitudes. —PAPER I.3— Abstract:** In an effort to improve student learning and success within the biology major, we have developed and implemented a new introductory biology curriculum, supported by an NSF CCLI-A&I grant. The curriculum focuses on active inquiry as a means of helping students develop a more in-depth and meaningful understanding of biological concepts. Two new courses to be taken upon entry into the curriculum have been implemented. One, Biological Inquiry and Analysis, focuses on understanding of biology as a process of inquiry. Students conduct three research projects during the semester. Each project includes the development of testable hypotheses, presentation of an oral proposal of their research, developing and implementing appropriate method, data analysis, and peer review of final research papers and posters. The second course, The Cellular Basis of Life uses a case-based approach to understanding basic concepts of cellular and molecular biology. Students then take two revised courses, Animal Form and Function and Plant Form and Function. These two courses now incorporate inquiry-based activities and a greater emphasis on physiological and ecological concepts. We will present an overview of the new curriculum and results of assessment data on content knowledge, student confidence in relation to conceptual learning and their scientific abilities, and attitudes towards science and its role in society.

**EGAN**, Todd P., J. Forrest Meekins, & Diane Maluso (Department of Biology, Elmira College, NY). **Dyes, fibers, and paper: a botany lab for non-biology majors. —POSTER— Abstract:** This laboratory afforded hands-on experience in learning about traditional dyes, fiber strength, and paper making. It was economical and simple to prepare. (1) Dyes: natural colors were extracted from plant tissue including coffee beans, berries, spinach leaves, and beet roots. Hard-boiled eggs were placed in the dye for 15 minutes to determine what colors each dye would produce. Colors of the eggs were somewhat different than the colors of the dye. (2) Fibers: twine from different materials (cotton, jute, hemp, etc.) was procured from local hardware stores. Filaments were removed from the twine and a stress test was used to determine the strength to weight ratio for each fiber type. Twine from each fiber type was used to make rope using the rope-maker from the Boy Scout's *Pioneering* Merit Badge Pamphlet. (3) Paper: recycled fibers were suspended in water, and a deckle made of a picture frame and chicken wire was used to collect and press the fibers. Students have a high amount of interest in this laboratory.

**FITCH**, Greg K. & Stephen S. Daggett (Department of Biology, Avila University, Kansas City MO). **Assessing the impact of a biology curriculum on biological knowledge and skills of undergraduates majoring in biology. —PAPER III.4— Abstract:** It is useful to know how much biology a major understands and what kinds of laboratory and communication skills the student has when he or she graduates. It is also desirable to know how much improvement the student has made in these three areas during his or her exposure to higher education. Previously, assessments of these items at Avila University have been tied to specific courses. We are now in the process of developing and implementing an on-going assessment program that is not tied to specific courses. Three items have been identified that are important to each biology major upon graduation: (1) knowledge of living things and processes that govern them, (2) the acquisition of laboratory skills and techniques, and (3) the ability to communicate scientific knowledge to others. The assessment program being developed attempts to assess one (or a few) aspects(s) of each of the three items. To measure knowledge about several key biological concepts, we have constructed several versions of a written test. The test covers several concepts in biology about which we think all majors should know. To measure the acquisition of one laboratory skill, we are designing a tool to assess how well a student is able to use a microscope. This test will be scored using a rubric that allows the student to be graded on a variety of technique issues. To measure one aspect of the ability to communicate scientific knowledge, students will be videotaped giving oral presentations of student research projects. The videotaped presentations will be scored using a rubric designed to measure communication skills, particularly as those skills relate to scientific presentations. Each assessment measure (the written test, the microscope skills test, and the taped oral presentation) is administered to the student at two different times: during his or her first semester, and after either four semesters (for the written and microscope skills tests) or eight semesters (for the oral presentations). Thus, we hope to collect for each biology major a "before college" and "during or after college" measurement for level of biological understanding, for one laboratory skill, and for one communication skill. The resulting data are expected to be useful in recruiting, accreditation visits, and (most importantly) course and curriculum reform. In addition, it will be possible to give each individual major a "profile" during his or her final semester that shows how much improvement he or she has made and where he or she may still be deficient.

**GIALAMAS**, Stefanos & Abour Cherif (DeVry University & Columbia College Chicago, IL). **Preparing faculty for entry level academic leadership positions. —WORKSHOP II.3— Abstract**: This workshop focuses on preparing faculty for entry level academic leadership positions (department chairs, heads, directors, etc). The participants will be introduced to a comprehensive program that has been implemented at a multi-campus institution where teaching is the primary focus of faculty. The processes of developing a mission and purposes of a department, faculty recruiting, training, development and performance evaluation, curriculum design, development, and assessment, will be explored. Participants will also be engaged in activities simulating the implementation of components of the program.

In recent years, most institutions have directed a great deal of attention and amount of resources toward the design and implementation of faculty development programs. Programs focused on the development of future academic leaders, specifically department chairpersons, heads, etc are still rare. As such, it is the presenters' hope that their counterparts at other institutions would find a great value and interest in learning about an academic leadership program that has been designed, implemented, evaluated, and revised based on the recommendations of both past participants and experienced department chairpersons, and heads.

The objectives of the session are: (1) to introduce participants to a comprehensive program that prepares faculty to assume entry level academic leadership positions; (2) to provide participants with a practical framework which they can use to begin to build their own academic leadership development program; (3) to engage participants in a variety of activities that will familiarize them with key elements of our program for implementation at their institutions.

The primary target audience would include faculty who anticipate moving into an entry-level academic leadership position. The session will be very active and learner-centered including a variety of activities such as having participants develop/revise their unit's missions, designing faculty professional development plans, performance reviews and recruiting faculty. Topics will include: Strategies defining the mission and vision of the unit in line with the mission of the institution; Strategies for recruiting, training, developing and evaluating faculty; Strategies for curriculum design, implementation and assessment; and, Strategies for developing leadership skills.

**GILLIE**, Lynn L. (Department of Biology, Elmira College, Elmira. NY). **Bimodal grade distributions in biology courses**. **—POSTER— Abstract:** Populations of students that differ greatly in preparedness, motivation, or ability can be a great challenge to teach in the same classroom. A bimodal grade distribution may be one indicator of such a mixed set of students. Several class situations with bimodal grade distributions can be described: non-science majors mixed with biology majors; freshman biology majors in their first biology class; and even upper-level biology majors. However, reasons for these distributions may differ in each case, and may differ among particular colleges and universities. Data will be presented for three different courses taught at a small, Liberal Arts College: a non-majors course, an introductory biology course, and an upper-level biology course. A bimodal grade distribution tends to be most pronounced early in the semester and becomes less apparent by the end of the term, although the trend will still be measurable in many cases. Some strategies for teaching this type of group will be discussed.

**GRABOWSKI**, Gregory (University of Detroit–Mercy, MI). **Protein Synthesis.** —**PAPER I.4— Abstract:** Not yet available.

**GRIFFITH**, G.A. & H.E. Stark (South Suburban College, IL). **Ethical theory and epidemiology: A case study involving the ebola virus. —CURRNET PAPER SESSION II—** It is not uncommon for biologists, in discussing ethically laden biological phenomena, to slip in moral conclusions without offering a full and explicit account of the ethical concepts and principles behind those conclusions. It is not uncommon for philosophers, in discussing ethical theory in relation to environmental issues, to spin a web of moral "oughts" that are far removed from the subtle facts of real world biology. An interdisciplinary approach, drawing on both biology and philosophy, can help avoid these pitfalls. The destruction of the natural environment of the Ebola virus provides an example of how such an interdisciplinary approach may be used.

**HANSON**, Ann (Columbia College Chicago, IL). **Math in Art and Nature. —POSTER—** This poster session will describe the course, Math and Art and Nature, which is taught by Ann Hanson at Columbia College Chicago. The course is a type of geometry course which relates geometric figures to nature; such as, the triangular shape to a butterfly and/or relates geometric figures to art; such as, in M. C. EscherÌs tessellations. Using a compass and straightedge, students learn how to do geometric constructions; as well as, how to construct the Golden Ratio or a spiral or the lute of Pythagoras. Students study constructions, triangles, quadrilaterals, dynamic rectangles, the Golden Ratio, Fibonacci numbers and spirals. After the students learn about the Fibonacci numbers, for example, they also see how that knowledge, especially biological knowledge, can be used to create a work of art. Samples of student artwork will be shown as well as some of the handouts.

**HEYWOOD**, N.C., K.P. Hefferan, M.E. Ritter, D. Post, P. Gasque, R. Bell, & R. Reser (University of Wisconsin—Stevens Point, WI). **Field Experience as Reinforcement to Undergraduate Awareness of Contemporary Environmental Problems. —PAPER III.3—** Long field trips to distant and unfamiliar locations afford superb opportunities for undergraduate students to reinforce prior classroom lessons, devise and practice acquisition and analysis of field data, advance their own professional development, and volunteer service to host agencies. Such excursions entail far greater expectations than mere sightseeing. With appropriate preparation and guidance, participants concurrently can experience the collaborative continuum of proposal, execution, analysis, and communication about a variety of environmental issues. Our field experiences have resulted in much faculty and student research for capstone projects, professional presentations, and publications. The focus has been eclectic yet cooperative, and includes such topics as historical bioclimatic habitat change assessment, satellite-assisted mapping of geologic formations and biosphere preserves, and analysis of catastrophic disturbance. Various student participants have visited such remote (and for Midwesterners, exotic) destinations as the North American and North African deserts, and most subsequently have further presented their work at local, regional, national, and international professional meetings. Our contentions are that (1) student and faculty participants who conform to the overall spirit and continuity of an excursion accrue substantial personal enrichment, & (2) there remains great need to extend cooperative field opportunities complementing classroom and technical competencies to more students and faculty.

**HOBACH**, Wyatt & Leon Higley (University of Nebraska, Kearney, NB). **Distance education like white elephants: insect ID at a distance.** —**WORKSHOP III.2— Abstract:** Not yet available.

**HOAGLAND**, Buzz (Westfield State College, MA). **Bioinformatics and environmental problem solving. —PAPER IV.1— Abstract:** Not yet available.

**INSLEY**, Peter (Columbia College Chicago, Chicago, IL). **Illusions: the eye, the brain, and the mind. —PAPER V.3— Abstract:** When a person sees something, light rays from the object are changed to electrical signals by the eye and these signals are processed by the brain. One can be deceived by the eye itself, or by the brain itself, or by the processing in the brain. We will look at various illusions and discuss where in the process the illusion occurs.

**JEDLICKA**, Dianne M. (Art Institute of Chicago). **Art students can collect valid field data, with a flare!**
**Abstract:** During an intense summer short course, students from the Art Institute of Chicago collected valuable data for a sand dune-forest study. The study site was located in Saugatuck, MI at the Art Institute's off campus site "Ox Box." Ox Box is approximately 100 acres of beach, dune, and dune forests. Interesting geological features were found along with examples of classical dune succession (Cowles 1899, Poulson 1992). The class collected seedling, sampling, and tree data using bested circular quadrats. Data were collected on dune tops and bottoms. Individual projects were also conducted in order to illustrate the scientific method. Individual projects included turtle location preferences, gull approach distance using foraging theory, house fly life history, and fern location with respect to moisture and shade. At the end of the session, an open house allowed the students to exhibit what data, conclusions and specimens that had collected. The students were not only capable in the field and lab, but also extremely creative in their project approaches and exhibitions.

**JENKINS**, Sharron K. (Columbia College Chicago) **Cyber-Science: a web-based science class. Abstract:** The *"Cyber-Science: Web-based Science Class"* is a hands-on workshop designed to demonstrate the resourcefulness of the World Wide Web in enhancing the development of interdisciplinary science courses. Using a previously designed course called *"The Biology of AIDS: The Life of A Virus"*, workshop participants will be guided through an "internet-based" curriculum that uses the topic of *"AIDS biology"* to develop basic scientific literacy. Through the study of the biological progression of HIV disease, the life cycle of HIV, and AIDS, students are exposed to basic concepts in general biology, chemistry, immunology and human disease. This type of course incorporates the elements of distance learning with traditional teaching methodology in which students are able to extend learning beyond the classroom and into their everyday life. The course format incorporates lectures with internet-based research activities and student-initiated discussions. *"Web-based"* science allows the instructor to incorporate interdisciplinary activities into a non-traditional science course and motivates proactive participation from students. *"Cyber-Science"* is a great way to enhance your science curriculum.

**JODY**, Sam (Argonne National Laboratory). **Recycling of non-biodegradable plastics to protect the environment. —PAPER IV.1— Abstract:** Not yet available.

**KHALILI**, Mahmoud & Hemati Hila (Northeastern Illinois University & Ravenswood Medical Center, Chicago, IL). **Photodynamic therapy of cancer cells. —PAPER II.1— Abstract:** Not yet available.

**LARSEN**, A. Karl (Columbia College Chicago, IL). **Science and technology in forensic science. —PAPER V.4— Abstract:** Not yet available.

**LARSON**, Ann M. (University of IL, Springfield, IL). **Cell receptors. —WORKSHOP II.2— Abstract:** Not yet available.

**MAHONEY**, Robert (Columbia College Chicago, Chicago, IL). **Implementing computer technologies in the classroom: some new approaches. —WORKSHOP I.2— Abstract:** A discussion of how recent developments in computer technologies may well revolutionize the teaching and grading of science and math concepts, both in the classroom and on the web. Topics covered will include the following: solving the broadband – narrowband problem; using overlays with movies; using interactive flash technology; using "Living Book Technology™"; improving academic integrity through new testing mechanisms; solving the high school science teacher shortage problem; and democratizing Advanced Placement™ for inner city youth.

**MARR**, Kathleen (Lakeland College, WI). **Developing an environmental ethic: perspectives on the use of environmental philosophies in non-majors and majors courses. —PAPER V.1— Abstract:** Not yet available.

**MARTIN**, Presley & Cynthia Bauerle, (Hamline University, MN). **An international collaborative course on recombinant DNA technology. —PAPER IV.3— Abstract:** Not yet available.

**MIDDLECHILD**, Zachia (Middlechild & Co. Evanston, Illinois & Columbia College Chicago, IL). **Ecology through art: a course for arts, media and communication students. —PAPER IV.2— Abstract:** In this presentation, I will talk about the development and teaching of an ecology course that is design specifically for Art, Media and Communications students. I will show how this course capitalizes on the use of visual thinking and expression, primarily drawing, to learn scientific and ecological concepts, and their assessment. It is specifically designed for those students in the Arts who think, learn, and express their understanding visually, and who would benefit from a course taught in this manner. For example, using sketchbooks and materials provided by the instructor, the students complete drawings of different kinds of ecosystems showing how different kinds of ecosystems (temperate forest, grasslands, oceans, etc.) different organisms interact with their environments. We will have researched through various literary and visual sources, (internet, library, Science & Math Department, hand-outs from instructor, and textbook). Through drawing, and painting students will "see" how an ecosystem works, and will then be able to describe not only visually, but also in words their understanding of the ecological principles and concepts. The perquisite for this course is Beginning Drawing from the Art Department or equivalent, or permission from the instructor.

**MOORE**, Randy (General College, University of Minnesota, Minneapolis, MN). **The ongoing popularity of creationism among biology teachers. —PAPER V.2— Abstract:** The "standards-based reform" of education has become overwhelmingly popular. In biology, a centerpiece of many states' standards is the treatment of evolution. Although evolution is the unifying concept in biology, relatively large percentages of biology teachers continue to reject it in favor or creationism. In this talk I will present data showing how biology teachers' attitudes and actions regarding the teaching of evolution correlate with their state's standards for teaching evolution.

**NOWICKI**, Alan, (Highland Community College). **Presenting poverty as an environmental problem: an interdisciplinary approach.** —**POSTER— Abstract:** Not yet available.

**POROMANSKA**, Margarita (Columbia College Chicago). **Student Projects on Environmental Issues.** —**POSTER— Abstract:** Not yet available.

**OFARI-OMOAH**, Ben, Abour Cherif, & Senyo Adjibolosoo (University of Wisconsin–Stevens Point, Columbia College Chicago & Point Lama Nazerene University, San Diego, CA). **Toward a better understanding of the environment in the 21st century. —PAPER IV.4— Abstract:** Over the past two decades or so, important strides have been made towards environmental consciousness. For example, our attitudes towards the environment have changed from less to more concern. We are now recycling a lot of materials that a decade ago we threw away as garbage. In addition, the environment has become an important feature in school and college curricula, while new business and community development projects have become increasingly evaluated for their environmental impact. However, our understanding and actions regarding the environment are still based in two knowledge compartments, namely ecology and economics (Grizzie, 1995). While this in itself has limited the scope for a better understanding of the environment, the situation has been further aggravated by the tendency to pitch ecology against economics in most environmental discussions. Thus, on the one hand, extreme environmentalists believe that economics (more specifically economic progress) is the source of environmental breakdown. On the other hand, conservative economists and businesses believe that environmentalist views are anti-economic progress (Carson 1965; Lorraine, 1972; Goldsmith et al, 1972; Curry-Lindahl, 1972; and Caldwell, 1972, Bartelmus, 1994). While recent efforts have tried to resolve this controversy, these efforts have not been very successful and traces of such confrontational views still remain.

This paper is of the view that a better understanding of the environment matters to everyone, not only to those who become ecologists or environmentalists. However, in order to obtain this understanding we need to go beyond economy and ecology. We need to develop a productive understanding that will enable us to see the environment as a concordant among mind, nature, and wise action. We outline the main elements of this productive understanding and show how each of the elements can help us achieve a better understanding of the environment. To achieve this, we need to "employ a model that moves us from becoming aware of total environment, to giving us knowledge, attitudes and skills, to finally empowering us to take positive environmental action." (Bacher's, 1991, p. 31). This in turn should help us make productive understanding a part of our own system of thought and behavior.

Bartelmus, P. (1994). *Environment, Growth and Development.* New York: Routledge.

Caldwell, L. K. (1972). *In Defense of Earth: International Protection for the Biosphere*. London: Bloomington.

Carson, R. (1965). *Silent Spring*. London: Penguin.

Curry-Lindahl, K. (1972). *Conservation For Survival: An Ecological Strategy*. New York: Morrow.

Goldsmith, E., Allen, R., Allaby, M., Davoll, J., and Lawrence, S. (1972). *Blueprint for Survival*. Boston:Houghton Mifflin.

Grizzle, R. (1995). Ecologists, economists, and social scientists (Letter to editor). *BioScience*, 45(8): 516.

Lorraine, J. A. C. (1972). *The Death of Tomorrow*. London: Heinemann.

**RASINARIU**, Constantin (Columbia College Chicago). **An accelerated introduction into the main features of *Maple*, a math tool.** —**WORKSHOP I.4— Abstract:** Used in many colleges and universities around the world, ***Maple*** is a spectacular math tool able to manipulate a wide class of problems ranging from solving simple equations to sophisticated differential equations. Complementing the symbolic operations there is a large set of graphics routines for visualizing (in 2-d or 3-d) mathematical information. This workshop represents an accelerated introduction into the main features of ***Maple***. It is organized in two parts. In first part the basics of ***Maple*** will be presented, which include the ***Maple*** interface, the help system, basic commands, numerical and symbolical calculations, algebraic manipulations and graphing. Each subject is introduced through numerous examples ranging from simple to not so simple. In the second part will be presented animations, solving equations and systems of equations (exact and numerical solutions), calculus and basic ***Maple*** programming. We conclude this workshop by discussing about ***Maple*** capabilities to export the worksheets directly ready for web or as Word documents. All the examples presented here will be included on the floppy disc attached to the workshop handouts.

SANDERS, Nancy (Truman State University). **Study abroad: cultural & natural history of St. Eustatices Island.** —**PAPER II.2— Abstract:** Not yet available.

SINDA, Joella, Sharon Doering, & Abour Cherif (Illinois Institute of Arts & Columbia College Chicago, IL). **Student creative final project as effective tools to maximizing learning and understanding of biology. — PAPER II.4— Abstract:** Freedom, imagination, creativity, critical thinking, scientific method, and humanizing science are elements that must be encouraged, developed, and nourished among students in order for them to make use of science and mathematics as permanent features of their lives as well as their professional careers (Cherif & Gialamas, 2000). Student Creative final project is an effective approach that engages students in exploring a given biological concept and producing a significant and substantial creative work that reflects their true understanding of the subject through media of their own choosing. In doing so, class final creative project becomes an educational instrument that helps to maximize students' learning and understanding.

In these kind of educational projects, students undertake a semester-long project, either individually or in pairs, to explore biological concepts utilizing their skills, creativity, and their professional choices. Students are encouraged to work in pairs as a collaborative work force, sharing ideas, creative styles and problem-solving methods. In this presentation, we will explain the approach's techniques, assessment, and the philosophy behind the student's final project approach to maximize learning and understanding. Then we will give successful examples of final projects in various areas of biology. Finally, we will share with the participants our own experiences and techniques that we have found successful in helping students produce high quality final creative projects in various biological concepts. In addition we will share successful evaluation and assessment techniques as well as strategies that ensure high quality projects.

Papacosta, P. & Hanson, A. 1998. Artistic experiences in science and mathematics. *J. Coll. Sci. Teach.* 28(4): 250-252.

Cherif, A. & Gialamas, S. 2002. Creative Final projects in mathematics and science. *J. Coll. Sci. Teach.* XI (4): 272-278.

WALLACE, Robert L. (Ripon College, WI). **Recasting your Curriculum Vitae according to the Boyer (1990) model of faculty development. —POSTER— Abstract:** ACUBE's purpose is to promote undergraduate education in the biological sciences. In the larger scope of undergraduate education that is, or at least should be, the primary goal for all colleges and universities in our country, after all this where our mission was founded. (Of course, this view is Pollyanna-ish in the extreme; research alone appears sovereign!) Nevertheless, when many colleges advertise for positions they expect broadly based, resourceful teacher-scholars, with a clear emphasis on the teacher part. Moreover, department chairs are usually responsible for the evaluation of established faculty members. In spite of these facts, most of the Curriculum Vitae (CVs) that I have seen are constructed to privilege the research agenda of the applicant/faculty member, even when there is a richer curriculum hidden within the résumé. I believe that ACUBE members should adopt the Boyer Model of faculty development (Boyer, 1990). The model states that there are four kinds of scholarship (below) and that all faculty members need to be engaged, at some meaningful level, and for some significant amount of time, in each. Beginning faculty might have more research than anything else to list on their CVs, but some point in one's career a better balance is achieved. These scholarships are the (1) Scholarship of Discovery, (2) Scholarship of Integration, (3) Scholarship of Application, and (4) Scholarship of Teaching. Here I demonstrate that a simple rearrangement of one's CV to the Boyer Model presents a different picture of the applicant/faculty member. Because this broad view of scholarship highlights strengths and weaknesses within all aspects of one's collegiate life, the Boyer model can be a useful tool in faculty development.

WATERMAN, Margaret & Ethel Stanley (Southeast Missouri State University mwaterman@semo.edu & BioQUEST, Beloit College, WI stanleye@beloit.edu) **Investigative Cases by Community College Faculty. — WORKSHOP I.3— Abstract:** Join us as we take a closer look at investigative case-based learning (ICBL) modules produced by community college faculty during the LifeLines OnLine summer institutes. To date, over thirty case modules offer exploration of biological topics such as microbial populations in a bath sponge, examining snake taxa using venom proteins, and revisiting meiosis with twin sisters. In this session, we invite participants to use two of the latest cases, to explore additional cases and to discuss implementing these cases in the classroom. See http://bioquest.org/lifelines for more information.

**WELSH**, Michael J. (Columbia College Chicago, IL). **"Dealing" with functional group recognition. —PAPER II.3— Abstract:** The recognition and identification of organic functional groups, while essential for chemistry and biology majors, are also very useful for non-science majors in the study of molecules in art and life. In order to make this task more palatable for the non-science major (art and communications students), the images of a traditional playing deck of cards (heart, spade, diamond, and club) have been replaced with four representations of the most common organic functional groups. The IUPAC hierarchy rules for naming two groups in a molecule was incorporated to represent the sequence (King, Queen, Jack, ... Ace) of the deck. Students are assisted in the recognition and identification of organic groups by playing simple card games of "Old Maid" and "Go Fish". To play games like "Poker" or "Gin", a student must not only recognize the functional groups, but also master the naming hierarchy of the organic groups.

**WILSON**, Chester (University of St. Thomas). **Interspecific competition experiments using fungi and fruit flies. —PAPER III.2— Abstract:** Not yet available.

# Call for Nominations

# *Bioscene* Editorial Board

We are soliciting nominations for four (4) *Bioscene* Editorial Board positions (term 2003-2005). Board members provide input concerning the publication of *Bioscene* to the Editors. Board members provide rapid review of manuscripts as requested. Board members are expected to assist in the solicitation of manuscripts and cover art for *Bioscene*. Board members are expected to provide assistance in proofing the final copy of *Bioscene* prior to publication.

If you are interested in serving a three-year term on the Editorial Board, please e-mail the editors by September 1, 2002.

Ethel Stanley -- stanleye@beloit.edu
Timothy Mulkey -- mulkey@biology.indstate.edu

# Call for Applications

# John Carlock Award

This Award was established to encourage biologists in the early stages of their professional careers to become involved with and excited by the profession of biology teaching. To this end, the Award provides partial support for graduate students in the field of Biology to attend the Fall Meeting of ACUBE.

**Guidelines:** The applicant must be actively pursuing graduate work in Biology. He/she must have the support of an active member of ACUBE. The Award will help defray the cost of attending the Fall meeting of ACUBE. The recipient of the Award will receive a certificate or plaque that will be presented at the annual banquet; and the Executive Secretary will provide the recipient with letters that might be useful in furthering her/his career in teaching. The recipient is expected to submit a brief report on how he/she benefited by attendance at the meeting. This report will be published in Bioscene.

**Application:** Applications, in the form of a letter, can be submitted anytime during the year. The application letter should include a statement indicating how attendance at the ACUBE meeting will further her/his professional growth and be accompanied by a letter of recommendation from a member of ACUBE. Send application information to:

Dr. William J. Brett, Department of Life Sciences, Indiana State University, Terre Haute, IN 47809; Voice -- (812) 237-2392 FAX (812) 237-4480; E-mail -- lsbrett@scifac.indstate.edu

If you wish to contribute to the **John Carlock Award** fund, please send check to: Dr. Pres Martin, Executive Secretary, ACUBE, Department of Biology, Hamline University, 1536 Hewitt Ave., St. Paul, MN 55104.

# ACUBE ELECTIONS 2002

## Biographic Sketches of Nominees for President


### Terry L. Derting

*Department of Biological Sciences*
*Murray State University*
*Murray, KY 42071-0009*


**Education**:

1982-86 Ph.D., Indiana University
1978-81 M.A., Virginia Polytechnic Institute
1974-78 B.A., Mount Holyoke College, MA

**Recent Honors and Recognition:**

2000 -- The Max Carmen Outstanding Teacher Award, Student Government Assoc.
1998 -- Regents Award for Teaching Excellence in the College of Science
1997 -- Marcia Athey Award, Kentucky Academy of Science

**Research Interests:** My two main areas of interest are physiological ecology and undergraduate education. Below are recent activities related to these two research areas.

**Professional Activities:**

1999-2000 -- Invited Participant, Conference on "Forging a link: What high school and college faculty have to offer each other." NSF-AIRE Project, Hope College, MI.
1998-99 -- Workshop Leader, Professional Development Institutes I, II, and III; Faculty Institutes for Reforming Science Teaching, Hancock Biological Station, KY.
1998-2000 -- Member, Steering Committee, ACUBE
1998 -- Participant, Professional Development Institutes I and II, Faculty Institutes for Reforming Science Teaching Through Field Stations, Archbold Field Station, FL and the Oregon Institute of Marine Biology, OR.
1997-99 -- Member, Editorial Board of Bioscene: Journal of College Biology Teaching

**Grants:**

2000-2003 -- T. L. Derting, D. R. Canning, C. A. Fuller, W. E. Spencer, and S. N. Wright. Reconstructing the Introductory Biology Curriculum using Inquiry-Based Approaches. NSF-CCLI A&I. $222,488.
1998-2000 -- T. L. Derting and D. White. Faculty Institutes for Reforming Science Teaching through Field Stations. Collaborators with NSF, DUE-9752713 grant to J. Hodder and D. Ebert-May. $15,500.
1997-98 -- H. K. Kobraei, T. L. Derting, and L. Shelby. An inquiry-based, mutidisciplinary science education course for pre-service elementary teachers. CHE/Eisenhower-PRISM (plus institutional match). $74,000.

**Publications:** In the past five years I have published five papers that included five undergraduate co-authors. I have also published 11 abstracts that included seven undergraduate co-authors.

**Presentations:** In the past five years I and my students have made 20 presentations at regional and national meetings.

**Professional Memberships:** American Association of University Women, American Society of Mammalogists, Association of College and University Biology Educators, BioQUEST Curriculum Consortium, Council on Undergraduate Research, Kentucky Academy of Science, Sigma Xi, Scientific Research Society

**Contributions to ACUBE:** 1998-2000, Member of Steering Cmmt., 1997-1999, Member of Editorial Board. I have made numerous presentations at annual meetings.

# Call for Nominations
# President-Elect & Steering Committee Members

ACUBE members are requested to nominate individuals for the office of President-Elect and two at large positions on the ACUBE Steering Committee. Self-nominations are welcome. If you wish to nominate a member of ACUBE for a position, send a Letter of Nomination to the chair of the Nominations Committee: Dr. Lynn Gillie, Dept. of Biology, Elmira College, One Park Place, Elmira, NY 14901, Voice –(607)735-1859, E-mail – lgillie@elmira.edu

# ACUBE ELECTIONS 2002

## Biographic Sketches of Nominees for Steering Committee


### Abour H. Cherif

*Biology and Science Education*
*Columbia College Chicago*


Abour Cherif is professor of Biology and Science education and the Director of Biology courses at Columbia College Chicago. He is a member of the executive committee of the International Institute For Human Factor Development (IIHFD) and one of the two vice presidents of the U.S.Chapter.

Dr. Cherif teaches Biology courses at the Science and Mathematics Department and graduate courses in Science Education at the Department of Educational Studies, Columbia College.

Dr. Cherif holds a bachelor degree in Biology from Tripoli University in North Africa, a masters degree in Teaching Biology from Portland State University and a Ph.D. in Science Education from Simon Fraser University, British Columbia, Canada.

He is an active member of a number of professional organizations such as the National Association Biology Teachers (NABT), The Association of College and University Biology Educators (ACUBE), National Science Teachers Association (NSTA), North American Association of Environmental Education (NAEE), The International Institute For Human Factor Development (IIHFD), National Association of Geoscience Teachers(NAGT), Association For Supervision and Curriculum Development (ASCD), to name a few.

Dr. Cherif is the founder of Friends of Schools and Teachers Support Group; a group of scientists and science educators who volunteer to respond to schools or science teachers requesting help in the areas of pedagogy and or science content. He is the founder and the managing editor of the Forward To Excellence In Teaching & Learning News Letter (FTENewsletter). The goal of FTE is to report trends, news, research findings, exemplary programs, and available resources in teaching and learning science and mathematics. It is also a vehicle of communication in new ideas and educational materials for teaching science and mathematics especially for art, media and communication students as well as non-science majors.

Dr. Cherif is also a member of the advisory board, editorial board and/or editorial review of a number of bi-review journals. For example, he is a co-editor of the Journal of Human Factor Studies and has been reviewing articles for The American Biology Teachers, to name a few. He is also a member of the advisory board of the Journal of College Science Teaching.

Dr. Cherif is also an educational consultant for a number of public school districts and publishing companies including Chicago Public Schools' office of accountability, and The NeoSciPublishing company, to name a few. He also published over60 papers in various professional journals, magazines, and newspapers in various areas of teaching, learning, curriculum development, and student assessment in the areas of general Science, ecology, environment, and biology. He has also published a number of science lab kits and teaching techniques. He has presented and conducted numerous presentations, workshops, and or mini-courses at state and national levels at NSTA, NABT, IIHFD, ACUBE, ISTA, WSTA, IASCD, MEEC and NCTM to name a few. He has also been conducting workshops for faculties at a number of colleges and universities on assessing students' needs in the classrooms, on teaching strategies and techniques, and promoting multiculturalism in classrooms through the teaching of science and mathematics. Dr. Cherif also developed numerous SCIENCELab Kits, and the author of the Biology: The Living World Around Us Student Laboratory Manual (2000), and the textbook, Biology: The Living World Around Us(in press 2002)

Dr. Cherif received a number of awards such as the 1999 ISTA Outstanding Preserve Science Education Award, and the 1998 IIHFD Outstanding **Accomplishments and Leadership Award.**

Dr. Cherif has been an advocate for helping and promoting graduate students and student-teachers in attending professional meetings and conferences and in publishing papers in professional journals.

Dr. Cherif's professional work includes Curriculum development and Reform, Instructional and Assessment Design, and Evaluation techniques in science areas.


### Carl H. Kaster

*Biology Department*
*Siena Heights University*
*Adrian, MI 49221*
*chkaster@sienahts.edu*


**Education:**

1987 -- Ph.D., University of Louisville
1974 -- B.A., University of Louisville

**Work Experience**

Siena Heights University (1982-present)
1999 promoted to Professor of Biology.

Adrian College (1987 - 1988) Adjunct Professor
Indiana University Southeast (1980 - 1982) Adjunct Prof.
University of Louisville (1975 - 1980); GTA

**Courses Taught**: Environmental Studies (BIO 110), Human Anatomy and Physiology (BIO 121-122), Basic Concepts of the Cell (BIO 141), Animal Biology (BIO 241), Entomology (BIO 341), Genetics (BIO 342), Animal Behavior (BIO 343), Comparative Vertebrate Anatomy (BIO 349), Developmental Biology (BIO 350),Vertebrate Physiology (BIO 351), Contemporary Topics in Biology (BIO 400), Parasitology (BIO 400), Zoogeography (BIO 400), Junior Seminar (BIO 395 & 396), Ecology (BIO 441), Evolution (BIO 442), Senior Seminar (BIO 495 & 496), Dilemmas and Decisions/FYI (GEN 100), Co-ops in Biology (GEN/BIO 280), General Education Seminar (GEN 401), Methods of Inquiry (GRS 499) and Honors Seminar (HON 140 - 340).

**Awards and Activities:**

Outstanding Teacher Award, Siena Heights College, 1986.
1994-present serving as Program Coordinator of Science
1994-present serving as Chair of Curriculum Committee

**Professional Memberships**: American Association for the Advancement of Science (AAAS), American Institute of Biological Sciences (AIBS), Animal Behavior Society, Association of College and University Biology Educators (ACUBE), Beta Beta Beta, Entomological Society of Washington, Michigan Entomological Society, Michigan Mosquito Control Association, Society for the Study of Evolution, Society of Systematic Biologists

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## Randy Moore

*Professor of Biology*
*University of Minnesota - General College*
*128 Pleasant Street S.E.*
*Minneapolis, MN 55455*

**Education and Professional Experience:**

B.S., 1975, Texas A & M University, College Station, Texas
M.S., 1977, University of Georgia, Athens, Georgia
Ph.D., 1980, University of California at Los Angeles (UCLA)

**Teaching Experience**

Science Methods, Teaching Biology, Plant Anatomy, Plant Physiology, Cytology, Introductory Botany, Introductory Biology (majors and nonmajors), Electron Microscopy, Scientific and Technical Writing, Safe Use of Nucleotides, Writing to Learn Biology, The Evolution-Creationism Controversy, Several workshops and weekly seminars, including those on TA Training, Biological Photography, Image Analysis and Light Microscopy

**Academic Awards and Honors**

Model Teacher, "Mastery of Teaching" film series
Elected Fellow, Texas Academy of Science
Recipient of the *Excellence in Educational Journalism Award* of the Education Press Association of America
Most Outstanding Professor, Baylor University
Fulbright Scholar, Thailand
Kendall Teacher Exemplar Award, presented by the Society for College Science Teachers
Most Outstanding Faculty Member, Wright State University
Outstanding Scientist Award, presented by the Affiliate Societies Council

**Grant Support**

National Science Foundation, National Aeronautics & Space Administration, IBM, U.S. Department of Education, and others.

**Professional Societies**

American Institute of Biological Science, National Association of Biology Teachers, National Science Teachers Association, Minnesota Science Teachers Association, and others.

**Publications**

More than 200 publications, the most recent of which include

Vodopich, D. and R. Moore. 2002. Biology Laboratory Manual, 6th Edn. Dubuque, IA: McGraw-Hill.
Moore, Randy. 2000. In the Light of Evolution: Science Education on Trial. Reston, VA: NABT.
Moore, Randy. 2001. The revival of creationism in the United States. J. Biological Education 35: 17-21.
Moore, R. (2001). The “rediscovery” of Mendel’s work. *Bioscene*, 27 (2), 13-24.
Moore, R. (2002). Do state standards matter? How the quality of state standards relates to evolution instruction. *The Science Teacher*, 69 (1), 49-51.
Moore, R. (2001). The lingering impact of the Scopes trial on high school biology textbooks. *BioScience*, 51 (9), 790-796.
Moore, R. (2001). Educational malpractice: Why do so many biology teachers endorse creationism? *Skeptical Inquirer*, 25 (6), 38-43.

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## Megan Thomas

*Front Range Community College*
*Ft. Collins, Colorado 80526*

**Education:**

Ph.D. -- 2002, Univ. of Northern Colorado

MS -- 1999, Colorado State University
B.S. -- 1997, Colorado State University

**Work Experience:**

08/99-Present -- Front Range Community College, Part Time Faculty, Dept. of Biology
01/01-Present -- COSMOS Upward Bound Math & Science, Graduate Assistant
06/01-07/01 -- COSMOS Upward Bound Math & Science, Science Instructor
06/00-07/00 -- COSMOS Upward Bound Math & Science, Science Instructor
08/99-12/00 -- University of Northern Colorado, Graduate Teaching Assistant

**Professional Association Participation:**

National Science Teachers Association - '00-Present
Colorado Science Teachers Association - '00-Present
Association of College and University Biology Educators - '01-Present
ACUBE Editorial Board - '01-Present
ASPIRE - '01-Present
Colorado Counsel on High School/College Relations - '01-Present

**Publications:**

Litster, M.E., L.M. Stone, T.E. Finger, & S.C. Kinnamon. 1998. Immunocytochemical Analysis of Serotonin Biosynthesis in Taste Cells. Chemical Senses (Abstracts), 23 (5): 593.

**Presentations:**

Litster, M.E., L.M. Stone, T.E. Finger, & S.C. Kinnamon. 1998. Immunocytochemical Analysis of Serotonin Biosynthesis in Taste Cells. Poster Presentation. Association for the Chemical Senses Annual Meeting. Saratota, FL.

Thomas, M.E. 2001. Interaction of Self-Efficacy and Inquiry in an introductory biology laboratory. Presentation. Botanical Society of America Annual Meeting. Albuquerque, NM.

Thomas, M.E. 2001 Interaction of Self-Efficacy and Inquiry in an introductory biology laboratory. Poster Presentation. Association of College and University Biology Educators (ACUBE) Annual Meeting. Kearney, NE.

## Call for Reviewers

We are looking for persons who are willing to review manuscripts for *Bioscene*. We need reviewers for a wide variety of subject areas. Reviewers should be willing to provide in depth reviews and detailed suggestions for authors concerning revisions necessary to improve their manuscript for possible publication. Reviewers should be willing to provide a rapid turn-around time for the manuscripts they review. If you are interested in reviewing for *Bioscene*, please send an email that includes your phone number, FAX number, and a list of the areas for which you are willing to review to: William Brett, Chair of the Editorial Board, at lsbrett@scifac.indstate.edu.

# ACUBE

**Web Site**

**http://acube.org**

The Association of College and University Biology Educators (ACUBE), placed the organization's rich archive of materials online for the benefit of the members and interested biology educators. Nearly 45 years of the society's publications and resources are currently accessible.

**Featuring the Online ACUBE archives:**

Bioscene: Journal of College Biology Teaching (1975-present)
AMCBT Newsletter (1964-1974)
AMCBT Proceedings (1957-1972)

**ACUBE Organizational Information:**

ACUBE Executive Committee
Editorial Board of Bioscene
ACUBE Annual Meeting Information
Meeting Abstract Submission Form
Searchable Membership Database
Online Membership Application
Scientific Meetings of Interest
ACUBE in the News
Sustaining Member Links

# Constitutional Issues

At the Winter Board meeting, the Constitution and By-laws of ACUBE was discussed and reviewed. The Board recommends a number of changes to correct errors and to bring the Constitution in line with current practices. Due to the number of changes and corrects, the entire Constitution and By-laws are printed below. All the suggested changes are in **<u>bold and underlined</u>**. The changes and corrects will be presented for vote at the Fall 2002 annual meeting.

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## ACUBE: THE ASSOCIATION OF COLLEGE AND UNIVERSITY BIOLOGY EDUCATORS

# CONSTITUTION

**ARTICLE I - NAME**

The name of this organization shall be "The Association of College and University Biology Educators" (ACUBE)

**ARTICLE II - OBJECTIVES**

The objective of this organization shall be: 1) to further the teaching of the biological sciences at the college and other levels of educational experience; 2) to bring to light common problems involving biological curricula at the college level and by the free interchange of ideas endeavor to resolve these problems: 3) to encourage active participation in biological research by teachers and students in the belief that such participation is an invaluable adjunct to effective teaching; 4) to create a voice which will be effective in bringing the collective views of **<u>college and university</u>** teachers of the biological sciences to the attention of college and civil government administrations.

**ARTICLE III - MEMBERSHIP**

There shall be five kinds of memberships; regular, honorary life, retired, sustaining, **<u>and graduate student.</u>** Any teacher in a college or university shall be eligible to become a regular member with full voting privileges. An honorary life membership in ACUBE may be conferred by vote of the Steering Committee on those individuals who have made outstanding contributions to the biological sciences and to biology teaching. Retired membership will be conferred on those regular members who request it following their retirement from active teaching. Regular members who, through change of position, no longer meet the criteria for such membership may continue their membership without loss of privilege. Business firms may become sustaining members on the payment of a sustaining membership fee. Sustaining members do not have the right to vote, but may have an exhibit at the Annual Meeting subject to such rules as may be determined by the host institution. Sustaining members may receive copies of membership lists with the approval of the Steering Committee. Any graduate student planning on a career in the teaching of biology at the college or university level is eligible to become a member.

**ARTICLE IV - OFFICERS AND THEIR ELECTION**

**Section 1:** The officers of the Association shall be president, president-elect, first vice-president, first vice-president-elect, second vice-president and secretary. These six officers, six members-at-large, and the most recent past-president shall constitute the Steering Committee. The Steering Committee shall appoint an executive secretary, **<u>Bioscene editors</u>**, and an historian, who shall be ex-officio members of the Steering Committee.

**Section 2.** Nominations for the offices of president-elect, secretary, and the members-at-large of the Steering Committee shall be made by a nominating committee of three members appointed by the president.

**Section 3.** The nominating committee shall present a slate of nominees consisting of not less than two names for each vacancy at the business session of the Annual Meeting of the Association.

**Section 4.** Nominations may be made from the floor after the committee has made its report.

**Section 5.** Election to office shall be on the basis of a simple plurality of the votes cast by the members present at the business session of the Annual Meeting.

**Section 6.** The president-elect shall automatically succeed to the office of president.

**Section 7.** The president-elect shall recommend and the Steering Committee shall appoint the first vice-president-elect. The first vice-president**<u>-elect</u>** shall automatically succeed to first vice-president the ensuing year.

**Section 8.** The second vice-president shall be from the host institution and shall be appointed by the Steering Committee after consultation with representatives from that institution.
**Section 9.** Vacancies in any office with the exception of that of president, president-elect, past presidents, **secretary,** and members-at-large of the Steering Committee, shall be filled by appointment by the Steering Committee.
**Section 10.** A vacancy in the office of president shall be automatically filled by the president-elect.
**Section 11.** A vacancy in the office of president-elect shall be left vacant until the next annual election. The vacancy shall then be filled by election of a president**-elect**.
**Section 12.** Vacancies which may occur in the position of member-at-large of the Steering Committee shall be left vacant until the next annual election.
**Section 13**. A vacancy in the office of secretary shall be filled temporarily by the past president or president-elect until an election at the annual meeting can fill the position.

**ARTICLE V - ANNUAL MEETING**

**Section 1.** An Annual Meeting of this Association shall be held at a place and time fixed by the Steering Committee in cooperation with the host school.
**Section 2.** Other meetings may be called at the discretion of the Steering Committee.

**ARTICLE VI - GENERAL PROHIBITIONS**

Notwithstanding any provision of the Constitution or By-Laws which might be susceptible to a contrary construction:

a. the Association shall be organized exclusively for scientific and educational purposes;
b. the Association shall be operated exclusively for scientific and educational purposes;
c. no part of the net earnings of the Association shall or may under any circumstances inure to the benefit of any private share-holder or individual;
d. no substantial part of the activities of the Association shall consist of carrying on propaganda, or otherwise attempting to influence legislation;
e. the Association shall not participate in, or intervene (including the publishing or distributing of statements) in any political campaign on behalf of any candidate for public office;
f. the Association shall not be organized or operated for profit;
g. the Association shall not:
    1. lend any part of its income or corpus, without the receipt of adequate security and reasonable rate of interest to;
    2. pay any compensation, in excess of reasonable allowance for salaries or other compensation for personal services actually rendered to;
    3. make any part of its services available on a preferential basis to;
    4. make any purchase of securities or any property, for more than adequate consideration in money and money's worth to; or
    5. engage in any other transactions which result in substantial diversions of its income or corpus to;

any officer, member of the Steering Committee, or substantial contributor to the Association.

The prohibitions contained in this subsection (g) do not imply that the Association may make such loans, payments, sale or purchases from anyone else, unless such authority be given or implied by other provision of the Constitution or By-Laws.

**ARTICLE VII - DISTRIBUTION ON DISSOLUTION**

Upon dissolution of the Association, the Steering Committee shall distribute the assets and accrued income to one or more organizations as determined by the Committee, but which organization or organizations shall meet the limitations prescribed in Sections (a)-(g) inclusive of Article VI, immediately preceding.

**ARTICLE VIII - AMENDMENTS**

**Section 1.** Amendment to this Constitution may be made by a three-fourths majority of the votes cast by the members present at the business session of the Annual Meeting.
**Section 2.** Proposed amendments must be submitted to the Steering Committee on or before the winter meeting of the committee. The Steering Committee may recommend passage, recommend non-passage or suggest modification of the proposed amendment. All proposed amendments shall be submitted in writing to the membership at least two weeks prior to the Annual Meeting.
**Section 3.** Articles VI and VII of the Constitution shall not be amended in any way without the recommendation of legal counsel as to the exact wording of the amendment.

**BY-LAWS**

**ARTICLE I. TERMS & DUTIES OF OFFICERS**

**SECTION 1**. The term of office of the president, president-elect, first vice-president-**elect** and second vice-president shall be for one year. The term of office of the secretary shall be for two years. The election for secretary shall be held in odd numbered years. All terms of office will begin immediately following election. The executive secretary shall serve for a minimum of three years and a maximum of five years at the discretion of the Steering Committee.

**SECTION 2**. The president shall preside at all Association meetings; chair the Steering Committee; appoint the nominating committee and such other committees as are necessary; and perform all other duties pertaining to the office of president.

**SECTION 3**. The president-elect shall perform the duties of the president in the absence or at the request of president, recommend to the Steering Committee a nominee for the office of first vice-president elect, and work with the first vice-president elect on preliminary plans for the program for the year she/he serves as president.

**SECTION 4**. The first vice-president shall be in charge of the program; organize discussion groups, obtain speakers, and take care of any other details of programming. The first vice-president is expected to attend the Steering Committee meetings, be the fall program chair and fulfill duties as outlined in the Steering Committee Handbook.

**SECTION 5**. The first vice-president elect shall make preliminary plans for the program for the year in which he/she will serve as first vice-president. The first vice president-elect is expected to attend the Steering Committee meetings and will be responsible for the program the following year and fulfill duties as outlined in the Steering Committee Handbook.

**SECTION 6**. The second vice-president is expected to attend the Steering Committee meetings, serve as the **chair of the** local arrangements **committee** at the host institution and fulfill duties as outlined in the Steering Committee Handbook.

**SECTION 7**. The secretary is expected to attend the Steering Committee meetings, keep minutes of the Association and Steering Committee and fulfill duties as outlined in the Steering Committee Handbook.

**SECTION 8**. The executive secretary is expected to attend the Steering Committee meetings, provide information about the state of the organization and fulfill duties as outlined in the Steering Committee Handbook. The executive secretary is a non-voting member of the Steering Committee.

**SECTION 9**. The past president is expected to attend the Steering Committee meetings, evaluate the currency of the constitution and fulfill duties as outlined in the Steering Committee Handbook.

**SECTION 10.** The association historian shall maintain a permanent archive of Association publications, minutes and other memorabilia. The historian is a non-voting member of the Steering Committee.

**ARTICLE II-ANNUAL MEETING**

**SECTION 1**. The Annual Meeting shall be held at a place and time selected by the Steering Committee.

**SECTION 2**. The president will accept invitations for the meeting sites for the succeeding years. Final determination of the meeting sites shall be the responsibility of the Steering Committee.

**ARTICLE III-DUES**

**SECTION 1**. To defray the cost of operating the business of the Association, all regular members shall be assessed annual dues as recommended by the Steering Committee and approved by a majority vote of the membership at a business session at the annual meeting.

**SECTION 2**. The annual fee for a sustaining member shall be determined by a vote of the Steering Committee and assessed by the Executive Secretary.

**SECTION 3**. These assessments are due and payable on January 1 of each year and shall cover the calendar year of January 1 to December 31**. Payment of dues is required to receive Bioscene issues for the year. If payment is received during the year (after some Bioscene issues have been mailed), the member will receive only subsequent issues. Back issues will not be issued.**

**SECTION 4**. Non-members wishing to attend sessions of the Annual Meeting shall be charged a registration fee determined by the Steering Committee.

**ARTICLE IV-AFFILIATIONS**

The Association may affiliate with such other scientific organizations as may be recommended by the Steering Committee and approved by a vote of the majority of the membership voting at an Annual Business Meeting.

**ARTICLE V-PARLIAMENTARY AUTHORITY**

On all questions not settled by the Constitution and By-Laws, *Roberts Rules of Order* shall govern.

**ARTICLE VIII-AMENDMENTS**

Amendments to these By-Laws may be made by a three-fourths majority of the votes cast by the members present at the business session at the Annual Meeting.

# ACUBE 46th Annual Meeting

## Association of College and University Biology Educators

Columbia College -- Chicago, Illinois

Thursday, Sept. 12 -- Saturday, Sept. 14, 2002

## *Visualizing and Communicating Environmental Issues*

Conference Registration Form

Name: First:______________________ Last: ______________________

Official Title: ______________________

Affiliation: ______________________

Mailing Address: ______________________

City: ______________________ State: __________ Zip:__________

Home Phone: ______________________ Work Phone: ______________________

E-Mail: ______________________ FAX: ______________________

Will you be presenting at this conference: Yes / Attending only

**Registration Fees:**

| | | |
|---|---|---|
| Participant ACUBE member | $ 95.00 | $ ______ |
| Participant non-ACUBE member | $ 125.00 | $ ______ |
| Graduate Student | $ 40.00 | $ ______ |
| Banquet/lecture only | $ 50.00 | $ ______ |
| Guest of member Banquet/lecture only | $ 35.00 | $ ______ |
| Guest of member *all meals* | $ 75.00 | $ ______ |
| Field Trip - Mazon | $ 40.00 | $ ______ |
| Field Trip - Aquarium | $ 20.00 | $ ______ |
| **Total**: | | $_______ |

**Registration includes Thursday evening reception, Friday breakfast, lunch and banquet/lecture, Saturday breakfast and lunch. Vegetarian option will be available for all meals.*

**Registration Payment:**

Check: ________ Money Order: ______ Credit Card: ______

Visa: ____ Master Card: ____ American Express: ____ Discover: ____

Name as appears on the card Card Number Expiration Date

______________________ ______________________ _______/_____

Signature as appears on the card: ______________________

Please send this registration form and a check, money order payable to "**Columbia College Chicago, ACUBE Conference**" to:

2002 ACUBE Conference
C/O Dr. A. Cherif or Dr. G. Adams
Dept. of Science & Mathematics
Columbia College Chicago
600 S. Michigan Ave.
Chicago, IL 60605

**For More Conference Information Please Communicate With Either:**

Robert Wallace at: (920) 748-8760, Fax. (920) 748-7243. E-mail: WallaceR@Ripon.edu
Abour H. Cherif at: (312) 344-7285, Fax (312) 344-8075, E-Mail: acherif@popmail.colum.edu.
Gerald E. Adams at: (312) 344-7540, Fax (312) 344-8075, E-Mail: gadams@popmail.colum.edu.
Malcolm P. Levin at: (217) 206-7875, Fax( 217) 206-7807, E-Mail: Levin.Malcolm@uis.edu

# ACUBE

## Association of College and University Biology Educators

NAME: ______________________________________________ DATE: _________________

TITLE: ______________________________________________________________________

DEPARTMENT: _________________________________________________________________

INSTITUTION: ________________________________________________________________

STREET ADDRESS: _____________________________________________________________

CITY: ______________________________ STATE: ____________ ZIP CODE: ___________

ADDRESS PREFERRED FOR MAILING: ______________________________________________

_____________________________________________________________________________

CITY: ___________________________ STATE: ___________ ZIP CODE: _______________

WORK PHONE: _________________ FAX NUMBER: ___________________________________

HOME PHONE: _________________ EMAIL ADDRESS: ________________________________

| **MAJOR INTERESTS** | **SUB DISCIPLINES:** (Mark as many as apply) | |
|---|---|---|
| ( ) 1. Biology | ( ) A. Ecology | ( ) H. Molecular |
| ( ) 2. Botany | ( ) B. Evolution | ( ) I. Developmental |
| ( ) 3. Zoology | ( ) C. Physiology | ( ) J. Cellular |
| ( ) 4. Microbiology | ( ) D. Anatomy | ( ) K. Genetics |
| ( ) 5. Pre-professional | ( ) E. History | ( ) L. Ethology |
| ( ) 6. Teacher Education | ( ) F. Philosophy | ( ) M. Neuroscience |
| ( ) 7. Other _______________ | ( ) G. Systematics | ( ) N. Other ______________ |

RESOURCE AREAS (Areas of teaching and training): ____________________________

_____________________________________________________________________________

RESEARCH AREAS: _____________________________________________________________

_____________________________________________________________________________

How did you find out about ACUBE? ___________________________________________

Have you been a member before: _____________ If so, when? ____________________

DUES (Jan-Dec 2002) Regular Membership $30 Student Membership $15 Retired Membership $5

Return to: Association of College and University Biology Educators, Attn: Pres Martin, Executive Secretary, Department of Biology, Hamline University, 1536 Hewitt Avenue, Saint Paul, MN 55104

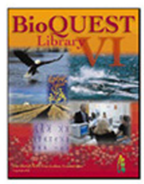
# BioQUEST

**The BioQUEST Curriculum Consortium is an open community of bioscience educators and researchers interested in undergraduate science curricular reform. The projects of the Consortium are designed to help teachers develop tools and resources to provide their students with opportunities to solve complex, research-like problems in the classroom.**

**We invite you to become involved in BioQUEST - attend a workshop, collaborate on a project, or explore a computer simulation!**


**Biocomplexity in Undergraduate Education: From Hard Data to Hard Decisions**

The Annual BioQUEST Summer Workshop
June 15 - June 23, 2002
Beloit College Beloit, WI




**The BioQUEST Library VI**

The BioQUEST Library is a peer-reviewed publication of computer-based curricular materials for biology education. Volume VI includes more than 75 software simulations, tools, datasets, and other support materials for many areas within bioscience.


**LifeLines OnLine Summer Workshop for Faculty from Two Year Colleges**

May 30 - June 2, 2002
Southeast Missouri State University
Cape Girardeau, MO
*Apply now: bioquest.org/lifelines.html*

**BioQUEST Project: Evolution Education**

Investigate evolution by making a wide range of data available to students with BIRRD, try out a simulation for selection against a recessive allele with Evolve, or add inquiry activities.

**BioQUEST Project: BEDROCK**

Join us at one of several planned workshops, such as the Chautauqua Short Course at Clark Atlanta University May 8 - 10, to develop and field test new learning materials for implementing bioinformatics in your bioscience curricula.

**BioQUEST Project: Microbes Count!**

Designed to accompany the video series Unseen Life on Earth, this collection of multimedia resources for problem solving in microbiology will be published in 2002 by ASM Press.

**BioQUEST Project: Biocomplexity**

A new curricular initiative in BioQUEST addresses the development of teaching strategies for integrating biocomplexity and its multidisciplinary approaches to problem solving in undergraduate education.

**BioQUEST Curriculum Consortium**
**Beloit College**
**700 College Street**
**Beloit, WI 53511**

**For more information on these and other BioQUEST Projects:**
**Email: bioquest@beloit.edu**
**Phone: 608-363-2743**
**bioquest.org**