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Co-Editors:

Timothy Mulkey
Indiana State University

Ethel Stanley
Beloit College

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Cover image: Photograph of bull thistles (Cirtsium vulgare) in Central Illinois courtesy of Ethel Stanley.

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Bioscene: Journal of College Biology Teaching

Co-Editors:

Timothy Mulkey
Department of Life Sciences
Indiana State University
Terre Haute, IN 47809
mulkey@biology.indstate.edu
FAX: (812) 237-4480

Ethel Stanley
Department of Biology
Beloit College
700 College St.
Beloit, WI 53511
stanleye@beloit.edu
FAX: (608)363-2052

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November 1, 2004 for the December 2004 Issue **February 1, 2005 for the March 2005 Issue**

The Cartesian Diver as an Aid for Teaching Respiratory Physiology

Greg K. Fitch, Ph.D.

Associate Professor of Biology
Department of Biology
Avila University
11901 Wornall
Kansas City MO 64145
E-mail: fitchgk@mail.avila.edu

ABSTRACT: The mechanism by which air enters the mammalian lung is difficult for many students of physiology. In particular, some students have trouble seeing how pressure can be transmitted through a fluid such as the intrapleural fluid and how the magnitude of that pressure can change. A Cartesian diver, an old-time child's toy, may be used as a visual aid during lecture to illustrate and make more understandable these hard-to-grasp concepts. The Cartesian diver is easy to construct from readily available materials. In addition to helping explain lung mechanics, the performance of the Cartesian diver takes most students completely by surprise and thereby serves to "wake up" the student whose mind may not be completely engaged in the topic.

KEYWORDS: physiology, respiration, visual aid, Cartesian diver

INTRODUCTION

Visual aids add spice to lectures. A visual aid is even more useful when, in addition to adding flair, it makes more understandable an otherwise abstract concept. Used properly, the Cartesian diver, an old-time child's toy, can be such an aid.

A Cartesian diver, also known as a Cartesian devil or bottle imp, is described in Webster's Dictionary (1983) as "a simple hydrostatic toy consisting of a hollow figure partly filled with air that may be induced to float at various depths in a tube of water by compression of the air." The basis of the toy's operation is that although air is normally thought of as being "light," it can be made more dense if the mean distance between the molecules is decreased by compression. In a Cartesian diver, increases and decreases in air compression and density are achieved by increasing or decreasing pressure in the fluid surrounding the air. *Because increases and decreases in fluid pressure (of the intrapleural fluid) are important in deflating and inflating the mammalian lung, the Cartesian diver can be used as a model for these aspects of lung function.*

I was prompted to bring a Cartesian diver into my classroom following a discussion of the mechanics of lung ventilation with my upper-level Human Physiology students. To facilitate understanding, many textbooks and lecturers divide the smooth, integrated process of inspiration into a series of separate steps (for example, see Stalheim-Smith and Fitch, 1993). In this stepwise description, the inspiratory muscles first contract. This muscular contraction moves the wall of the thoracic cage and its attached layer of parietal pleura away from the layer of visceral pleura that is attached to the lung wall. Because the parietal and visceral regions of the pleural membrane are continuous (much like the "front" and "back" walls of a balloon), the size of the pleural cavity bounded by the pleural membrane is increased as the walls of this cavity are pulled away from one another (Figure 1).

At this point in the lecture, I usually ask students to recall from introductory physics what happens to the pressure exerted by a population of molecules when the volume they occupy is made larger. Many students are able to answer that such a change will decrease the pressure exerted by the molecules. (This relationship is described by Boyle's Law.) I then return to the stepwise description of inspiration, pointing out that an increase in the size of the pleural cavity causes the

pressure (called intrapleural pressure) within the cavity to drop, creating in essence a partial vacuum around the lung. Because intrapleural pressure at all times "pushes" on the outer lung wall at the same time as atmospheric/intrapulmonary pressure pushes on the inner lung wall in the opposite direction, a decrease in intrapleural pressure (a weaker push) allows the push exerted by intrapulmonary pressure to move the lung wall outward, thereby expanding the lung. Stated differently, the elastic lung expands as it is sucked "into" the partial vacuum that has been created around it. This increase in lung size then causes the intrapulmonary pressure within the lung to fall, and atmospheric air flows from a region of higher pressure (the atmosphere) to a region of lower pressure (within the alveoli), filling the lung. The lung does not expand because air has entered it; rather, air enters the lung because it has expanded.

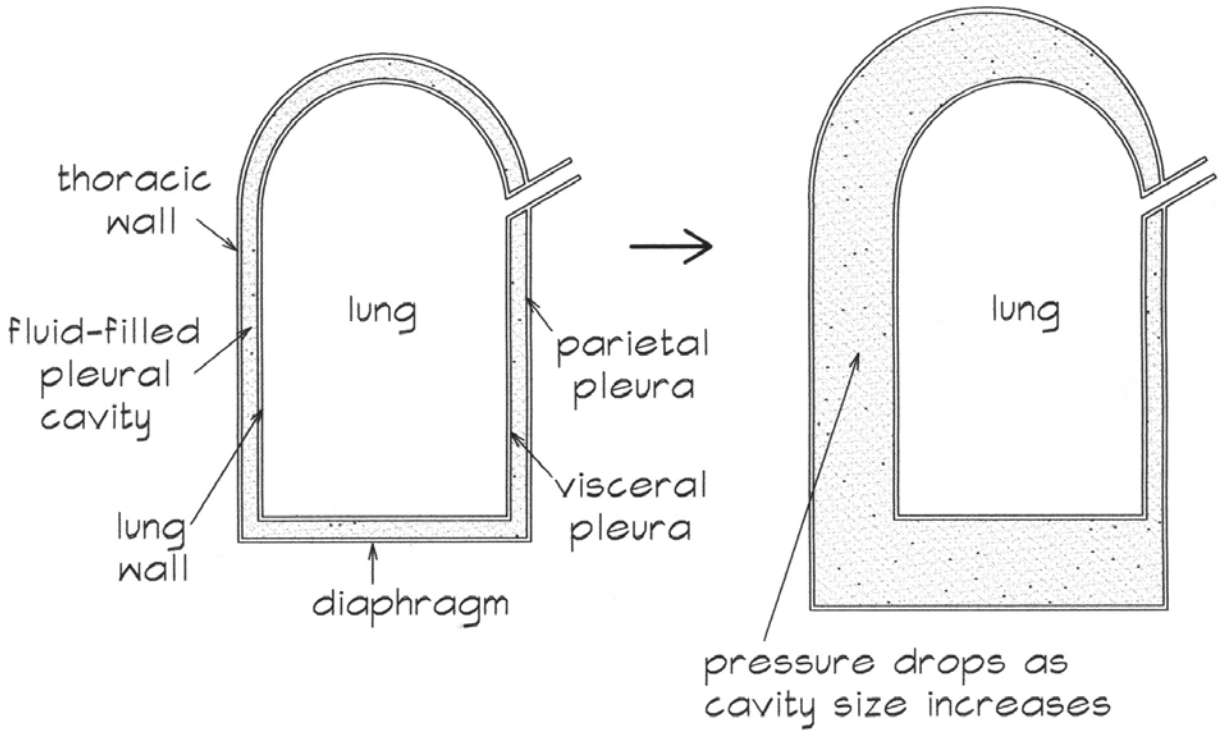

Figure 1. *Volume and pressure changes occurring in the human pleural cavity when inspiration is viewed as a stepwise process. Before contraction of the inspiratory muscles, the pleural cavity in a normal individual assumes its smallest volume (left). As the inspiratory muscles contract, the layer of parietal pleura attached to the thoracic wall is pulled away from the layer of visceral pleura attached to the lung wall, thereby increasing the volume of the pleural cavity (right). Boyle's Law states that this increase in intrapleural volume leads to a decrease in intrapleural pressure. The lung expands as its walls move in the direction of this decreased intrapleural pressure. Note that the parietal and visceral layers of the pleura are both part of a single, continuous membrane.*

Several semesters ago, a bright student objected to one portion of the above description. Essentially this student stated that while he agreed that increasing the volume of the container occupied by a population of *gas* molecules would decrease the pressure they exert, he had been taught in physics that liquids are incompressible and thus did not see how the same argument could be applied to a population of molecules forming a liquid. His position was that the volume of a liquid remains constant, meaning that if molecules were not added to or subtracted from the intrapleural fluid, its volume (and thus, according to Boyle's Law, its pressure) could not change. The change in the magnitude of the pressure gradient across the lung wall that I had described therefore could not be accomplished.

I tried to address this objection, but could tell that the class found my answer neither clear nor satisfying. Later that day, I decided to build a Cartesian diver and bring it to the next meeting of the class. I have used it as a visual aid during lectures on the mechanics of ventilation in every subsequent semester.

BUILDING A CARTESIAN DIVER

Most science teachers will find that they already have the materials needed to construct a Cartesian diver. Required materials include an empty plastic soda pop bottle (sizes from sixteen ounce to two liter all work fine), the screw-on lid for the soda pop bottle, and a small glass test tube. Optional materials include a glass Pasteur pipette with rubber bulb and a Bunsen or alcohol burner. Fill the plastic soda pop bottle to the very top with water. Next, fill the test tube about half full of water, quickly invert it without losing the water, and push it into the water within the plastic soda pop bottle so that the open mouth of the test tube faces the bottom of the soda pop bottle. The test tube should float (by virtue of its being half-filled with air) in the water at the top of the soda pop bottle with the rounded bottom of the test tube upward. Now screw on the lid of the soda pop bottle, trapping the floating test tube inside. The rounded, closed bottom of the test tube will be pushing up against the screwed-on lid (Figure 2). If your test tube is at the bottom of the plastic bottle instead of floating, you do not have enough air trapped inside the test tube. Remove the test tube and try again.

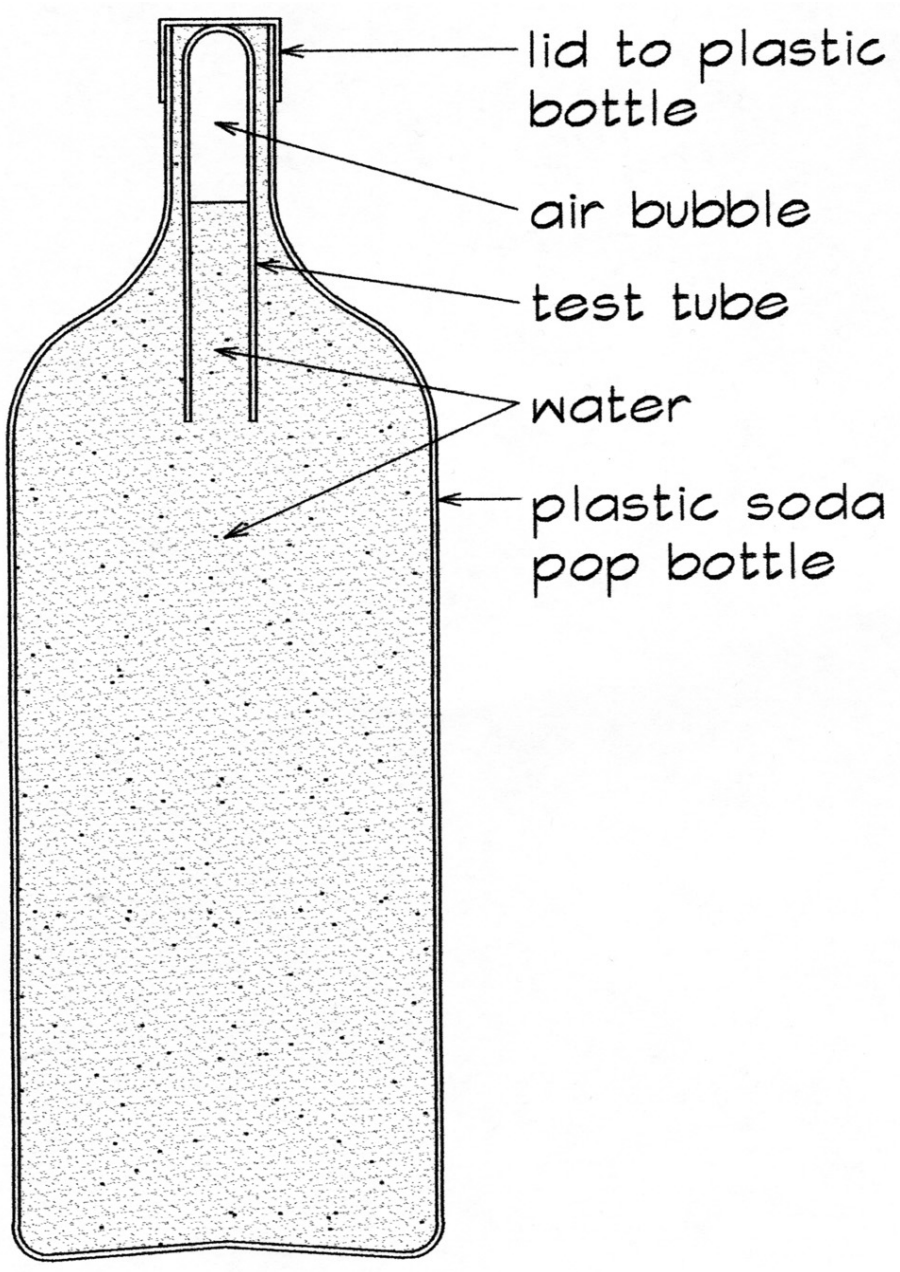

Figure 2. *Cartesian diver constructed from a plastic soda pop bottle and a test tube. An air bubble is trapped within the inverted test tube, causing it to float against the lid of the plastic bottle.*

The tricky part of Cartesian diver construction is getting the correct amount of air in the test tube. Using both hands, firmly squeeze the sides of the soda pop bottle. Does the test tube sink or "dive" to the bottom? If it does, you are set. If it does not, you need to remove some air from the test tube. One way to adjust the amount of air in the test tube is to remove and then reinsert it, using trial and error to get the desired amount of air. A more controlled method for adding or removing air involves the use of a bent Pasteur pipette. To bend a pipette, hold the middle portion of the narrow, drawn-out end of the pipette horizontally in the flame of a Bunsen or alcohol burner. When the glass becomes hot enough, the tip of the drawn-out part of the pipette will "droop" down, giving you roughly a 90 degree bend in the glass. You then need to rotate the pipette along its long axis while still heating it so that this bend increases to almost 180 degrees. The bend must be sharp enough so that the entire bent end of the pipette will fit into the mouth of the soda pop bottle. And the length of pipette beyond the bend must be great enough to extend part way into the air in the test tube. The bent pipette can now be used to adjust the air level in the test tube. After each adjustment, screw the lid back onto the soda pop bottle and squeeze its sides as before. When you can get the test tube to dive to the bottom with a squeeze of moderate strength, your Cartesian diver is completed.

HOW THE CARTESIAN DIVER WORKS

The real value of the Cartesian diver to a teacher of respiratory physiology is that it shows that (1) pressure can be transmitted through a fluid, and (2) the strength of that pressure can change. The water in the soda pop bottle exerts a hydrostatic (fluid) pressure against the walls of its container. You can easily convince students of this fact by asking what would happen if you used a needle to make a small hole in the side of the soda pop bottle. It is intellectually valid to think about this pressure as being transmitted throughout the entire volume of fluid. The magnitude of the pressure is equal at all points at a given horizontal level of the bottle, although due to gravity it is slightly greater at the bottom of the bottle than at the top. The key point illustrated by the Cartesian diver is that the magnitude of the pressure transmitted through the fluid can be increased. Squeezing the sides of the soda pop bottle causes such an increase. Ask students to watch the column of air within the test tube as you slowly squeeze the soda pop bottle. It is easy to see that the height of the air column progressively decreases before the test tube begins to dive. The explanation for the shortening of the air column is that squeezing the soda pop bottle increases the pressure exerted by the fluid in all directions, including in the upward direction of the air-water interface. As this increasing pressure "pushes" on the air, the gas molecules forming it are forced closer and closer together. As the gas molecules get closer together, the column of air becomes shorter and the density of the air increases. (Air becomes "thinner" as one drives up a mountain for the opposite reason; the decreasing height and thus decreasing weight of the column of air "sitting" on the earth's surface exerts a weaker push on the gas molecules near the earth's surface, allowing these molecules to be farther apart than they would be if they were under a taller column of air.) An increase in the density of gas molecules within the test tube shortens the column of air, thereby allowing water to enter the test tube. These changes increase the mean density of the test tube plus its contents. When the mean density of the test tube and the water and air within it becomes greater than the density of the water in the soda pop bottle, the test tube sinks.

Your students may ask *how* squeezing the soda pop bottle increases the pressure transmitted through the water it contains. Although the complete answer to this question is best left to a physicist, the main point is that while a liquid is incompressible on a macroscopic scale, applying pressure to the liquid does compress it by a very small amount. By squeezing the plastic bottle, you are forcing the water molecules to move slightly closer to one another.

USING THE CARTESIAN DIVER AS A LECTURE AID

After I use the Cartesian diver to demonstrate how the pressure transmitted through a fluid can change, I next use it as a model for human inspiration. In small classes, I typically use the diver once or twice to model inspiration and expiration, and then ask the students to pass the diver around the room and squeeze it for themselves.

As a model for human inspiration, the walls and bottom of the soda pop bottle represent the right (or left) pleural membrane. The space within the bottle is analogous to the pleural cavity, and the water within this space represents intrapleural fluid. One aspect of this model of inspiration is a bit counterintuitive: contraction of one's arm muscles to squeeze the soda pop bottle represents *relaxation* of the muscles of inspiration (the diaphragm and external intercostal muscles). Thus, to demonstrate inspiration with the model, you must *release* the soda pop bottle that you were previously holding in the squeezed position.

I usually show the model in the following manner. Before beginning any explanation, I squeeze the plastic bottle to sink the test tube. Holding the diver in the squeezed position, I point out that we are now "between" breaths--that is, between the end of expiration and the onset of the next inspiration. At this point, because the inspiratory muscles are relaxed, the pleural cavity assumes its smallest volume during the respiratory cycle. Likewise, the soda pop bottle is assuming its smallest volume (because I am pushing inward on its walls). I then tell the class that I am

about to release my squeeze on the plastic bottle, which will represent contraction of the inspiratory muscles. Just as contraction of those muscles moves the chest wall and attached parietal pleura outward (and diaphragm downward), releasing the soda pop bottle allows its walls to move outward. The "pleural cavity" (soda pop bottle) is about to increase in size.

As I release my squeeze on the soda pop bottle, I point out that the pressure in the "intrapleural fluid" (water within the soda pop bottle) is now decreasing. In the Cartesian diver, this decreased pressure allows the gas within the test tube to expand and the test tube to float once again. In the mammalian body, the decreased pressure within the intrapleural fluid forces the lung wall toward the wall of the thoracic cage--that is, makes the lung expand. The expansion in turn causes atmospheric air to be pushed into the alveoli where the pressure has become slightly less than atmospheric pressure. This pushing of air into the alveoli completes the process of inspiration.

Several caveats are in order here. If you are describing mammalian lungs in general rather than human lungs in particular, the space within the soda pop bottle represents for some species the combined right and left pleural cavities as the two cavities communicate with each other. (In humans they do not communicate.) Also, the model and the above description do not give a complete description of the mechanics of inspiration. Ignored, for example, is the attraction between parietal pleura and visceral pleura due to the layer of water between the two. This attraction aids lung expansion as the moving chest wall attempts to pull the two pleural layers apart. The above description also ignores the elastic force inherent in lung tissue, which "attempts" to reduce lung size during the periods of both inspiration and expiration (Stalheim-Smith and Fitch, 1993). Finally, as mentioned earlier, the wall of the thoracic cage, the pleural membrane, and the lung wall move together at almost exactly the same time, rather than in the stepwise fashion in which they were described above. Despite these caveats, the Cartesian diver nicely illustrates certain aspects of lung ventilation and, in addition, is guaranteed to wake up (at least temporarily) even the sleepiest student.

ACKNOWLEDGEMENTS

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Ethel Stanley
Department of Biology
Beloit College
700 College St.
Beloit, WI 53511
stanleye@beloit.edu
FAX: (608)363-2052

Timothy Mulkey
Department of Life Sciences
Indiana State University
Terre Haute, IN 47809
mulkey@biology.indstate.edu
FAX: (812) 237-2418

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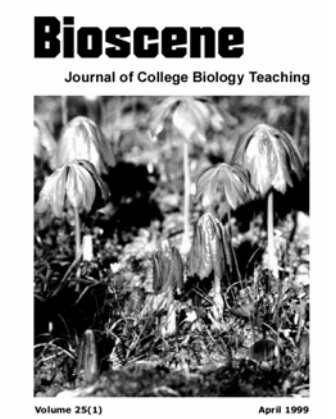

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General Education Course: Is It Relevant?

William J. Brett & Timothy Mulkey

Department of Life Sciences
Indiana State University
Terre Haute, IN 47809
lsbrett@isugw.indstate.edu
lsmulky@isugw.indstate.edu

Abstract: The paper presents a teaching regime and evaluation criteria for a general education course in biology. The purpose of the course is to provide students with biological information to help them understand problems facing humans and some of the social and ethical aspects of these problems. Using input from students concerning what constitutes a good learning environment, the course is designed to give students the opportunity to control much of their own success in the course. The paper also examines how students respond to the variety of evaluation methods.

Key words: general education course, evaluation, student opinions, Boyer's commonalities

INTRODUCTION

Most courses in Biology have a specific focus, such as histology, embryology, or taxonomy; however, the focus of a General Education Course in Biology is not on specific subject matter. Instead, it provides students with information that fosters a better understanding of biologically related issues, which they will face some day as world citizens. Because "One of the most difficult courses to teach among a biology department's offerings is the general biology course for non-majors." (Anderson, 1984), we believe the material presented needs to be relevant to living in the "real world." We have designed a course, which we hope will accomplish this goal. The course is centered upon major problems facing humans now and in the future. The scientific content of the course prepares students to examine these problems and their ramifications with an informed background, i.e. information is provided as a means to examine problems, not as an end in itself. This examination requires that scientific and technological contributions are accompanied by social and ethical considerations with the goal that, long after students have completed the course, they will continue to use this approach to science for making informed decisions. Derting points out that the emphasis placed on ethics and its importance in the decisions our students will make throughout life is increasing in undergraduate education in the United States (Derting, 1994). As instructors, we believe our role is to educate, not to indoctrinate. We maintain the position that science is a way of life, which includes examining information and problems in a special way. A general education course should not be designed to turn students into biologists, but rather to help them understand how biologists attempt to solve problems and how biology relates to everyday life. Rogers and Ford point out that students do not acquire positive attitudes toward science just because they learn more science. They further state that instructors need to keep aware of the changes observed in the expectations and experiences of the student population (Rogers & Ford, 1997)

For this General Education Course in Biology we have constructed a method for student evaluation in agreement with student preferences outlined in Richard Light's book *Making the Most of College: Students Speak Their Minds.* He lists several factors that make for a better course, as indicated by students (Light, 2003). He states,

> "A large majority of students say they learn significantly more in

> courses that are highly structured with relatively many quizzes and short assignments. Critical to this preference is getting quick feedback from the professor, ideally with an opportunity to revise and make changes before receiving a final grade (p. 8)."
>
> "How students study and do their homework assignments outside of class is a far stronger predictor of engagement and learning than particular details of their instructor's teaching style (p. 51)."
>
> "Of all skills students say they want to strengthen, writing is mentioned three times more than any other (p. 54)."
>
> "They believe they can learn most effectively when writing instruction is organized around a substantive discipline (p. 59)."
>
> "In reference to science courses, students prefer those that have a modest rather than higher levels of competition for grades (p. 73)."

In keeping with these student recommendations, our course includes significant writing, frequent evaluations with rapid feedback to the students, outside homework, opportunity to improve their work, and minimum competition.

Ernest L. Boyer in a report in *Rethinking the Curriculum* entitled "Making the Connections: The Search for Our Common Humanity" states,

> "Today students live in a world that is economically, politically, and environmentally connected. The protective ozone layer is endangered. Our shorelines are polluted, and the tropical rain forests are being destroyed at the rate of 100,000 square kilometers every year. I worry that education in this country is becoming increasingly parochial at the very moment that human agenda is more global. Students are not becoming sufficiently well educated about the world they will inherit (Boyer, 1995)."

He further states than an undergraduate curriculum should be based on what he calls the *human commonalities*—those universal human experiences that are found among all people and all cultures on this planet. He then proposes the question, "What are these experiences that non-uniform people have in common?" We believe that Boyer's question can be extended to all living things, not just to humans. This approach has proven to be quite successful when applied to an introductory course for biology majors (Brett 1998).

Boyer lists the following 7 commonalities:

1. We all experience life: birth, growth, and death.
2. We all communicate with each other.
3. We all respond to the aesthetic.
4. There is an historic perspective; we all recall the past and anticipate the future.
5. We all organize ourselves into societies.
6. We are all embedded in Nature. We are interconnected.
7. We all seek to give meaning to our lives.

Whenever possible during the course, these commonalities are applied to the subject matter. Time is allotted during the scheduled class periods to examine material from these viewpoints and apply the process of Critical Thinking to the subject matter. At the conclusion of each unit, students respond to a series of objective questions to assure they know the factual content. Then they discuss a series of questions to help them apply the factual material to biologically related human problems or issues. A significant number of the discussion questions are controversial and stimulate diverse opinions. Whereas there is little disagreement among students about the answers to strictly biological questions, there is seldom unanimity in their consideration of social and ethical implications.

COURSE OUTLINE

The course examines biology as problems facing humans. Hopefully the text and class discussions will better equip students to examine problems of a biological nature facing all of us at the present time and from some time into the future, as well as helping them to arrive at informed decisions in considering these problems. The course is based upon five major problems or themes:

1. The environment and factors affecting it.
2. Human populations—causes and consequences.
3. Nutritional needs and meeting those needs for all humans.
4. Genetics, genetic engineering and their implications for humans.
5. "New" diseases—causes, treatments, and preventions.

SCHEDULE OF TOPICS

1. **The Environment and Factors Affecting It**
   - Spaceship earth
   - Major biotic components of ecosystems
   - Energy flow in ecosystems
   - The cycling of nutrients
   - Human ecology

2. **Human Population — Causes and Consequences**
   - Population growth and control
   - Structure and function of the male reproductive system
   - Structure and function of the female reproductive system
   - Fertilization and development
   - Contraception
   - New technologies for reproduction and problems associated with these technologies
   - Aging

3. **Nutritional Needs and Meeting Those Needs for All Humans**
   - Photosynthesis
   - Cells and energy
   - Nutrition and digestion
   - Humans and their food supplies
   - Possible solutions to the world's food problems
   - Diet
   - Muscle structure and function, and exercise and beneficial effects

4. **Genetics, Genetic Engineering and its Implications for Humans**
   - Cell organization
   - Cell reproduction
   - Chromosomal inheritance
   - Human genetics
   - Genetic disorders
   - Biotechnology

5. **"New" diseases—causes, treatments, and prevention**
   - Homeostasis
   - Immunity and disease
   - Sexually transmitted diseases
   - Major killers of the past
   - Cancer
   - Cardiovascular diseases

6. **Evidence for Evolution**

REQUIRED MATERIALS FOR COURSE EVALUATION

In a CCCR report entitled "Education", Branscomb states, "Too many Americans believe that you must be gifted to learn math and science; in fact, everyone can learn. Hard work, not innate talent, is the key to learning (Branscomb, 1993). As most instructors who have been in the trenches for a relatively long period of time know, no matter how hard the instructor works, students must do the learning. Therefore, we believe students must be involved in their own learning. Directing them to relate biological information to everyday life is one way to do this. Yorks acknowledging the often asked question, "Why do we have to learn this?", states that allowing and requiring students to relate concepts that they learn in the classroom to some aspect of their personal environment helps them answer the question themselves (York). Therefore, course evaluation includes a variety of requirements, which involve students in the process of learning; it does not consist merely of tests over memorized facts. Interestingly, the use of a variety of evaluation tools, in addition to tests, not only permits students to witness and evaluate biological information from many viewpoints, but also decreases the competitive nature of the course. This is in agreement with Light's findings (Light, p. 73).

REQUIREMENTS FOR THE COURSE AND THEIR VALUE

1. **Exams** 200
   There are four exams, including the final, worth 50 points each. The questions are taken from the lecture material covered since the previous exam. Each exam consists of about 60% objective, multiple choice, and matching questions, and 40% short discussion questions including commonality questions.

2. **Newspaper articles** 20
   During the 15 weeks semester, students are required to submit 10 articles from a newspaper or weekly magazine. Each article must "touch upon" information that has been or will be covered in the course. The article must be dated, indicating that it appeared during a specific week of the semester. Students may clip the article, if it is from their own newspaper or magazine, or they may photocopy it, if it is from a library holding. A brief paragraph in ink or by word processor, explaining the student's perspective on the significance of the information, is required. Articles are turned in for a minimum of 10 weeks during the semester; i.e., an article is turned in each of 10 weeks, not 2 to 10 articles in one week. The articles must be turned in as paper copy, not as email. This requirement causes the student to check recent news copy and provide the specific week's material.

3. **Bonus newspaper articles** 10
   Students may turn in as many as 5 extra articles. They receive 2 bonus points for each additional article for a possible 10 bonus points.

4. **Written essays** 20
   Two essays, each of 500 words minimum, are required. A satisfactory essay will receive 10 points; a less than satisfactory essay will receive an appropriate number of points. Topics for essays are included in the schedule and students are required to apply 5 of Boyer's commonalities in the text. In previous years, students were given the opportunity to write on any topic they believed applied to the course material; however, this was not found to be satisfactory as predicted in Light's discovery that students are more comfortable when writing around a substantive discipline (Light, p. 59). The due dates for the essays are included in the schedule, but students can submit their essays any time prior to the due dates. Submitting the essay before the due date permits the instructor time to review it and return it to the student for corrections, additions, and other improvements, if they are needed. This gives students the opportunity to improve their grades on the essays, which students appreciate (Light, p. 8). Regardless of when the essay is submitted, it is edited and returned rapidly to the student with the requirement that it be resubmitted before a grade is assigned. Most students require only one resubmission, but some require 2 or 3. No attempt is made to change the students' ideas or opinions, but only corrections and suggestions are provided that will enable them to state these in a clearer and acceptable form

5. **Bonus exercises** 10
   During the semester there are opportunities to earn bonus points by submitting satisfactory answers to problems or short essays on a variety of topics

6. **Photographic evidence of topics covered in the course** 20
   Students submit a minimum of five colored photographs taken by them during the semester, which illustrate principles or topics covered in the course. The photographs must illustrate different topics such as reproduction, genetics, pollution, or population. Each photograph most be accompanied by a short description of what the photograph illustrates. Students are to obtain duplicate copies so that their submitted photographs do not need to be returned. A class album is prepared containing some of the best responses to the assignment. If students don't own a camera, it is suggested they purchase an inexpensive, single-use camera for about $5.00. Their objection to this additional cost is overruled by the cost of their textbook, which is free from the Web.

Total points possible for the course 270

Grade determined on the basis of 250

ESSAY TOPICS

1. Pollution as caused by humans
2. World population problems
3. World nutritional problems
4. A genetic disease
5. A viral STD
6. Biotechnology

Each essay must include reference to a minimum of 5 of Boyer's commonalities. This requirement for students to use some thought and originality in their essays significantly reduces the likelihood that their essays will come from the Internet. If students submit their essays with a list of Boyer's commonalities at the beginning or end of the essays, they are returned with the instruction that the commonalities must be illustrated in the body of the text. All essays are graded only after the students make the necessary corrections. Without this requirement, students pay little attention to improving their writing. Moore, in his comments about students' essays, asks the question, "Do our marks and comments help students develop a writing style that will serve them well in their careers (Moore, 1994)?"As was indicated by students, they want to strengthen their writing skills (Light, p. 54); this will not occur, if the instructor does not serve as an editor to help them improve.

NEWSPAPER ARTICLES

Students tend to submit articles with short summarizing paragraphs; however, after one or two are returned, most students begin personalizing their narratives. If the articles are turned in on time, students are permitted to correct and resubmit the assignments without them being considered late. This leeway is only permitted for the first one or two articles.

These are a few examples of how students relate to news articles.

1. "Implant in Scalp Can Zap Headaches"—*Indianapolis Star*, Feb. 17, 2003. When I saw this article, it immediately sparked my interest. I have suffered from migraines for about six years. I still remember my first migraine and how awfully incapacitating it was. Little did I know then that it was the beginning of this horrible journey through migraine headaches. Thankfully, however, Midrin has worked for me in controlling my migraine headaches. However, I know that it might not always work, and I will have to turn to an alternative medication source. Therefore, I constantly have my eyes open for the newest information on headache research. The idea of a tiny electrode controlling a nerve and preventing severe pain is really exciting. The idea of spending $5,000 to $10,000 on a headache cure may sound absurd to some, but to those who suffer, it's definitely worth it.

2. "Antibiotic-Resistant Strep Germs Gaining Ground, Researchers Say"— *Indianapolis Star*, March 10, 2003. This article says, "Next year there will be up to 40% of the strains of strep that could become immune to penicillin and erythromycin." This means that more people will get sick from these strains and they will be harder to treat. Scientists will have to find new medicines. Meningitis is one of the diseases that is immune to drugs. Last week in my hometown, there were three cases they couldn't cure. This article touches upon the unit of immunity and disease.

3. "Obese Children Rate Quality of Life Very Low"—*Indianapolis Star*, April 13, 2003. Lindsey Tanner of the Associated Press says, "The quality of life for children who are considered to be overweight is a lot lower than expected." The article states, "15% of the nation's youth is overweight. After rating themselves physically, emotionally, and socially, it was found that their scores were very similar to those of children with cancer." I think that this article goes along with our section on nutrition and its effects. This article interested me because I was an overweight child and realized that I didn't want to go to school because of being teased and because I was ashamed of my body. Effects of that still follow me and even though I have come to terms with never being a super model, I still have a large fear of being overweight. Hopefully after this study, there will be more attention paid to obesity in youth and trying to help them and educate parents on proper eating habits for children.

PHOTOGRAPHS

The first semester that photographs were included in the evaluation, the instructions did not indicate that each photograph should illustrate a different topic; therefore, some students submitted five photographs on the same topic. The most common topic was pollution. By requiring 5 different topics, it is hoped that the students will become involved in and retain information from a variety of areas. A short description of what each photograph illustrates is required. Students who turn in their work before the deadline are offered the opportunity to improve their work and receive a better grade. Examples of photographs and descriptions are included in Figure 1.

Figure 1. *Examples of photographs and student descriptions.*

1. Pollution — Photograph of a "junkyard" or automobile graveyard

"The materials and debris found in the junkyard occupy around one half acre and cause a serious threat to the environment. The run offs from oil, antifreeze, steering fluid, battery acid, and Freon will be absorbed into the soil contaminating the land. When a heavy rain comes, the runoff from the junkyard will most likely find its way into a river or water supply of some kind, affecting wildlife and humans."

2. Contraception—Photograph of the contraceptive display in a store

"Condoms, vaginal contraceptive foam, and other forms of birth control are easily available at any drug store. While condoms are 85% effective, abstinence is 100% effective. The vendors at this particular store said that the birth control methods were moved to the "Baby Supply" area with the specific intent of sending a message. By this small act, they are allowing people to remember that pregnancy is a possibility if you are sexually active."

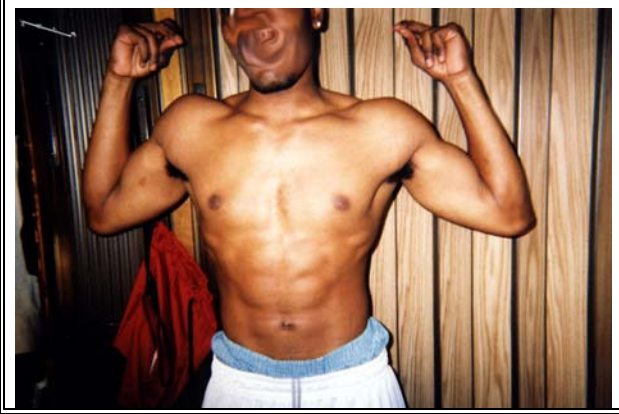
3. Genetics—Photograph showing inherited traits

"We inherit certain characteristics and traits from our parents and ancestors. My grandmother has type-one diabetes (Diabetes mellitus). It usually occurs in people under 30 years of age but may also appear at any age. In type-one the insulin producing cells of the pancreas (beta cells) have been destroyed leaving no insulin available to open the doors of the cell for glucose to enter. Cells then have no energy and blood glucose levels are excessively high. My aunt and grandmother both have type-one diabetes."

Figure 1. *Continued*

4. Fertilization and Development -- Photograph showing pregnant woman with young child.

"This photograph shows the process of fertilization and development. It shows that when an egg is fertilized this is what happens most of the time and the outcome is pregnancy. The woman goes through many stages when an egg is beginning to develop in her uterus. The mother goes through a lot of different stages for nine months and then the child is developed and birth occurs.



5. Exercise and Beneficial Effects -- Photograph shows a young man flexing his muscles.

"In this photograph it shows how when you take care of your body and exercise it shows in the body. This man's body is really in shape and he is cute as well as built really nice. It also shows that he has worked hard in many places and the outcome is what he looks like now. He is being rewarded for the hard work he has done with his body."

BONUS POINTS

Bonus points are earned for students' input on a variety of materials. Several examples are listed below.

1. Students are asked to find out the present population of the world and the United States, which requires that they become acquainted with the World Population Clock on the Web.
2. Students are required to present both sides of an argument, such as in the case of twins born to members of the U'wa tribe in Bogotá, Columbia. Customarily, the U'wa tribe abandons newborn twins in the forest or tosses them into the river, believing they are ill equipped for life and brings bad luck. Juan and Keila Aquablance were spared that fate when their parents left them in a public health clinic three days after their birth. The tribe demanded the babies be returned to the tribe; however, the health officials said the babies shouldn't be returned and should be placed for adoption. The tribe decided to fight the adoption process and demanded the children's return. Students were asked to present arguments to support both the tribe's rights and the babies' rights (actually, the health officials' decision).
3. Students are presented with a world map showing the multiple effects of global warming and asked to list the various areas and organisms being affected by increased warming.
4. Students are asked to present arguments for and against the requirement of medical personnel to make known that they are HIV positive.

As with essays, these papers are edited and returned to students, usually during the next class period; they are required to resubmit papers with corrections or suggested improvements.

RESPONSE OF STUDENTS TO EVALUATION TOOLS

How can instructors evaluate a teaching tool or technique when results of an educational experience often are not evident until long after the student leaves the class? In most cases, instructors settle on short-term evidence. Table 1 examines what percent of the class actually completed the different evaluation criteria, and Table 2 indicates the correlation of grades with student participation in the evaluation criteria. The data are for two classes. One class had an enrollment of 11 and was taught at a private college; the other had an enrollment of 43 and was taught at a state university. Comparing small and large classes is not ideal, but obtaining a small class at the university would have required using data from an honors class, in which case pre-college factors would have clouded the issue.

Table 1. *Response of Students to Evaluation Criteria*

	Private College Class of 11	State University Class of 43
Essays	10 (91%)	41 (95%)
Photographs	10 (91%)	32 (74%)
10 News articles	8 (73%)	24 (56%)
9	1	3
8		3
7	1	3
6		1
5		2
4		3
3	1	3
2		1
Bonus News articles (1-5)	6 (55%)	19 (44%)
Bonus points (1-10)	11 (100%)	37 (86%)

Table 2. *Correlation of Grades with evaluation responses.*

Letter Grade	Private College # Student (%)	State University # Student (%)
A	6 (55%)	5 (12%)
B	2 (18%)	7 (16%)
C	2 (18%)	15 (35%)
D		12 (28%)
F	1 (9%)	4 (9%)

Grade Obtained	Essays 20	Photographs 10	New Articles 20	Bonus News 10	Bonus 10
State University					
A	20.0	9.6	20.0	6.4	8.3
B	17.9	10.0	19.4	4.2	6.4
C	17.8	5.3	20.0	3.2	6.1
D	13.3	8.2	12.5	0.5	4.0
F	6.5	2.5	9.5	0.0	4.5
Private College					
A	18.4	10.0	20.0	3.7	6.2
B	19.0	10.0	19.0	5.0	7.0
C	18.0	10.0	17.0	0.0	5.5
D	0.0	0.0	0.0	0.0	0.0
F	5.0	0.0	6.0	0.0	1.0

Better than 90% of the students in both classes turned in essays. Ninety percent of the students in the small class turned in photographs; whereas, only 74% of the students in the larger class completed the assignment. There was a similar percent difference in the response to the requirement of 10 news articles; about 73% of the small class and 55% of the larger class turned in 10 articles, but all members of both classes turned in some news articles. Both classes showed a tendency to respond less to bonus new articles, 54% and 44%. Surprisingly, 100% of the small class and 86% of the larger class turned in some bonus work.

CORRELATION OF GRADES WITH COMPLETION OF EVALUATION REQUIREMENTS

In the larger class, the average number of points students earned for evaluation criteria, with the exception of tests, compared to their grades indicates a general tendency for them to submit fewer items as grades decrease from A to F. This drop is significant in the lower two grades: D and F. The same is true for the small class, but even the C students did not complete much of the bonus work. The grade distribution is also significantly different between the

two classes. The smaller class size and the type of student in a private school certainly have an affect on this.

The results indicate that students who participate in more of the activities used as evaluation criteria do better grade-wise, and as has been shown by other studies, students in small classes perform better than students in larger classes (Princeton Review). This holds true in both lecture and laboratory as indicated by Ghosh (Ghosh, 1999). One should not overlook the difference in the student population between an expensive, private college and a state university, which plays an additional role in the differences between the two classes (Princeton Review).

DISCUSSION

The purpose of introducing a variety of evaluation tools is three fold: to involve the students in their own education, to emphasize that biological information is present every day in places familiar to them, and to personalize the relationship between instructor and student in a large class. Having students take some ownership for their learning not only makes them teachers in the course, but also helps them retain important information. A frustration for many instructors is their inability to personalize the educational experience for students in large classes. There can be 100 to 200 students in a General Education course in Biology. Although it is difficult, actually impossible, to communicate with most of the students in a large class by "standard" means, i.e. asking them a question; this can be done outside of class by evaluating students' written material as it applies to news articles, photographs, and special problems. Written comments on the students' work and reference to some of the work in daily lectures create a more personal relationship; however, the instructor must be prepared to spend considerably more time than is required for a straight lecture-discussion presentation. Each instructor must decide if the extra work is worth it both for the student and for the instructor. Research has shown that students appreciate the extra work and learn more when there are frequent and rapidly returned evaluations. Several of the items used in this course lend themselves to this type of response.

The results, as indicated in Tables 1 and 2, suggest that the instructor's extra work was relatively worthwhile with A, B, and C students, but was not worthwhile in the case of D and F students. There is a tendency in colleges and universities to emphasize student retention; faculty are continually being asked to design methods for increasing retention, which has resulted in many faculty requiring less of the students. What often seems to be overlooked is the fact that learning is an active endeavor; although someone can guide and encourage them, the students have the ultimate responsibility for their learning. Years ago at a Sigma Xi seminar on teaching methods and philosophies, I was impressed with the results the speaker had been obtaining in his classes. When he opened the session to questions, I asked him what he did with students who didn't attend class and didn't turn in required work. Somewhat angrily he responded, "Some students want to screw themselves; let them." It is difficult for most instructors to follow this advice, but unless they want to continuously see themselves as failures, it may be necessary to do so. The message is "Do all you can as an instructor to encourage and help individuals become good students." Adapting to the classroom the Greyhound motto, "Leave the driving to us," instructors must finally leave the learning to the students.

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The Association of College and University Biology Educators (ACUBE), placed the organization's rich archive of materials online for the benefit of members and interested biology educators. Nearly 48 years of the society's publications and resources are currently accessible.

Featuring Online ACUBE archives:

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

ACUBE

Web Site

http://acube.org

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

Call for Nominations

Honorary Life Award

The **ACUBE Honorary Life Award** is presented to ACUBE members who have made significant contributions and/or service to ACUBE and the advancement of the society's mission. The award is presented at the annual fall meeting of the society.

If you wish to nominate a member of ACUBE for this award, send a Letter of Nomination citing the accomplishments/contributions of the nominee and a *Curriculum Vita* of the nominee to the chair of the Honorary Life Award committee:

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@isugw.indstate.edu

To the Membership of the ACUBE:

After several years of work and with the participation of many members of the Constitution committee, we are providing the membership with amendments to both the ACUBE Constitution and By-Laws. These changes were discussed and accepted by the Steering Committee at the Winter Meeting (January 2004). They are now presented to you for your consideration. Members attending the Annual Meeting in Crawfordsville, IN, October 14-16, 2004, will be voting on these changes.

There are many minor changes that clarify wording or make corrections. Major changes in the Constitution include the following:

1. add "graduate student" as a membership category
2. make the term of the office of President two years instead of one. This increases the commitment from three to four years.
3. The appointed office of ACUBE Website Editor has been created to oversee the content and updating of the website.

Changes in the By-Laws were made to clarify the roles of the elected and appointed members of the steering committee, and to formalize procedures (such as the winter steering committee meeting) that historically have been a part of the organization.

1. Elections of President will take place only in even-numbered years.
2. A vacated secretary office will be filled with the president-elect or past-president.
3. Role of the steering Committee member at Large has been defined
4. A new by-law concerning removal from office of non-functioning members of the Steering Committee
5. Formalized the Winter Steering Committee arrangements
6. Formalized dues procedures.

Please note that new material is shown in bold and underlined. Material which will be removed is shown with strike-through. Only those sections with changes are shown. To see the complete document (last amended in 1999) please go to the ACUBE web site.

Respectfully submitted,
Margaret Waterman
ACUBE Past-President
Chair of Constitution Committee

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). **ACUBE is officially recorded in the state of Iowa**.

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 **college and university** 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, **and graduate student.** 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, **Bioscene editors**, **ACUBE website Editor,** and an historian who shall be ex-officio members of the Steering Committee.

Section 7. The president-elect shall recommend and the Steering Committee shall appoint the first vice-president-elect **at the annual meeting two years in advance of the meeting for which the first vice president shall provide the program**. The first vice-president**-elect** shall automatically succeed to first vice-president the ensuing year.

Section 8. The second vicepresident-**elect** shall be from the host institution and shall be appointed by the Steering Committee after consultation with representatives from that institution, **and at the annual meeting two years in advance of the year during which the meeting will be held at their institution. The second vice president-elect shall automatically succeed to second vice president the ensuing year.**

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 ~~next~~ annual meeting can fill the position.

BY-LAWS

ARTICLE I. TERMS & DUTIES OF OFFICERS

SECTION 1. The term of office of the president **shall be for two years**. The term of office for the president-elect shall be for one year. ~~**The term of office for the past president shall be one year**~~**. The term of office for the first vice-president and second vice-president shall be for 18 months**. The term of office of the secretary shall be for two years. **The term of office for the Members at Large shall be three years.** The election for secretary shall be held in odd numbered years. **The election for president-elect shall be in even 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; **in the first year of office as President, recommend to the Steering Committee a nominee for the office of first vice president elect;** 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~~,~~, and work with the first vice-resident elect on preliminary plans for the program**s** for the year she/he serves as ~~**president-elect and the first year 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 **annual meeting** program chair 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 11. The Members at Large shall serve for three years and are expected to attend the Steering Committee meetings, serve as chairs of Steering Committee Standing committees, assist in carrying out the responsibilities of the organization, and fulfill duties as outlined in the Steering Committee handbook.

SECTION 12. The Steering Committee will appoint an editor for the ACUBE website who shall determine web site policies. He or she shall attend Steering Committee meetings as an *ex officio* member.

SECTON 13. The Steering Committee shall appoint the Bioscene Editor(s), who shall determine publication policies and page charges for non-members.

SECTION 14. Members of the Steering Committee may be removed from office if they fail to attend all Steering Committee meetings in a one year period (i.e., winter and annual meetings). Exceptions to this may be made on a case-by-case basis by a majority vote of the Steering Committee at the second set of meetings missed by the Steering Committee member. Steering Committee Members may also be removed for misusing ACUBE funds or egregious failure to carry out assigned duties, as determined by a majority vote of the Steering Committee.

ARTICLE II-ANNUAL MEETINGS

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

SECTION 3. A winter meeting of the Steering Committee shall be held at the site of the upcoming annual meeting. If available, ACUBE funds may be used to provide modest housing costs and one meal for the members of the Steering Committee attending the meeting.

ARTICLE III-DUES

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 and to be a presenter at the Annual Meeting. 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 available. Keynote speakers at the Annual Meeting shall receive complimentary membership and Bioscene for the year following their presentation at the Annual Meeting.**

Wabash College

Site of the 48th Annual Meeting

Association of College and University Biology Educators

Wabash College was founded in 1832 as an independent non-sectarian college for men. For more than 170 years Wabash has been educating young men to "think critically, act responsibly, lead effectively, and live humanely" with a classical liberal arts educational experience. Students may pursue one of twenty-one different majors. The curriculum seeks to allow maximum flexibility as well as to provide the broad base of understanding that is at the core of the liberal arts concept. At Wabash about 25% of the students participate in over 140 study abroad programs. The 850 students come from 34 states and 13 foreign countries. Nearly 21% are students of color. Approximately 90% of the students receive some form of financial aid. The U.S. News and World Report rank Wabash in the top 20% of the 212 National Liberal Arts Colleges. Wabash set two national benchmarks in The National Survey of Student Engagement and ranked in the 90th percentile in three other categories. Wabash ranked first in the level of academic challenge and students' interaction with the faculty. About 75% of Wabash alums attend graduate school within five years of graduation. Thirteen percent of our alums hold Ph.Ds and 12% hold the title of "President" or "Chairman." Only two Ivies have a higher percentage of alumni in Who's Who.

Crawfordsville, Indiana

Located on the banks of Sugar Creek in West Central Indiana, Crawfordsville was organized into a city in 1823. As the seat of Montgomery County, Crawfordsville has served as the financial and trading center for surrounding counties. Because of its cultural strengths, by the end of the 19th Century, it became known as the "Athens of Indiana." In addition to being the home of General Lew Wallace, author of "Ben Hur," Crawfordsville has been the home of numerous other writers. Today, the City has diverse industry sectors including, steel production and processing, agribusiness, printing, education, distribution, optics, metal and plastic fabrication and lighting. With a growing population of over 15,000 diverse residents, Crawfordsville is one of the "Top 100 Best Small Towns in America."

ACUBE 48TH Annual Meeting Registration

October 14-16, 2004

Wabash College
Crawfordsville, IN

Technology in Biology Education

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: _____

Registration Fee: **Includes** all meals Friday through-Sat noon, refreshments at breaks, and field trips.

Membership status	**by 08/01/2004**	**after 10/01/04**
Regular Member	$ 85	$ 100
Regular member + 2005 dues	$ 115	$ 130
New Member (includes 2005 dues)	$ 115	$ 130
Non-Member	$ 115	$ 130
Non-Participating guest/spouse	$ 55	$ 55
Student (Grad or Undergrad)	$ 55	$ 55
K-12 teacher	$ 55	$ 55
Friday evening dinner only	$ 15	$ 15

TOTAL ENCLOSED (Please make checks payable to ACUBE) _____

Field Trips: Indicate the trip(s) you plan to attend. Space is limited, register early!

- _____ Pre-meeting field trip to Pine Hills (relic hemlock trees) (Thursday afternoon, October 14)
- _____ Birding trip (Friday morning October 15)
- _____ Crinoid fossil collecting trip (Friday afternoon October 15)

Special needs (food, facilities, etc.):

Please send registration form and payment to: Dr. Austin Brooks
ACUBE Local Arrangements Chair
Department of Biology, Wabash College
Crawfordsville, IN 47933
Voice: 765-361-6350 FAX 765-361-6149 brooksa@wabash.edu

ACUBE 48TH Annual Meeting

October 14-16, 2004

Wabash College
Crawfordsville, IN

Technology in Biology Education

Preliminary Program

Thursday, October 14th

2:00 - 5:00 PM	**Pre-Conference Field Trip: Pine Hills**	**Location TBA**
3:00 - 5:00 PM	**Steering Committee Meeting**	**Biology and Chemistry Buidling** (TBA)
6:00 - 8:00 PM	**Registration and Reception** *heavy h'ors d'oerves*	**Biology and Chemistry Building Entry and Room 104**
8:00 - 9:00 PM	**Opening Session** **Welcome to ACUBE**: ACUBE President: **Terry Derting**, *Murray State University* **Welcome to Wabash College:** Dean of the College**, Dr. Mauri Ditzler,** *Wabash College* Program Chair: **Joyce V. Cadwallader,** *Saint Mary-of-the-Woods College* Local Arrangements Chair: **Austin Brooks,**.*Wabash College* **OPENING ADDRESS** (Public Welcome to Attend) **John Kraemer, *Southeast Missouri State University*** *Title: The Application of Remote Sensing and GIS Technology in Environmental Science Education*	**Biology and Chemistry Building Room 104**
9:15 - 10:15 PM	**Steering Committee Meeting**	**Biology and Chemistry Building** (TBA)

Friday, October 15th

7:00 AM - 5:00 PM	**Registration table**	**(all locations are in the Biology and Chemistry Building unless otherwise indicated)**

Friday, October 15th

7:00 - 8:00 AM	**Buffet Breakfast** (by Interest Group)	**Detchon Center**
7:30 - 10:30 AM	**Field Trip: Birding**	**Location TBA**
9:00 AM - Noon and 2:00 - 5:00 PM	**SUSTAINING MEMBER EXHIBITS** Refreshments provided	**Biology and Chemistry Building**
8:15-9:45 AM	**CONCURRENT WORKSHOP SESSIONS I**	**Biology and Chemistry Building**

1. **Easy Ways to do Physiology Labs from iWORX/CB Sciences**, Steve Andre, iWORX/CB Sciences
2. **Using Technology with Investigative Case Based Learning** Margaret Waterman, Southeast Missouri State University and Ethel Stanley, BioQUEST, Beloit College
3. **Mastery Teaching and Learning Workshop**, Abour H. Cherif and Karen Murkar, DeVry University
4. **Amphipods as a Model System for Teaching Ecology**, Evolution, and Behavior**.** Susan E. Lewis, Carroll College

9:50-10:20 AM	**POSTER SESSION I** Refreshments provided	**Biology and Chemistry Building**

1. **Investigative Case Based Learning: The LifeLines OnLine Project** Margaret Waterman, Southeast Missouri State University and Ethel Stanley, BioQUEST, Beloit College
2. **Development of a Blended Online/Traditional Environmental Science Course** Jennifer A Sadowski* and Michael S. Alfieri, Viterbo University
3. **Teaching Population Growth Using Cultures of Vinegar Eels, *Turbatrix aceti* (Nematoda)** Robert L. Wallace, Ripon College
4. **Development of an Upper-level Comparative Bioinformatics Course** Glenna G. Temple, Viterbo University
5. **Tools for Environmental Conservation & Restoration** Peter J. Wilkin, Purdue Univ. North Central

10:30 - 11:15 AM	**CONCURRENT PAPER SESSIONS I**	**Biology and Chemistry Building**

1. **A Single Organism Can Serve Many Educational Purposes** William Brett, Indiana State University
2. **Bridging the Interdisciplinary Divide: A Mathematical Model of Muscle Contraction and Its Uses in Undergraduate Biology and Math Education** Tom Hoogendyk, Biology Department, Northeastern University, and Jennifer Galovich, Mathematics Department, College of Saint Benedict and Saint John's University

Friday, October 15th

10:30 - 11:15 AM **CONCURRENT PAPER SESSIONS I** — **Biology and Chemistry Building**

3. **Writing, Collaborative Media, and Interactive Online Environments.** Steve Brewer, University of Massachusetts Amherst

4. ***LabWrite*: Educational Technology to Enhance Students' Writing and Learning in Biology Labs** Miriam Ferzli, Michael Carter, and Eric Wiebe, North Carolina State University

11:20 - 12:05 AM **CONCURRENT PAPER SESSIONS II** — **Biology and Chemistry Building**

1. **The Web Enhanced Course: A Liaison Between the Computer and the Classroom** Hugh B. Cole, Hopkinsville Community College

2. **Human Allometry: Sexual Differences in Growth Rates of Various Body Parts** Buzz Hoagland, Westfield State College

3. **Long-term Impacts on One Semester of Reformed Teaching on Student Learning.** Terry L. Derting, Murray State University

12:15 - 1:00 PM **Luncheon and First Business Meeting** — **Detchon Center**

First and Final Call for Nominations!!
Out of this World Teaching Idea contributions

1:00 - 1:45 PM **Luncheon Program** — **Detchon Center**

John Jungck, *Beloit College*
Title: Computer Power and Human Learning: Using Technology As If Sudents Matter

2:00 - 5:00 PM **Field Trip: Crawfordsville Crinoid Beds** — **Location TBA**

2:00–2:45 PM **CONCURRENT PAPER SESSIONS III** — **Biology and Chemistry Building**

1. **The Science of Flight 3.** Lynn Gillie, Todd Egan, and Mary Anne Perks, Elmira College

2. **Round Table Discussion—Recruiting 1st and 2nd year Potential Majors—Strategies** Thomas A. Davis, Loras College

3. **A Survival Guide for Students in the Anatomy and Physiology Course** Neil Baird, Millikin University

2:50 - 3:20 PM **POSTER SESSION II** — **Biology and Chemistry Building**

Refreshments provided

1. **Investigative Case Based Learning: The LifeLines OnLine Project** Margaret Waterman, Southeast Missouri State University and Ethel Stanley, BioQUEST, Beloit College

Friday, October 15th

2:50 - 3:20 PM	**POSTER SESSION II** Refreshments provided	**Biology and Chemistry Building**

2. **Investigative Case Based Learning: The LifeLines OnLine Project** Margaret Waterman, Southeast Missouri State University and Ethel Stanley, BioQUEST, Beloit College

3. **Development of a Blended Online/Traditional Environmental Science Course** Jennifer A Sadowski* and Michael S. Alfieri, Viterbo University

4. **Teaching Population Growth Using Cultures of Vinegar Eels, Turbatrix aceti (Nematoda)** Robert L. Wallace, Ripon College

5. **Development of an Upper-level Comparative Bioinformatics Course** Glenna G. Temple, Viterbo University

6. **Tools for Environmental Conservation & Restoration** Peter J. Wilkin, Purdue Univ. North Central

3:30 - 5:00 PM	**CONCURRENT WORKSHOP SESSIONS II**	**Biology and Chemistry Building**

1. **Case It! Computer Simulations for the Analysis of Genetic and Infectious Disease—An Update** Mark Bergland and Karen Klyczek, University of Wisconsin, River Falls

2. **Using *LabWrite*: Helping Students Write Better Lab Reports** Michael Carter, Miriam Ferzli, and Eric Wiebe, North Carolina State University

3. **Integrating video camera, digital microscopy into the Biology curriculum and laboratory** Richard E. Wilson, Ken-A-Vision Mfg. Co. Inc

5:05 - 5:45 PM	**Web Committee Meeting**	**Biology and Chemistry Building**
6:00 - 7:00 PM	**Social Hour:**	**Detchon Center**
7:00 - 9:00 PM	**Dinner and Second Business Meeting** (two-minute speeches by the candidates prior to dinner; balloting after dinner presentation) **Dinner Presentation** **Cary Mitchell, Purdue University**, *Title: TBA* *Presentation of the 2003 Out of this World Teaching Idea*	**Detchon Center**

Saturday, October 16th

7:30 - 8:45 AM	**Buffet Breakfast** (by Interest Group)	**Detchon Center**
7:45 - 8:45 AM	**Bioscene Editorial Board**	**Biology and Chemistry Building**

Saturday, October 16th

9:00 - 9:45 AM **CONCURRENT PAPER SESSIONS IV** **Biology and Chemistry Building**

1. **Teaching with Ultrastructure—Active Learning with Rotating Teams** Thomas A. Davis, Loras College

2. **Using Technology to Teach an Integrated Mathematics/Biology Course – Preliminary Report** George M. O'Connor and John G. Koelzer, Rockhurst University

3. **Grantsmanship and NSF-Style Student Peer Review In Undergraduate Research Experience** B. G. Blair, G. R. Cline, and William R. Bowen, Jacksonville State University

10:00 - 10:45 AM **CONCURRENT PAPER SESSIONS V** **Biology and Chemistry Building**

1. **Interdisciplinary Impact of Evolution** David P. Benson, Marian College

2. **Bioinformatics Instruction: Using Microarray Data Sets to Stimulate Student Learning.** Hugh A. Miller III and Karl H. Joplin, East Tennessee State University

3. **PDAs in the Biology Classroom and Lab: The Future or Fad?** Timothy Mulkey, Indiana State University

11:00 AM - 12:15 PM **Luncheon and Third Business Meeting** **Detchon Center**

BUSINESS MEETING

Resolutions:
Dick Wilson, Rockhurst University
Executive Secretary Report:
Pres Martin, Hamline University
Bioscene:
Ethel Stanley, Beloit College & Tim Mulkey, Indiana State University
Presidential Address:
Terry Derting, Murray State University
2004 Meeting:
Margaret Waterman, Southeast Missouri State University

12:30 - 3:00 PM **Steering Committee Meeting** **Biology and Chemistry Building**
Includes newly elected Steering Committee members!

12:30 – 4:00 PM **Post conference: Covered Bridge Festival of Parke County, Indiana -- (Information will be available at meeting for those who wish to participate on their own)**

ABSTRACTS OF PRESENTATIONS

ACUBE 48TH Annual Meeting

Concurrent Workshop Session I

8:15-9:45 am
Friday, October 15, 2004

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

Physiology teaching kits and Labs on CD, and Labs on Line from iWorx/CB Sciences make it easy to do human and animal physiology experiments includes cardiovascular, neuromuscular, and respiration exercises. Teaching kits include all the hardware (except computer), software, and courseware needed to do over 150 experiments with multiple exercises. Data collection and analysis can easily be accomplished with the "click" of a button or two. Users can also complete experiments of their own design with the same "click and play" ease.

The same types of experiments can be done without data recording hardware, on a computer in lab or at home with Labs on CD, or over the Internet with Labs on Line. With Labs on CD or Labs on Line products from iWorx, students record and analyze data just as they would with a physiology teaching kit. Animations, illustrations, and digital movies compliment each lab exercise so students have an understanding of how the experiment was conducted. Participants in this workshop will be able to collect and analyze data with Labs on CD/Labs on Line.

Using Technology with Investigative Case Based Learning , ***Margaret Waterman,*** *Southeast Missouri State University and* ***Ethel Stanley,*** *BioQUEST, Beloit College*

In this highly interactive workshop, participants will work with two investigative cases that connect nicely to software available on the internet. We will use a case in which alleged whale meat is subjected to forensic genomic analysis with the powerful genomics tools collected at the Biology Workbench. With a second case we will use web-based audio files, as well as real-time data collected about the Chesapeake Bay to illustrate how to make data-rich websites into open-ended investigations. If time permits, a third case on fermentation will be used to show how to link a CD-based simulation to investigative case-based learning. Teaching approaches for using cases, adapting cases from the wealth of those already available, and assessing learning will be addressed if participants wish. To learn more about Investigative Case Based Learning, and to see some cases online, go to http://bioquest.org/lifelines

Poster Session I

9:50-10:20 am
Friday, October 15, 2004

Investigative Case Based Learning: The LifeLines OnLine Project, ***Margaret Waterman,*** *Southeast Missouri State University and* ***Ethel Stanley,*** *BioQUEST, Beloit College*

The LifeLines project developed science teaching methods and curriculum materials useful across STEM disciplines and institutional types, prepared a cadre of faculty to use and disseminate those practices, developed a web site rich with resources and faculty products, and assessed the use of biology cases in college classrooms.

The pedagogical approach, Investigative Case Based Learning (ICBL), aligns problem-based learning methods with the investigative approaches found in the software, tools and resources of the BioQUEST Curriculum Consortium. ICBL involves learners in a collaborative problem space describing a realistic

situation. The case provides a context for learning,. Case analysis allows students to identify their own questions and prior knowledge. Students are encouraged to explore questions from the case through extended science investigations, providing a more meaningful experience of science.

The LifeLines project participants developed over 65 modules, each contains case, related investigative activities, resources, assessments and implementation plans. The curriculum modules are part of the LifeLines OnLine website which includes resources for ICBL.

Development of a Blended Online/Traditional Environmental Science Course, *Jennifer A. Sadowski and Michael s. Alfieri,* *Viterbo University*

Environmental Science (ENVS 101), a non-majors general education science course with a lab component, is offered during the academic year as a traditional course (3 hours lecture, 2 hours lab per week) at Viterbo University. Due to the large number of non-traditional students at Viterbo University, the goal was to adapt the traditional course to accommodate students in the School of Adult Learning program by incorporating the on-campus laboratory component with an online lecture component as an 8-week blended online course. Environmental Science has been offered for the past 2 years in this format using technology available with Blackboard (such as discussion boards, digital drop box, Powerpoint lectures, and an online grade book), which allows for student interaction and instructor feedback while maintaining flexibility for our non-traditional students. On-campus laboratory meetings are scheduled in the evening or weekends for longer blocks than typical traditional labs. This presentation will summarize how this blended online course is constructed and discuss both the challenges and benefits of teaching environmental science in this format. The course syllabus, course outcomes, and a summary of preliminary assessment data will be presented.

Teaching Population Growth Using Cultures of Vinegar Eels, *Turvatrix aceti* (Nematoda), *Robert L. Wallace,* *Ripon College*

The dynamics of population growth is a challenging topic to explore in an ecology course that is only one semester in length. Simple options for instruction include analyzing extant data sets and the use of computer models. While more time consuming and replete with the possibility of failure, fast-growing microbes such as bacteria, yeasts, and algae or other small organisms such as protistans and Lemna also can be employed. Here I present a simple laboratory exercise that follows population growth of vinegar eels (*Turbatrix aceti*; Nematoda) in microcosms using a culture medium comprising 1.5 L of apple cider vinegar and a bit of decaying apple.

Development of an Upper-level Comparative Bioinformatics Course, *Glenna G. Temple,* *Viterbo University*

This presentation will highlight the development of a comparative bioinformatics course at Viterbo University during the 2003-2004 school year. The comparative bioinformatics course was added to the curriculum to support the biotechnology certificate now offered to science majors in addition to a bachelors degree in biology or chemistry. The goal for this course is to provide students with the skills to apply computational methods to searching sequence databases, pairwise and multiple sequence alignment, phylogenetic methods for pattern recognition and functional inference from sequence data. This course is a requirement for students pursuing the biotechnology certificate and is an upper-level elective or all majors in the department. This poster will include course syllabus, course outcomes, sample student activities, resource materials and assessment data from the first time the course was taught.

Tools for Environmental Conservation & Restoration, *Peter J. Wilkin*, *Purdue University, North Central.*

Porter county in Northwest Indiana is threatened by sprawl. The area has high biodiversity due to its proximity to Lake Michigan, but it is also the site of industrial activity, high human population density, endless through traffic, and rapid growth. Only a few % of the land area is protected, mostly adjacent to the Lake. At Indiana's dunes, biologists are restoring wetland, woodland and prairie. An expected outcome is fewer beach closings due to high levels of *E. coli*. A tool developed by the Indiana Biodiversity Initiative is used to identify the most valuable areas for conservation in the county. In 2002 a Land Use Plan was adopted by the county to guide growth. Changes in zoning ordinances needed to retain both the urban &

rural character are described and compared with recent developments. The progress is assessed of conservation & restoration activities at Coffee Creek, a model community for more sustainable development. Tools developed at Purdue to model the impacts of land use change on water resources are used to determine the effects of a new mall in Valparaiso. For access to the links, and for more tools click on http://faculty.pnc.edu/pwilkin/environmentalscience.html

Concurrent Paper Session I

10:30-11:15 am
Friday, October 15, 2004

A Single Organism Can Serve Many Educational Purposes. ***William Brett,*** *Indiana State University*

Amanita, sometimes referred to as the "death angle," plays a range of roles. It can serve as a feast for some organisms and a death sentence for others. In examining this interesting organism, one finds its life cycle touches the biological fields of ecology, evolution, genetics, physiology, taxonomy, and toxicology, as well as chemistry and history. This presentation will provide a general introduction to its role in all these areas and also suggest research projects that Amanita offers.

Bridging the Interdisciplinary Divide: A Mathematic Model of Muscle Contraction and Its Uses in Undergraduate Biology and Math Education . ***Tom Hoogendyk,*** *Northeastern University, and* ***Jennifer Galovich,*** *College of Saint Benedict and Saint John's University*

Quantitative methods and interdisciplinary approaches are the hallmark of modern biology; yet undergraduate biology education continues to emphasize rote memorization of vocabulary and explanations over quantitative reasoning and problem solving. At the University of Massachusetts Amherst, problem-solving activities based on reasoning with causal models have been used successfully in introductory biology lectures. Here we present example laboratory activities where introductory biology students use a mathematical model of muscle contraction to pose questions, solve problems, and present results. Using the model, students manipulate five parameters: actin and myosin length, number of sarcomeres in series and in parallel, and fiber pennation angle. The model predicts maximum muscle shortening and force as a function of these parameters. Combining data resulting from model manipulations with data from wet-lab experiments and the literature provides a rich problem space for student inquiry, spanning biological levels of organization from protein to cell to tissue. These quantitative laboratory activities are intended to extend conceptual models used in lectures. Students use the model to ask whether actin and myosin lengths are constant across taxonomic groups and, if not, what are the consequences in terms of maximum shortening and force production? Do parallel-fibered muscles necessarily shorten faster and farther than pennate-fibered muscles? Are pennate-fibered muscles always more forceful? By incorporating simulation and experimental data into labs, students are challenged to reconcile differences between prediction and observation, which is, ultimately, a more authentic scientific activity.

Writing, Collaborative Media, and Interactive Online Environments. ***Steve Brewer,*** *University of Massachusetts-Amherst*

Collaborative learning has many documented benefits: students get more feedback faster from peers than from instructors and construct knowledge in a social context that more accurately reflects the way disciplines really work. A common learning goal is for students to learn to work effectively as a team. Creating the support for student groups to work effectively, however, is often a significant challenge: students often resist working in groups because of the logistical challenges of collaboration and because they fear unequal contribution by group members. A recently emerging system of collaborative media, called "wikiwikiweb" can address these problems by reducing barriers to effective collaboration and increasing the accountability of the team members. We will discuss a range of collaborative media, describe wikis in more detail, provide a history of their implementation in the curriculum of the Biology Department at UMass Amherst, and offer a summary of some of their effects.

LabWrite*: Educational Technology to Enhance Students' Writing and Learning in Biology Labs, *Miriam Ferzli, Michael Carter, and Eric Wiebe,* *North Carolina State University

Many scholars in the fields of science writing and writing to learn science have noted a connection between writing and learning. A case in point is the lab report, the major form of writing in biology classes. Lab reports encourage learning not only by inviting students to reflect on what they have done in the lab but also, through the format of the report itself, by guiding students in thinking scientifically about the lab experience. At the same time, there is a growing recognition of the learning potential in educational technologies. The problem, then, is how to take advantage of the potential of both writing to learn and learning through technology in the laboratory setting. This paper describes one solution to this problem: *LabWrite*, a free, online, just-in-time instructional technology (http://labwrite.ncsu.edu). We report on a control-group study of science majors taking an introduction to biological sciences. The treatment was *LabWrite*. The control group received the lab report instruction that is typically given in the labs. We tested three hypotheses: that students in the treatment group would demonstrate (1) a greater understanding of the scientific concepts of the labs, (2) a greater ability to apply scientific thinking to the labs, and (3) a better attitude toward lab reports than students in the control group. Our results yielded statistically significant support for all three hypotheses.

Concurrent Paper Session II

11:20-12:05 am
Friday, October 15, 2004

The Web Enhanced Course: A Liaison, Between the Computer and the Classroom. ***Hugh B. Cole****, Hopkinsville Community College*

This session is to be, in part, a brief introduction for those who do not use a computer in the classroom very much and for those who are unfamiliar with the advantages of a web enhanced course. This session is also meant to be a discussion forum for those familiar with the web-based course. Everyone is invited to trade ideas and share strategies that have proven success.

Web enhancing immediately brings technology into a course. It can complement a course which may have been based primarily upon traditional methods of instruction. A web enhanced course sets up a private web site for each class. Here the instructor may open multiple avenues of communication with the student that may be invaluable to a student's performance in the class.

The instructor can also almost eliminate a paper trail, not only saving a tree, but, making the copier virtually obsolete.

Human Allometry: Sexual Differences in Growth Rates of Various Body Parts
Buzz Hoagland*,Westfield State College*

For the past five years students (primarily non-majors) enrolled in my Human Biology courses have collected and analyzed measurements taken from their own bodies. These data have been aggregated into a single downloadable text file and is available through the web (http://biology.wsc.ma.edu/biology /experiments/symmetry/body/). Students are provided specific directions on how to collect and analyze data, but question and hypothesis development is a student-centered activity. Frequently asked questions include does handedness influence length of hands, and are height and foot length positively correlated. Occasionally, a group of students derive and test the hypothesis that males have proportionately longer feet and hands then do females. The answer is yes when foot and hand length are standardized by height. The biological rationale for this statistically-demonstrated relationship is that males grow for a longer time period and that foot and hand growth trajectories are different from the axial skeleton growth trajectory and possibly long bone growth trajectories. This laboratory exercise contains the necessary elements to get non-majors actively involved in the process of science, and they have fun.

Long-term Impacts on One Semester of Reformed Teaching on Student Learning. ***Terry L. Derting****, Murray State University*

Over the past four years a new first-semester curriculum has been implemented for biology majors at Murray State University. The curriculum reform arose from an NSF-Course, Curriculum, and Laboratory Improvement grant and focused on use of inquiry-based approaches to learning in a student-centered format. Throughout the implementation process, a variety of instruments were used to assess impacts of the curriculum change on our students. These assessments focused on self-efficacy, understanding of the scientific process, and learning gains. Assessments were administered to students at all levels so that long-term impacts of the new introductory curriculum could be identified. Our assessment results showed significant effects of the new curriculum on students from their first-year through senior-year of study. These long-term effects are particularly notable because no other curriculum changes, at the sophomore through senior level, occurred. The results indicate that just one semester of inquiry-based learning, occurring early in the major, can have positive impacts on students that persist throughout four years of undergraduate study. I will present an overview of the new curriculum and specific results of the different assessments. Discussion of the curriculum as a model for adaptation at other institutions and for other majors is welcome.

CONCURRENT PAPER SESSIONS III

2:00-2:45 pm
Friday, October 15, 2004

The Science of Flight, ***Lynn Gillie, Todd Egan, and Mary Anne Perks****, Elmira College*

Interdisciplinary courses in biology for non-science majors can help link the process of conducting science with experiences familiar to the students. The Science of Flight is an interdisciplinary course designed to use the recent 100th anniversary of powered flight by humans as a theme around which to study scientific principles. Class format was activity-based with labs or investigative activities taking up most of every class period. Vertebrate and invertebrate powered and gliding flight were examined along with dispersal of seeds and pollen, physics of flight and airfoils, and history of the development of flight in humans from kites to rockets. Field trips to three local museums dedicated to soaring, early flight pioneer Glenn Curtiss, and warplanes were part of the course. Other fieldtrips included birding at two different nature preserves. Activities were coordinated using ANGEL online course management system for announcements, emails, pickup and dropoff boxes, and links to relevant internet sites. The advantages and disadvantages of an activities-based approach will be shared and some sample exercises will be conducted.

Round Table Discussion—Recruiting 1st and 2nd year Potential Majors—Strategies
Thomas A. Davis*, Loras College*

This session will be an open discussion about ways we can communicate with and recruit underclassmen (currently enrolled students) as potential Biology majors. I have no magic answers and encourage participation to generate some ideas. Best 3 ideas get big prizes!!

A Survival Guide for Students in the Anatomy and Physiology Course ***Neil Baird****, Millikin University*

Today there is a wide diversity in the background knowledge, ability, and willingness to work that students bring to the Anatomy and Physiology course. Faculty cannot assume that all these students know how to approach a high-content course like this and be successful. Although some students may not be ready to listen to advice until a disastrous first exam, it is useful for them to have a survival guide in their hands on day one. This paper will review advice for A & P students covering such topics as notetaking skills, study strategies, peer study groups, use of flashcards, time management schedules, effective use of tutors, etc. A passive "looking over the notes" before an exam will not be adequate for most students. A more active drill and practice style of study is called for where the student is forced to interact with the material in recalling and thinking about terms and concepts prior to the exam. An increased quantity and quality of study time is essential for most students to be successful in the A & P course.

Amphipods as a model system for teaching ecology, evolution, and behavior. ***Susan E. Lewis****, Carroll College*

Amphipods are small freshwater and marine crustaceans. Several species are common throughout the United States. Amphipods are an important component of the food web in aquatic systems, and often comprise the largest percentage of the macroinvertebrate biomass in lakes or streams. For the past several years, my students in an introductory course in Ecology and Evolution have designed investigations of the pairing and reproductive behavior of *Gammarus pseudolimnaeus*, a common local amphipod, to gain experience with experimental design, data collection and analysis, and other aspects of the scientific method. Several of these students have gone on to independently design further investigations with amphipods for their senior capstone projects. This presentation will describe the logistics of working with amphipods, the types of investigations students have developed, and factors that make amphipods particularly useful as a model organism for biological investigations

CONCURRENT WORKSHOP SESSIONS II

3:00-4:30 pm
Friday, October 15, 2004

Case It! Computer Simulations for the Analysis of Genetic and Infectious Disease—An Update, ***Mark Bergland and Karen Klyczek****, University of Wisconsin, River Falls*

Case It! is a National Science Foundation-sponsored project to promote collaborative case-based learning in biology education worldwide, via molecular biology computer simulations and Internet conferencing. We have developed software that will analyze any DNA or protein sequence using a variety of techniques (DNA gel electrophoresis, restriction enzyme digestion, Southern, Western and dot blotting, PCR, and ELISA). Cases have been constructed for a variety of disease conditions including HIV, breast cancer, Alzheimer's, cystic fibrosis, Huntington's disease, and DMD. Students use Case It! software to analyze DNA or protein sequences associated with genetic or infectious diseases of humans and domestic animals, then discuss results with their peers at other institutions via web-based "poster sessions." Case It! Investigator, an application used in conjunction with a web browser, helps students to gather background information on cases. Participants will use a new, integrated web editor /conferencing system and will also use new protein-based simulations based on ELISA and Western blotting. A new version of Case It! Investigator that has video capability will also be used. Five years of class-testing of the DNA simulations have shown the pedagogical value of our approach. High school and university educators throughout the U.S. and in foreign countries have downloaded Case It software, which is free of charge for educational use (see http://www.uwrf.edu/caseit/caseit.html for details).

Using *LabWrite*: Helping Students Write Better Lab Reports, ***Michael Carter, Miriam Ferzli, and Eric Wiebe****, North Carolina State University*

Perhaps the area of biology education that has attracted the least attention in terms of teaching technologies is the laboratory report. Though students may work on virtual labs and record data and write and submit reports electronically, the typical instruction for writing lab reports still consists of one or two pages listing the parts of the report with brief descriptions of each part. This workshop will introduce participants to *LabWrite* , a free, online resource designed to help student learn science by writing better lab reports (http://labwrite.ncsu.edu). *LabWrite* enables students to take advantage of the learning potential in writing lab reports by guiding students through the entire lab experience. In a control-group study of students in biology labs, those using *LabWrite* demonstrated significantly greater understanding of the science of the labs and a greater ability to apply formal scientific reasoning to the labs than students receiving the typical instruction in writing lab reports.

The workshop consists of a brief introduction to *LabWrite*, a tour of the website, a hands-on activity using the site, an overview of *LabWrite for Lab Instructors* (an online "teacher's manual"), and a discussion of how to use the website effectively in lab classes. By the end of the workshop, participants will have all the information they need to incorporate *LabWrite* in their lab classes. *LabWrite* is funded by the National Science Foundation.

Integrating Video Camera, Digital Microscopy into the Biology Curriculum and Laboratory, ***Richard E. Wilson****, Ken-A-Vision Mfg. Co. Inc*

Historically video cameras, like a VideoFlex are seem as ancillaries to microscopic presentations. We will demonstrate a number of possible classroom applications, on- and off- microscopes. We will have cameras, microscopes and computers available for participants to make their own movies, time-lapse movies, time-lapse pictures, or still pictures. Everyone will be able to take home their own on-microscope made movie and some suggested laboratories in which video cameras can be essential. Finally we will allow some time for creative brainstorming of other potential applications in both our lectures and laboratories.

CONCURRENT PAPER SESSIONS IV

9:00-9:45 am

Saturday, October 16, 2004

Teaching with Ultrastructure—Active Learning with Rotating Teams, ***Thomas A. Davis,*** *Loras College*

This is NOT a talk about cellular or tissue or plant morphology but about a different kind of ultrastructure. I use this term to describe the teaching method that I have used that employs student groups, active learning, question-based learning and a lab component to have the students develop more direct ownership of classroom information and the learning process. Its purpose is to get students to pick topics, generate questions, and invest their time into the learning process. Please come to spend 20 minutes hearing about my big ideas and the remaining 20 minutes discussing and critiquing this learning strategy.

Using Technology to Teach an Integrated Mathematics/Biology Course – Preliminary Report, ***George M. O'Connor and John G. Koelzer****, Rockhurst University*

Biology majors at Rockhurst University – especially those contemplating graduate school – are urged to take Calculus I and in this course they are exposed to mathematical modeling. Several models of interest to biologists are studied in the calculus course; for example, population growth models and S-I-R models for the spread of infectious diseases. The students and teachers use the computer algebra system *Mathematica* (in classroom activities, demonstrations, long-term projects and computer laboratory exercises) to help visualize and explore the models developed in class.

After finishing Calculus I, however, there is very little opportunity for biology students to further investigate the uses of mathematics in biology. In this talk, the presenters, one a biology teacher and the other a mathematics teacher, will describe an interdisciplinary honors mathematics/biology course to be taught in the spring semester of 2005. This course will present the students with a broad range of mathematical biology models and applications of these models to real world problems. The prerequisites for this course are relatively minimal – General Biology I and Calculus I – so *Mathematica* and other software tools will be used to augment the students' biological and mathematical background and provide hands-on tools for exploring biological models.

The presenters will describe several of the topics to be covered in the course and will demonstrate how computer technology will be used to develop the underlying concepts.

Grantsmanship and NSF-Style Student Peer Review In Undergraduate Research Experience, ***B. G. Blair, G. R. Cline, and William R. Bowen****, Jacksonville State University*

Although the ability to critically assess scientific research is an important aspect of becoming a scientist, there is little formal training for undergraduates. The JSU Biology Department has emphasized an undergraduate research experience for several years. Prior to conducting undergraduate research, all majors as sophomores take "Introduction to Research in Biology" which has 2-3 sections. Students develop an insight into scientific inquiry, literature searching and analysis, hypothesis development and produce a grant proposal with budget to conduct a research project. Previously, the instructor has evaluated the proposal. This year students submit their proposals to an NSF-style student peer panel whose members are students from another section. As peers, individually and as a panel, they also evaluate and rank proposals based on scientific content, writing style, format, budget, and overall proposal quality. Student participants become very cognizant of the need for cognitive, analytical and communicative skills and are much more critical of their own proposals. Their comments are very insightful, constructive and reasonable. Student peer review was so successful in this course that it is now been integrated into the Department's capstone course, Senior Seminar. That is, biology majors now undergo peer review of their senior thesis and presentation, the latter in a symposium format.

CONCURRENT PAPER SESSIONS IV

10:00-10:45 am
Saturday, October 16, 2004

Interdisciplinary Impact of Evolution, ***David P. Benson****, Marian College*

One hundred and fifty years after Darwin proposed a mechanism for evolution it has permeated all but the most blind corners of biology. That evolution and Darwin's mechanism have affected the study of biology is not surprising. What is fascinating is how Darwin's idea has impacted areas outside of biology. This was the premise for a course I taught with the help of many of my colleagues in the fall 2002. The class began with an introduction to the science of evolution to give students a good grounding in the biology behind the theory. The second half of the course involved colleagues form the College explaining how Darwin and evolution have impacted their disciplines. A psychologist explained the field of evolutionary psychology. An art historian and a British literature expert explained the impact of the publication of The Origin of Species on art and 19th century British literature as we read H. G. Well's War of the Worlds. Evolutionary theory has been co-opted to explain national relations as elucidated by a political scientist. The course ended with a look at the creation/evolution debates beginning with the Scopes Monkey Trials by a historian, how the theory has affected theology by a theologian, and the societal implications of the Creation/Evolution debates by a sociologist. The students, all biology majors, were fascinated by the wide ranging applications of evolutionary theory to a diversity of human endeavors. Teaching evolution using this method resulted in the students developing a deep understanding of the theory and could be adapted by anyone teaching evolution at an institution with a reasonably engaged faculty.

Bioinformatics Instruction: Using Microarray Data Sets to Stimulate Student Learning, ***Hugh A. Miller III and Karl H. Joplin****, East Tennessee State University*

As an approach to teaching bioinformatic resources, we have made use of data from a Drosophila Microarray. Students learn to use databases and sequence analysis to identify genes. Each student is given 20-25 genes from the Microarray dataset. With over 14,000 data points, it is easy to provide each student with a unique set of data including gene identification variables, fluorescent intensity and background for two channels of cDNA hybridization. Students are shown how to use databases such as NCBI and Flybase to look up a possible identity for each gene. In many cases, the student finds that a gene has no immediate identity, thus the predicted amino acid sequence for each unidentified gene is used in a BLAST similarity search. This analysis frequently provides a possible name based on significant alignment within the BLAST results. For those genes that do not give significant similarity to a protein in the database, students are encouraged to examine their proteins for known domains. If all these approaches fail to provide an identity, the students (with much consternation) have to label their gene as unknown. We use this approach in two different classes with non-overlapping populations: Cell Biology Lab and Recombinant DNA Lab. At the end

of this project each student will prepare a PowerPoint presentation outlining their results. We will discuss the use of databases, BLAST analysis, and domain searching with real examples from student projects.

PDAs in the Biology Classroom an Lab: The Future or Fad? ***Timothy Mulkey****, Indiana State University*

PDAs (Personal Digital Assistants) and other portable wireless devices are growing in popularity. These devices provide opportunities for a wide variety of teaching experiences in both the classroom and the laboratory. In the classroom, these devices provide for distribution of teaching materials, quizzing and testing of students, and real-time feedback concerning the effectiveness of the classroom experience. In the laboratory, these devices can be interfaced to a variety of probes for collection of data. Simple interface modules are available for most PDAs, which allow a variety of different probes to be attached. Probes are available for collection of temperature, pH, light, conductivity, humidity, oxygen, heart rate, heart flow, pressure, radiation, and a variety of other data. Discussion and demonstration of the myriad of potential uses of these devices will be presented.

Housing Preview

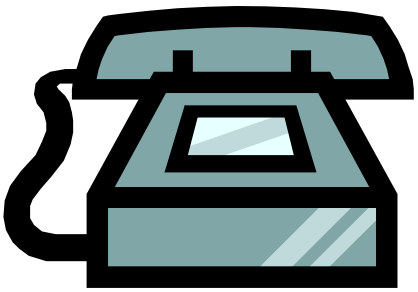
48th Annual ACUBE Fall Meeting

Technology in Biology Education

Wabash College

Crawfordsville, IN

October 14-16, 2004



Lodging: Blocks of rooms have been reserved until September 14, 2004 at the Comfort Inn and Holiday Inn.

IMPORTANT: Please note this is the same weekend as the **Parke County Covered Bridge Festival** which draws thousands of visitors on weekends. As you will note, weekend rates can be higher than weekday rates. Rooms are at a premium during this time. **PLEASE BOOK YOUR ROOMS EARLY**.

Comfort Inn Phone: (765) 361-0665 (800) 329-5150 ***Book by: 9/14/04*** 10/14 $ 89.95+tax 10/15 $ 89.95+tax	**Holiday Inn** Phone: 765-362-8700 ***Book by: 8/17/04*** 10/14 $ 69.00+tax 10/15 $122.95+tax
Super 8 Motel Phone: (765) 361-8800 (800) 800-8000 10/14 $ 60.00+tax 10/15 $ 75.00+tax	**Days Inn** Phone: (765) 362-0300 (800) 329-7666 10/14 $ 65.00+tax 10/15 $ 75.00+tax
Ramada Limited Phone: (765) 364-9999 (800) 272-6232 10/14 $ 63.00+tax 10/15 $ 82.00+tax	**General Lew Wallace Inn** Phone: (765) 362-8400 10/14 $ 56.00+tax 10/15 $ 75.00+tax
Trippet Hall (on campus) Phone. (765) 361-6490 10/14 $ 87.00+tax 10/15 $ 87.00+tax	

Call For Resolutions

The Steering Committee of ACUBE requests that the membership submit resolutions for consideration at the 2004 Annual meeting to the Chair of the Resolutions Committee. Submit proposed resolutions to:

Brenda Moore, Truman State University, Division of Science, MG3062, Kirksville, MO 63501, bmoore@truman.edu Phone (660)785-7340

Call for Nominations

Bioscene Editorial Board

We are soliciting nominations for four (4) *Bioscene* Editorial Board positions (term through-2007). 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

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 upper division undergraduate and graduate students in the field of Biology to attend the Fall Meeting of ACUBE.

Guidelines: The applicant must be actively pursuing an undergraduate program or 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 an active member of ACUBE. Send application information or any questions about the Award 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@isugw.indstate.edu

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

ACUBE Governance for 2004

President – Terry Derting, *Murray State University*
President-Elect – Lynn Gillie, *Elmira College*
Immediate Past President – Margaret Waterman, *Southeast Missouri State University*
Executive Secretary – Presley Martin, *Hamline University*
Secretary – Jill Kruper, *Murray State University*
First Vice President (Program Chair) – Joyce Cadwallader, *St. Mary-of-the-Woods College*
Second Vice President (Local Arrangements) – Aus Brooks, *Wabash College*

Board Members

Abour Cherif, *DeVry University*
Janet Cooper, *Rockhurst University*
Neil Grant, *William Patterson University*
Brenda Moore, *Truman State University*
Conrad Toepfer, *Millikin University*
Robert Wallace, *Rippon College*

Standing Committees

Membership – Aus Brooks, *Wabash College*
Constitution- Margaret Waterman, *Southeast Missouri State University*
Nominations – Janet Cooper, *Rockhurst University*
Internet- Margaret Waterman, *Southeast Missouri State University*
Bioscene – Tim Mulkey, *Indiana State University*; Ethel Stanley, *Beloit College*
Awards: Honorary Life Award and Carlock Award – William Brett, *Indiana State University*
Resolutions- Brenda Moore, *Truman State University*
Historian – Edward Kos, *Rockhurst University*

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. Janet Cooper, Dept. of Biology, Rockhurst University
1100 Rockhurst Road, Kansas City, MO 64110
Voice –(816) 501-4237, E-mail – janet.cooper@rockhurst.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

( ) 1. Biology
( ) 2. Botany
( ) 3. Zoology
( ) 4. Microbiology
( ) 5. Pre-professional
( ) 6. Teacher Education
( ) 7. Other _____

SUB DISCIPLINES: (Mark as many as apply)

( ) A. Ecology
( ) B. Evolution
( ) C. Physiology
( ) D. Anatomy
( ) E. History
( ) F. Philosophy
( ) G. Systematics
( ) H. Molecular
( ) I. Developmental
( ) J. Cellular
( ) K. Genetics
( ) L. Ethology
( ) M. Neuroscience
( ) 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 2005) 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