

# Bioscene



**Journal of College Biology Teaching**  
**Volume 17 Number 3 • December 1991**

# ***Bioscene***

## **Journal of College Biology Teaching**

**Volume 17(3)**

**December 1991**

### **Table of Contents**

#### **Articles:**

- |  |           |
|--|-----------|
| <b>AIDS Education In College Biology Courses</b>                       | <b>3</b>  |
| Susan P. Speece  |           |
| <b>Anaerobic Power in the Audio-Tutorial Laboratory</b>                | <b>8</b>  |
| Jim Waddel   |           |
| <b>Using the Winogradsky Column to Demonstrate Biodegradation</b>      | <b>10</b> |
| Dorothy G. May   |           |
| <b>Implementing Student Research in a Biology Course for Nonmajors</b> | <b>12</b> |
| Helen K. Pigage  |           |

#### **News & Views:**

- |   |           |
|---|-----------|
| <b>1991-1992 AMCBT Election Results</b>                                   | <b>15</b> |
| <b>AMCBT Guidelines for Evaluating Undergraduate Education in Biology</b> | <b>16</b> |
| <b>A Policy Concerning The Use of Lab Organisms</b>                       | <b>18</b> |
| The Biology Faculty, Ripon College  |           |
| <b>Call For Presentations: The 1992 AMCBT Conference</b>                  | <b>22</b> |
| <b>AMCBT Membership Application Form</b>                                  | <b>23</b> |

# Bioscene: Journal of College Biology Teaching

*Bioscene* is the official publication of the *Association of Midwestern College Biology Teachers*

## Editor:

John R. Jungck  
Department of Biology  
Beloit College  
700 College St.  
Beloit, Wisconsin 53511

## Managing Editor:

T. Zier

Please submit all manuscripts directly to the Editor. We prefer receiving two printed copies and one in computer readable form. We work with the following word processors on the following computers: MacWrite and Word on the Macintosh, Appleworks and Applewriter on the Apple IIe/IIc, Word Perfect on IBM PC compatibles, TDP on an HP 3000, and WHIPS Plus on a DEC VAX. Final copy is prepared in Quark Xpress on a Mac II. If you can submit your manuscript only on another system, please check with us beforehand. We can receive manuscripts electronically by connecting through Applelink where our address is BioQUEST. If you are connecting from BITNET via INTERNET, then our address is BIO-QUEST@APPLELINK.APPLE.COM. Please address file to AMCBT. All manuscripts will be sent out to two members of the editorial board for review. In the case of a split decision the manuscript will go to a third reviewer. The next deadline in 1992 is February 15.

## Bioscene Editorial Board:

### Chairperson:

Susan Speece  
Biology Department  
Anderson University  
Anderson, IN 46012

George Garoian  
Biology Department  
Southern Illinois University  
Carbondale, IL 62901

**Secretary:** Timothy J. Mulkey  
Biology Department  
Indiana State University  
Terre Haute, IN 47809

William Brett  
Biology Department  
Indiana State University  
Terre Haute, IN 47809

Phyllis Kingsbury  
Biology Department  
Drake University  
Des Moines, IA 50311

Ray Reed  
Biology Department  
Jefferson Community College  
Louisville, KY 40210

Bruce Edinger  
Biology Department  
Valparaiso University  
Valparaiso, IN 46383

Richard Kowles  
Biology Department  
Saint Mary's College  
Winona, MN 55987

Robert L. Wallace  
Biology Department  
Ripon College  
Ripon, WI 54871

Dave Finley  
Biology Department  
Lincoln University  
Jefferson City, MO 65101

Malcolm P. Levin  
Biology Department  
Sangamon State University  
Springfield, IL 62708

C. Robert Wikel  
Biology Department  
Doane College  
Crete, NE 68333

## Suggestions for Manuscripts:

Announcements  
Laboratories that work  
Courses that work  
Minority Education  
Computer Advice

Letters to the Editor  
Sources of Funding  
Professional School  
History of Biology  
Review of Software/  
Hardware

Book Reviews  
Sociology of Biology  
Biology Policy Issues  
Women in Biology  
Philosophy of Biology

# AIDS Education in College Biology Courses

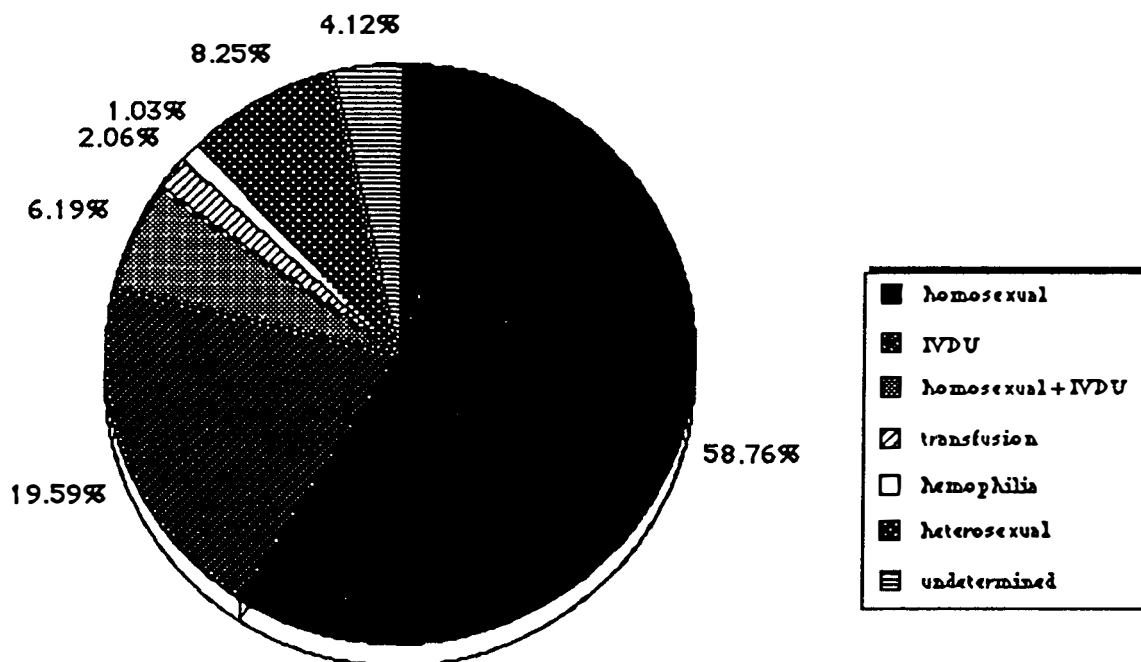
DR. SUSAN P. SPEECE  
Anderson University

Today, a greater percentage of our population is taking advantage of the opportunity to attend college. Most hope to expand the possibilities of their life through education and the people that they meet. Yet, for a frightening number, college experiences, sexual encounters, drug use, etc., may also end those possibilities before they really begin. Many of our students, who perceive themselves to be not at risk, will become infected with the Human Immunodeficiency Virus (HIV).

Since 1981 more than 192,000 persons in the United States have been diagnosed as having full blown AIDS. Full blown AIDS is defined by the Centers for Disease Control (CDC) as having the presence of certain opportunistic diseases, wasting syndrome, encephalopa-

thy and evidence of the presence of the HIV-1 pathogen. It is estimated that there are more than 1 million persons in the U.S. who are HIV infected, though many of those persons do not realize that they are infected (CDC, Morbidity & Mortality Weekly Report, June 1991). The disease has spread into all sectors of the U.S. population, and the number of heterosexual cases is now on the rise and the age patterns are quite clear. For approximately 67-72% of adults with AIDS, the Human Immunodeficiency Virus - type 1 (HIV-1) has been acquired by sexual transmission, either homosexual or heterosexual (see Graph 1). For another 20-25%, the HIV-1 has been acquired through intravenous (IV) drug use (Indiana State Board of Health, June 1991).

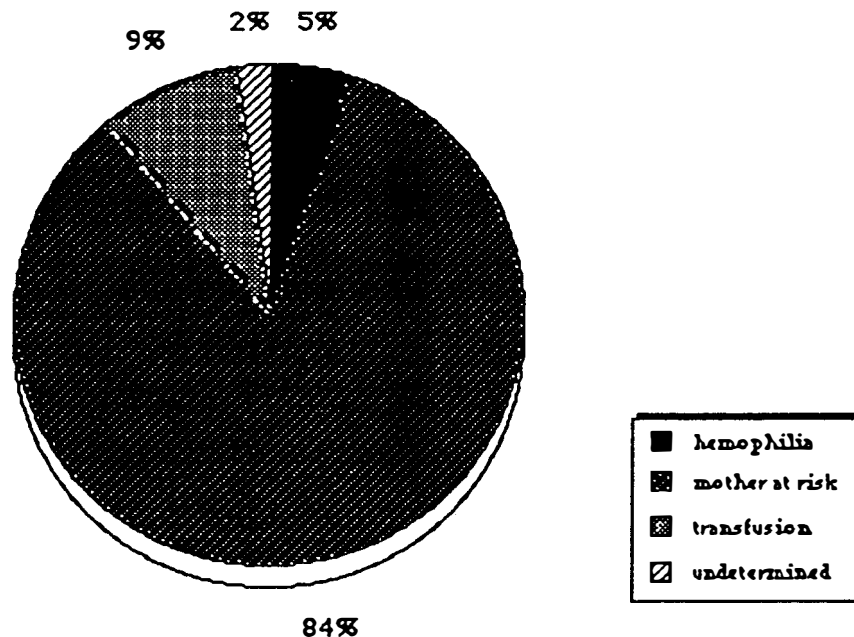
**GRAPH 1: AIDS CASES BY EXPOSURE CATEGORY 10/91**



One percent of male AIDS patients have been between the ages of 15 and 19 when diagnosed with AIDS, 21% have been between 20 and 29, and 46% have been between 30 and 39. For female AIDS patients between 20 and 29 years of age the rate is 26% and between 30 and 39 it is 43% (CDC, 1991). Research suggests that the average incubation time for adolescents (ages 15-22) is 8.26 years (Schwartz, 1988). This means that a significant percentage of persons with AIDS very likely were exposed to the HIV-1 pathogen when they were adolescents. Perhaps as many as 50% of all persons with full blown AIDS many have first encountered the virus when they were teenagers or early adolescents. This is also the most likely time when they are also beginning to become pregnant (see Graph 2). These are sobering statistics. They provide a compelling argument for more rigorous actions on the part of schools, communities, parents, and particularly educators. More effective AIDS/HIV education is not suggested, it is required!

Until recently, most of the college level HIV instruction has been facilitated by the institutional health care provider(s) or the student life offices. Biology instructors occasionally introduce HIV education as part of a discussion of virology, but **the premise of this paper is that that level of instruction is insufficient to alter the behavior of our college students.** Biology instructors are well suited to assist in HIV education, we usually have a deep understanding of the immune system and the nature of viruses. This can serve as a starting point for AIDS/HIV education. There is, however, far more to AIDS/HIV education than scientific facts. In a recent presentation made to science teachers, Dr. Beverly Bradley, Director of AIDS Education for Youth Project in San Francisco, stressed that it is not necessary to know all of the facts about HIV infection. What is important is to thoroughly understand how the HIV can be transmitted, how it cannot be transmitted, how one can protect themselves, what the difference is between HIV and AIDS, and where to go for help. A scientific

**GRAPH 2: PEDIATRIC CASES OF AIDS 10/91**



underpinning is excellent, but the most important factor in stopping the epidemic is education about behavior.

The education must go beyond academic content and work on students' abilities to make healthy decisions and to take responsibility for their actions. Ultimately our AIDS/HIV education must be interpreted into behavioral changes. C. Everett Koop has stated that:

"Adolescents and pre-adolescents are those whose behavior we wish to especially influence because of their vulnerability when they are exploring their own sexuality (heterosexual and homosexual) and perhaps experimenting with drugs. Teenagers often consider themselves immortal, and these young people may be putting themselves at great risk...Education about AIDS should start in early elementary school and at home so that children can grow-up knowing the behavior to avoid to protect themselves from exposure to the AIDS virus. The threat of AIDS can provide an opportunity for parents to instill in their children their own moral and ethical standards. Those of us who are parents, educators and community leaders, indeed all adults, cannot disregard this responsibility to educate our young. The need is critical and the price of neglect is high. The lives of our young people depend on our fulfilling our responsibility." (Koop, 1988)

In spite of Koop's warnings and the media hype about AIDS, our youth do not see the relationship between their knowledge, behavior and their future health. There are several reasons why college students do not change behavior: "1) students do not believe themselves to be at risk for AIDS; 2) they believe AIDS is a disease that strikes members of stigmatized groups; 3) they lack the necessary

communication skills; 4) they lack the technical skills (i.e., knowledge of how to use condoms or how to practice safer sex); and 5) they value immediate gratifications." (Sheehan, 1990)

The Health Belief Model (HBM, Brown et al; 1991) has been used by many to describe the difficulties in altering health related behaviors. Much like Sheehan's premises, the HBM postulates that four factors account for most of health behavior: 1) perceived susceptibility, 2) perceived severity, 3) perceived benefits, and 4) perceived barriers. If a person perceives that they are vulnerable, they may be motivated to change their behavior. If a person perceives there is a real and serious health risk, they may be motivated to alter their behavior. The gay population watched in horror as hundreds of their friends and lovers died. This was a graphic illustration of their vulnerability and the reality of the disease. The motivation was so great that educational programs have been very effective. If a person considers the benefits of changed behavior to truly be positive, they may take action to change their behavior. Finally, if a person sees the adversities to changed behavior too great, they likely will not take actions to change their behavior. The most compelling factors of the four are the perception of susceptibility and the perception of barriers. Most of our adolescent college students, both homosexual and heterosexual, do not consider themselves to be susceptible and the belief that altering sexual behavior infringes on their "fringe benefits" is usually sufficient to prevent any positive behavioral changes. After an extensive advertising campaign in New York City to promote safer sex, the target population was surveyed. While more than 80% agreed condoms should be carried, more than 60% had failed to use a condom (Fineberg, 1988).

Gibbs (1991) reports that 84% of all 19 year old males and 75% of all females 19 years of age or older are sexually active. Of those who are sexually

active, it is estimated that only 50% of the female and 25% of the male teens practice serial monogamy (National Institute of Health, 1989). A 1989 national survey indicated one third of college students never have safe sex and as many reported their partners never want to practice safe sex (NIH, 1989). Recently Perlman (1990) reported that only 12% of females used condoms. Perlman maintains that there is less than a 0.1% failure rate of condoms with respect to HIV-1 transmission. In spite of this statistic, our youth are not protecting themselves. This is evident in the increased incidence of sexually transmitted diseases (STD's). In the ten years between 1977 and 1987, resistant gonorrhea increased 12,765%, chancroid was up 697%, primary and secondary syphilis was up 77%, genital herpes up 57%, and genital warts was up 44% (NIH, 1989). Since AIDS is predominantly a sexually transmitted disease, it is hard to avoid the conclusion that the incidence of new infections among young people is also increasing greatly.

As biology teachers we should not abdicate the responsibility for comprehensive AIDS/HIV education. What can biology teachers do to become active performers in the AIDS/HIV education process? We need to stress how the disease is spread and how it is NOT spread. Only four fluids contain the virus in sufficient quantities to infect - blood, semen, vaginal secretions, and mother's milk. Contact with these fluids has the potential of transmitting the disease. In a February 8, 1991 address to the Hoosier Association of Science Teachers, Inc. (HASTI) Convention, Otis Bowen, an M.D., former Secretary of Health and Human Services stated, **"You, as science teachers, and in fact all teachers need to know these facts and figures because you will be dealing more and more with them — perhaps not so much with full blown AIDS, but with those who have HIV positive blood...there is a need for fairly explicit instruction at a fairly early age if we want to be realistic and have a greater**

**impact...When we talk about the AIDS virus, we must try to implant both morals and practical knowledge to get the greatest good for our efforts."**

As biology teachers we need to:

1. Stress abstinence as a solution, we need to let them know that it is okay to say "no". On the other hand, we must face the fact that nationally our students are sexually active, therefore, we must, even in biology classes, discuss the alternatives.

2. As scientists and educators we **MUST** stress the importance of modifying behavior. The types of classroom activities that have been shown to be effective in promoting behavior modification include:

a. Positive peer pressure - discussions where students learn what positive steps are being taken by their peers. By contacting a local AIDS support center, you may be able to invite an HIV positive adolescent to come and talk with your students.

b. Role playing - scenarios where students practice saying no to a variety of difficult situations. These should include situations that relate to drug and alcohol uses as well as peer pressure for sex.

c. Paired problem solving - students work in pairs as they propose solutions to hypothetical problems. One student acts as the problem solver and the other one interprets the steps of the solution.

d. Analogical Reasoning - students study hypothetical problems to identify the variables in the problem and propose the options available.

In all activities it is essential that frank, open discussions be fostered, where direct and appropriate biological terms are used.

If we are to be totally effective, however, we must also address the issue of IV drug use and the use of alcohol among college students. According to C. Everett Koop, the greatest cause of condom failure is alcohol, which results in the lack of use or misuse of condoms.

**Biology teachers must become proactive in the battle against AIDS. We need to work with our colleagues, administrators and community to mount a more effective campaign against the disease. We cannot afford to comfortably sit back in our laboratories and assume someone else will do something about AIDS education. We must become the ones who do something about the problem.**

#### REFERENCES

1. Bowen, Otis. "Address to the Hoosier Association of Science Teachers, Inc." February 8, 1991.
2. Bradley, Beverly. "The AIDS Epidemic is Real". Presentation made at Anderson University. Anderson, IN. August, 1990.
3. Brown, Larry, Ralph J. DiClemente, and Lynn Ann Reynolds. "HIV Prevention for Adolescents: Utility of the Health Belief Model". *AIDS Education and Prevention*, 3 (1); 1991.
4. Center for Disease Control, MMWR (Morbidity and Mortality Weekly Report). Atlanta, GA. June 1, 1991.
5. Fineberg, Harvey. "Education to Prevent AIDS: Prospects & Obstacles". *Science*, 239 (4840), 592-596; 5 February, 1988.
6. Gibbs, Deborah A., David N. Hamill, and Kathryn Magruder-Habib. "Populations at Increased Risk of HIV Infection: Current Knowledge and Limitation". *Journal of Acquired Immune Deficiency Syndromes*. 4, (9); 1991.
7. Indiana State Board of Health. "Monthly Report". Indianapolis, IN. June 1, 1991.
8. Koop, C. Everett. "Surgeon General's Report on Acquired Immune Deficiency Syndrome" (update). U.S. Department of Health and Human Services. Government Printing Office. Washington, D.C. 1988.
9. National Institute of Health. "Sexually Transmitted Diseases and Youth - Survey Reports". Washington, D.C. 1989.
10. Perlman, Jeffery, et. al. "HIV Risk Difference Between Condom Users & Nonusers Among U.S. Heterosexual Women". *Journal of Acquired Immune Deficiency Syndrome* 3, (2), 156; 1990.
11. Schwartz, Roy. "AIDS and Adolescent Health". Presentation at NABT Convention, Chicago, IL 1988.
12. Sheehan, Eugene. "AIDS Among College Students: A Review of Research with Recommendations for Education." Unpublished manuscript, 1990.

# Anaerobic Power in the Audio-Tutorial Laboratory

Jim Waddel  
Associate Professor of Biology  
University of Minnesota, Waseca

It is certainly true that a teacher in these times also has to be part entertainer. We complained when television was our only high-tech competition. Now we have television, video games and even audio systems that are small enough to be worn almost inconspicuously. Most teachers would agree that the classroom is not for pure entertainment, but from time to time we have to do something which will reach out and grab the student's attention. Below is described one small component of an audio-tutorial laboratory program for the General Biology course at the University of Minnesota, Waseca.

## Background

For readers not familiar with the audio-tutorial format, it is a self-paced teaching method which reached its hey-day in the mid to late seventies. The laboratory is open extended hours. Students come and go as their individual schedules permit. While working in the lab a student listens to instructions on a cassette tape player. The tape may deliver information or provide instructions on how to perform some experiment or make some observations. An accompanying workbook has additional instructions, questions and plenty of space in which to write answers, results and observations. In order to keep the student interested, the lesson should be broken up into many and varied activities. The student therefore is frequently getting up from his or her study booth and going to a different part of the lab to observe some particular aspect of biology. An example of such an activity is described below.

Students quickly adapt to this routine and can sometimes be observed walking sleepily from one part of the lab to another. In an attempt to rouse the student into more active learning we try to have dramatic examples available whenever possible; one such example is a large glass carboy containing 5 gallons of seething brown liquid. The exhibit demonstrates anaerobic respiration on a larger scale than is really required, but it is also much more noticeable than the usual small flask of fermenting grape juice with a balloon on top.

## The Demonstration

The seething brown liquid is a hopped malt extract which has been boiled briefly to ensure relative sterility. About 1.5 pounds of sucrose is added, and enough water to make the volume total five gallons. A few hours before the lab is due to open for the week a small inoculum of *Saccharomyces cerevisiae* yeast is added to the carboy and it is capped with an air lock. The air lock is necessary to exclude oxygen from the culture and thus force the yeast to respire anaerobically. As the fermentation continues the yeast multiply prodigiously and produce large quantities of carbon dioxide gas. At the height of its activity great clumps of yeast cells rise to the top of the liquid, lifted by bubbles of carbon dioxide. Other clumps, which have released their bubbles, fall to the bottom. This combination of rising and falling yeast creates the seething in the liquid. There is a two to three inch thick layer of fairly disgusting foam on the surface. Carbon dioxide is bubbling out of the air lock and carrying with it an aroma which

is vaguely familiar to some and moderately disgusting to most.

The written material in the workbook tells the student what is in the carboy and asks a few questions, such as:

“What gas is escaping from the top of the vessel?”

“What is left behind in the carboy as a result of the yeast activity?”

“What is a possible commercial application of this process?”

With a demonstration the size of a carboy on the table, students rarely miss it. The sound of bubbling carbon dioxide and the aroma emanating from the display add to the visual impact, involving all of the senses in the learning experience. Very few students are unable to answer the first two questions. However, many seem unable to answer the last one until they receive a few hints from the teaching assistant who checks their work on com-

pletion of the lab. Perhaps they feel that such a foul looking and smelling concoction could never be fit for human consumption (an opinion rigidly maintained by some). We have found, however, that many students will stop back to the lab briefly from time to time to check on the progress of the culture. Several even remember the demonstration several weeks after it has been removed from display, inquiring about its fate, out of concern for the yeast cells, no doubt.

### Conclusions

It is our firm conviction that nothing can be taught without first getting the attention of the student. This demonstration certainly accomplishes this. Another minor benefit from this demonstration is that after a few weeks the clear liquid by-products can be siphoned into bottles and treated so as to become a most palatable refreshment. The conclusion is that dramatic demonstrations in the laboratory can be very beneficial to both students and faculty alike, if taken in moderation.

### AUTHORS NOTE;

This submission definitely leans toward the lighter side of the teaching business, but it may be of interest to some of our members. It was actually written as a challenge- to see if the I could write about a hobby of mine (home brewing) without mentioning the word 'beer'.

If you feel that it is too light hearted, by all means, disregard it.

# Using the Winogradsky Column to Demonstrate Biodegradation

Dorothy G. May  
Associate Professor of Biology  
Park College

## Introduction

The Winogradsky column was developed in 1877 to study a variety of soil microorganisms. The apparatus is described in few current microbiology laboratory manuals (Atlas *et. al.* 1984; Colome *et. al.* 1986; Seeley and VanDemark, 1981; Wright, 1984) due to the demand for clinical techniques and less emphasis on such subjects as soil ecology.

Because it is a closed microecosystem, it occurred to me that the apparatus could be used to demonstrate what is meant by biodegradation to introductory students. The simplicity of the apparatus lends itself well to an experiment for non-majors at the freshman or senior level.

## Materials and Methods

Materials are listed in Table 1. Instead of graduated cylinders, large test tubes, about 35 X 300 mm, can be used. These are particularly useful if individual students are to make the columns.

*Packing the column:* Mix 50 gm CaSO<sub>4</sub>, 40 gm bottom ooze, and 10 gm decomposed plant material in a bucket. Amounts are approximate. Add enough pond water to make a slurry. It needs to be fluid enough to pour, but solid enough to prevent styrofoam from floating to the top of a column. Fill a column about half full with the slurry.

*Adding the filter paper indicator:* To make the bacterial "bloom" more visible, it is desirable to place a moistened strip of filter paper against the inside of the cylinder at this point. When additional layers are added, the paper should press against the side of the glass.

*Adding the experimental layers:* Add a layer of shredded styrofoam or other non-biodegradable material, and add another few centimeters of mud. Add another layer of biodegradable material, such as paper plates. The experimental materials should be visible from the outside of the column. Alternate layers of mud, biodegradable material, and non-biodegradable material as desired until the column is about three-quarters full. The top layer should be mud. Allow the slurry to settle for a few minutes. Tap the sides to allow air bubbles to escape.

*Adding the water layer:* Cover the slurry with pond water to a depth of about 3 cm from the top. Cover loosely with Parafilm to prevent evaporation—not to keep oxygen out.

### Table 1

#### Materials for Winogradsky Column:

graduated cylinder  
calcium sulfate  
fine mud, bottom ooze  
decomposed plant material  
pond, river, or stream water  
Parafilm or plastic wrap  
aluminum foil  
light source  
strip of filter paper

#### optional, cut up:

styrofoam  
paper plates  
plastic trash bags

**Incubation:** Cover the entire column with foil, or place in a light-tight cabinet for 2-4 days.

**Expose the cylinder to heat:** A 60-watt bulb at a distance of 0.5 m continuously is recommended.

**Observations:** Examine the material from the column periodically, macroscopically for the appearance of photosynthetic bacteria, algae, and other organisms, microscopically for various organisms in the sulfur cycle. Reddish-purple growth indicates the presence of purple photosynthetic bacteria. Record when the biodegradable material changes appearance. Columns can be carefully emptied to examine degradation at each layer. After being emptied, columns are essentially "sacrificed," although the slurry can be reused. Be sure to open the columns in a well-ventilated area.

## Results

**Biodegradation:** Paper products are degraded within three weeks; styrofoam does not show any degradation after eight months. These are the shortest and longest parameters tested so far.

**Bacteria:** Various bacterial populations which are likely to appear are well-documented in Atlas *et. al.* (1984).

**Other Organisms:** In addition to the succession of bacterial populations, both eukaryotic and prokaryotic algae appear in the illuminated aerobic region of the column. Horsehair worms, phylum Nematomorpha, can be found burrowing in the mud and swimming in the water layer. The larvae parasitize a variety of arthropod hosts. Rotifers, *Daphnia*, and other small invertebrates have been seen in the water layer of the column even after eight months of incubation.

## Discussion

The exercise makes a powerful statement about biodegradation. Variations on the method are endless. At the recent meeting for AMCBT we came up with the idea of using clear plastic beverage containers for the columns. There would be two lessons taught with the use of such items: first, that these containers are not biodegradable; and second, there are ways to reuse them. The only disadvantage I see to using them is that it would take much more material to pack the column. The neck portion of the bottle needs to be cut off for packing the column, and it should be replaced with tape to prevent evaporation.

Students are fascinated with the succession of organisms they see over the weeks. This simple apparatus can lead to any number of student-designed spinoff projects.

## Literature Cited

Atlas, R.M., A.E. Brown, K.W. Dobra, and L. Miller. 1984. *Experimental Microbiology: Fundamentals and Applications*. Macmillan.

Calome, J.S., R.J. Cano, A.M. Kubinski, and D.V. Grady. 1986. *Laboratory Exercises in Microbiology*. West Publications.

Seeley, H.W., and P.J. VanDemark. 1981. *Microbes in Action*. W. Freeman.

Wright, E. R. 1984. *General Biology Laboratory Manual*. Times Mirror/Mosby.

EDITORS NOTE: See Also;

Pigage, Helen K.  
"The Winogradsky Column:  
A Miniature Pond Bottom"  
*The American Biology Teacher*  
47: 239-240 (April 1985).

# Implementing Student Research in a Biology Course for Nonmajors

Helen K. Pigage  
Associate Professor, Biology Department  
Elmhurst College

Inspired, or rather, shaken by reading *The Liberal Art of Science* (1990), two Sigma Xi Wingspread Conference Reports (1989; 1990), the Project Kaleidoscope Report (1991) and one of many articles in the popular press (Leslie, 1990) but decry mind-numbing methods of teaching science in college courses, I responded by altering my approach to the introductory biology course for nonmajors. This was accomplished by incorporating student-generated research into the laboratory. Over the past eleven years I had provided sound laboratory exercises, yet the spirit of discovery was simply not a part of the laboratory component of the course for students who did not major in biology. For them the introductory biology course was yet another difficult hurdle on the road to a baccalaureate degree in a liberal arts college which requires two laboratory courses in the natural sciences. Two other members of the Biology Department had begun experimenting with investigative biology laboratories for nonmajors the previous year and had reported great success with the process and the outcomes. After much hesitation, reading, and comparing notes with college biology instructors at the 1990 Biology Curriculum Conference held at Butler University, I decided that a laboratory in which the students conducted their own research was a logical approach to address student understanding of the process of science; I could delay no longer.

Several years ago, in answer to the question "What could be done to improve this course?" one student wrote: "Let us do our own research." I was baffled then by the logistics of implementing such a request and by my perception that students did not have a great enough

knowledge base to allow them to do research. These objections persisted in my mind for several years, but I put them aside after realizing that students must have many unanswered questions that their research could address. After all, students in poetry classes write poetry although they are not poets (Tobias, 1990), so why shouldn't students in a science class do science? As a result, I reorganized the laboratory component so that a student-generated research project became an integral part of the introductory biology course.

At present, lecture/laboratory sections of the nonmajor biology courses at Elmhurst College are taught by one instructor and include a maximum of twenty-four students. Each instructor can choose the format of the laboratory exercises and is not bound by a common laboratory syllabus. Nevertheless, all of the instructors have chosen variations of the same format. This approach will be more difficult to implement in courses that will require major changes in the use of staff, namely; those courses with multiple sections of laboratories and hundreds of students per term. Under some circumstances, the investigative laboratory approach may not be feasible for a variety of reasons.

## Laboratory Organization

To begin, I divided the laboratory component (fourteen two and one-third hour meetings) into equal halves based on the work to be done. During the first seven weeks of the semester, students worked in groups of three or four on laboratory exercises chosen to allow them to become familiar with laboratory equip-

ment, metric measurement, graphing, reading and following laboratory directions. To enable the students to become familiar with some basic statistical tests, groups of two students taught one statistical test to the others in the class. Another goal of the laboratory exercises was to give students the opportunity to meet and work with others who were potential collaborators in the upcoming research project. For these exercises, the students were encouraged to work with different laboratory partners each week. Written reports on the exercises were collected from each student and evaluated so that students could learn what was expected of them in a written laboratory report.

When the laboratory exercises were short enough to allow other activities, the students met in groups to discuss research projects. To assist with the discussions, each received a handout listing organisms suitable for an introductory biology experiment and the titles of experiments carried out by students in other classes. These were helpful in the decision-making process. Whenever possible, students were given time to hold research group meetings during laboratory or class. Some of the time was also used to tour the department's greenhouse and other laboratories in our Science Center to see the facilities available for student research.

During the second half of the semester, groups of two or three students worked on their research and used library resources to gather information. From this point, the scheduled laboratory meeting times were used for data collection, research group meetings, library research, writing or preparation for the oral presentation. As a result, nonmajor students became involved in the process of biological research from hypothesis formation and experimental design, to data analysis and presentation.

All in all, the logistics of securing, providing and moving supplies proceeded quite smoothly. Each student research group submitted a research proposal two weeks before beginning the experiments. The proposal included the purpose of the

experiment, the null hypothesis and alternate hypotheses, an outline of the experimental design, and a complete list of materials needed for the work. An undergraduate assistant and I then used the lists to assemble materials in the laboratory. The students were informed that I would be available during the scheduled laboratory time each week to provide technical assistance with experiments as well as during my regular office hours. After the first hectic laboratory meeting I divided the time into twenty minute intervals which research groups could reserve. Thus I could give each group undivided attention for a concentrated period of time.

The organizational framework of the laboratory and research was based on the Handbook of Biological Investigation (Ambrose and Ambrose, 1987), which not only provide the basic steps in beginning a research project, but also include statistical tests and clear examples for student use. The text includes an outline of experimental design, the mechanics of writing a scientific paper and gave excellent examples for each step in the process. There is no doubt that this type of laboratory could be conducted without a text, but I thought that the book allowed the students more independence in their work by providing a ready reference for them during all stages of the work.

Another major hurdle to overcome was the students' lack of facility in using the library for research on technical topics. At my request, one of the reference librarians organized and presented an introduction to finding technical information in the college library. Her approach was to assume that she was a student in the course, so she chose a topic of interest - acid rain - to "investigate". She then detailed the steps of information gathering for the students. After spending just one class period in this introduction to the library's science resources, the students reported feeling more confident of their ability to find information during the library research portion of their work.

The projects chosen by the students varied widely based on personal interests (gardening, raising goldfish), an experiment remembered from high school (effect of various chemicals on the heart rate of *Daphnia*), or simply choosing an organism from the list, reading about its life cycle, and devising an experiment (effect of temperature on mealworm pupation rate). One group chose to study the effect of acid rain on bean plants as a result of the library presentation.

During the final laboratory period, each research group was allotted twenty minutes to present their work in the format of a scientific meeting. For this assignment many of the students produced their own overhead transparencies or posters to present data. While data sharing and discussion of the results and conclusions were expected among the members of a group, each student was required to write a scientific paper detailing the work of the experiment. Some of the students learned word processing or used word processing skills acquired in other classes to write the research papers. Several students learned to use a computer graphics program to prepare graphs of their data for the presentation and for the paper.

### Conclusion

When class evaluations were collected at the end of the semester, several students remarked that although they had not especially liked science before taking introductory biology, they had found the laboratory interesting and "actually liked it". I had never seen this type of response to the course prior to using the student-generated research. I also think that another benefit of the research-oriented approach to the introductory biology laboratory was that it allowed more of the students to get to know one another. After giving two presentations, talking with other class members about the research and working in the laboratory or greenhouse with others in an informal setting, they were able to get better acquainted

with each other, thus allowing more of a "community spirit" to develop within the class.

Because students had to carry out experiments in groups, they learned to rely on each other, and to trust their own observations and conclusions. They discovered that they could learn new concepts both from their own and other students' work. They also learned that experiments often produce unexpected results or ones which were difficult to interpret. Many of them also realized that they were required to explain those results in a manner consistent with some of the basic biological principles which they had learned in the course. Several of the students also gained insight into changes in the experimental design that would have allowed them to better focus on the question under investigation.

Implementation of a student research component in a biology course for nonmajor students requires a considerable amount of organization and time available for consultation with the students. The first two weeks and the last week of the experimental phase probably require the greatest amount of faculty input. Just before the presentations I did show several students how to use a computer program to generate graphs. I will incorporate that work into the first half of the laboratory when I teach the course again. Several students handed in their papers early for comments and suggestions on the work. Reviewing these papers took less time than I had anticipated because of my close involvement with the planning and execution of the experiments.

I intend to continue to use the research-oriented laboratory for nonmajor students. I also think that some of the principles involved in this type of course can be applied to make required laboratory courses for biology majors more appealing by allowing them to experiment and discover some of the excitement of biology very early in their academic careers.

### Literature Cited

Ambrose, H.W., III and K. P. Ambrose. 1987. A handbook of biological investigation. Fourth Edition. Hunter Textbooks Inc., Knoxville, Tennessee.

Independent Colleges Office. 1991. What works: building natural science communities. Volume One. Project Kaleidoscope, Washington, D.C. Leslie, C. 1990. A class for freshmen that may last a lifetime. Newsweek 115 (15): 64.

National Advisory Group of Sigma Xi. 1989. An exploration of the nature and quality of undergraduate education in science, mathematics and engineering. Sigma Xi. New Haven, Connecticut.

National Advisory Group of Sigma Xi.

1990. Entry level undergraduate courses in science, mathematics and engineering: an investment in human resources. Sigma Xi. New Haven, Connecticut.

Project on Liberal Education and the Sciences. 1990. The liberal art of science: agenda for action. American Association for the Advancement of Science. Washington, D.C.

Tobias, S. 1990. They're not dumb, they're different: stalking the second tier. Research Corporation. Tucson, Arizona.

**Helen K. Pigage, D.A.**  
**Associate Professor,**  
**Biology Department**  
**Elmhurst College**  
**190 Prospect Avenue**  
**Elmhurst, IL 60126**

## 1991-1992 Election Results

At the October annual meeting in Kansas City, Cathy Hunt of Henderson Community College (Kentucky) assumed the Presidency for the 1991-1992 year. The highlight of the meeting was the presentation of Honorary Life Membership to Edward S. Kos of Rockhurst College (Missouri). Congratulations from all of us, Ed. Sister Marion Johnson of Saint Xavier College (Illinois) was elected President-Elect for the 1991-1992 year. President Cathy Hunt appointed Robert Wallace of Ripon College (Wisconsin) as the Program Chairperson for next year and thus he will serve as First Vice President. Harold Wilkinson of Milikin University (Illinois) and Edward S. Kos were both re-elected as Secretary and Executive Secretary, respectively. Newly elected members of the Executive Board as Members-at-Large are Patricia Bowne of Alverno College (Wisconsin) and Leland Hansen of Highland Community College (Illinois). Continuing members of the Board are Timothy Mulkey, Malcolm Levin, Ben Dolbeare, and James Waddell. Sister Marion Johnson and Stan Boyer, both of Saint Xavier College (Illinois), will share duties as local arrangements chairpersons next year; thus, Stan Boyer will serve as Second Vice President. John R. Jungck will continue on the Board as Past President and Editor of *Bioscene*. The next meeting of the Board will be at Saint Xavier College in late February 1992. If you have business to go before the Board, please inform either or both Executive Secretary Edward S. Kos or President Cathy Hunt in time for them to send the agenda out to all Board members.

# **AMCBT Guidelines for Evaluating Undergraduate Education in Biology**

An AMCBT approved program of study for a major in Biology should include at least the following:

- \* 480 Hours of classroom work in Biology (33 semester hours)
- \* 360 Hours of Laboratory/Field work in Biology (approximately one three hour session per week of the semester per course)
- \* A core curriculum that covers principles of Evolution, Prokaryotic Biology, Eukaryotic Biology, Systematic Biology, Cellular and Molecular Biology, Ecological and Environmental Biology, Genetics, Physiological Biology, Structural (Anatomical) Biology, and Experimental Design/Biometrics
- \* Capstone experience such as a Senior Seminar
- \* One year of advanced work in biology or in allied fields that is outside of the core
- \* An undergraduate Research experience
- \* One year of Mathematics/Computer Science
- \* One year of Physics
- \* Two years of Chemistry to include Biochemistry

**An AMCBT approved program would also include the additional evaluation of:**

- \* Faculty Size (minimum four biologists, three-fourths with Ph.D.'s in Biology)
- \* Teaching loads (maximum 12 contact hours per week, including labs)
- \* Examinations, syllabi, and student research reports
- \* Faculty compensation
- \* Faculty professional activities
- \* Library collection (20 subscriptions to refereed journals, access to Biological Abstracts)
- \* Facilities and Equipment
- \* Budget and administrative structure; Support Personnel
- \* Textbooks and use of primary literature
- \* Placement of graduates

These suggestions are the result of a survey conducted by AMCBT between 1988 and 1990. The statistics were compiled by Secretary Harold Wilkinson. Please consult him for copies of the full nine page summary of all responses.

# A Policy Concerning The Use Of Lab Organisms

by  
The Biology Faculty  
Ripon College  
Ripon, WI 54971-0248

## ***"Before you dissect, Reflect!"***

Have you seen this advertisement in your school's student newspaper?

A few years ago our department became concerned that we might be confronted with politically motivated Animal Right's Activists, resulting in the disruption of our teaching laboratories. We thought that the targets for political action by such a coterie would include both the Departments of Biology and Psychology, but that Biology would be the prime one. In some institutions such political activities have resulted only in simple annoyances. However, other institutions have suffered major damage to their facilities (i.e., building, equipment, personal files).

While we sympathize with many of the concerns of those who call themselves Animal Right's Activists and support their right to demonstrate and voice their opinions, we felt that as educators we had rights and obligations, too. Faculty rights include the freedom to design and implement courses in a thoughtful and professional way. We also have the right to run our courses without

fear that 'at the last minute' a student will disrupt a laboratory with a vociferous refusal to participate in an exercise. For an additional exposition on this topic see ErkenBrack (1990) and references cited therein.

Given these concerns, we thought it prudent to develop a policy for our department which addressed animal, student, and faculty right's. Not only would this help to thwart confrontation, we also felt that it was the right thing to do. The policy was reviewed by the Dean of Faculty to make sure that it did not violate any school policy.

Once the policy was crafted, we posted it in every biology laboratory and animal care facility in our building and added it to all in-house laboratory manuals.

The policy is based on common sense, and it has been used successfully three times in two years. We welcome your comments on our policy; they may be directed to the Chair of the Department of Biology.

**Ripon College**  
**Department of Biology**  
**Organism Use Policy**

---

**USE OF ANIMALS IS A NECESSARY  
PART OF TEACHING BIOLOGY**

Whether animals should be used for research and educational purposes is a many faceted issue having philosophical, moral, scientific, and legal components. However, it is a fact that use of animals in research and education is vital to advancement of human and animal health; the alternative is to stop work and to permit our knowledge to stagnate at its current level. The faculty of the Department of Biology believe that use of animals for purposes of teaching and research is necessary as it ultimately leads to relieving humans and other animals from suffering caused by disease. We feel that depriving sick human beings and animals of benefits derived from animal research is inhumane.

Further, we believe that use of animals is vital for the education of students in the life sciences. Use of animals in a proper setting gives the student a direct understanding of how living systems work, an understanding that cannot be gained by reading a textbook, watching a video, or using a computer model. Textbooks, isolated cells, computer models, and other representations of intact living organisms are a good start, but they

can only provide a partial understanding of life processes. To achieve the best biological education, students must have a complete learning experience which includes use of laboratory animals. Nevertheless, we appreciate the position which calls for 1) critical thinking and 2) respect for life when using animals in teaching and research. This last concept is one of the primary reasons that compels biologists in making their career choice.

**GUIDING PRINCIPLES IN THE  
CARE AND USE OF ORGANISMS**

Acquiring and Housing Animals, and Acquiring Plants:

Only organisms that are lawfully acquired will be used by the Department of Biology. The retention and use of rare, endangered, and threatened species will be in strict compliance with federal, state, and local laws, regulations, and statutes.

Animals will receive every consideration for their bodily comfort. They will be kindly treated, properly fed, and their surroundings kept in a sanitary condition. They will be housed in a humane, clean, safe, and uncrowded manner with adequate food, water, and ventilation.

**Proper Use of Animals**

Appropriate anesthetics will be used to eliminate sensibility to pain during operative procedures. Muscle relaxants or paralytic agents are not anesthetics and they will not be used alone for surgical restraint; however, they may be used in conjunction with drugs known to produce adequate analgesia.

When recovery from anesthesia is necessary, acceptable techniques to minimize pain will be followed. Postoperative care of animals will be such as to minimize discomfort and pain, and in all cases will be equivalent to accepted practices in schools of veterinary medicine.

Where the study does not require recovery from anesthesia, the animal will be quickly killed in a humane and painless manner.

When animals will be used by students for their education or the advancement of science, such work shall be under direct supervision of a qualified, experienced professor.

### **Courses that Use Animals**

The appropriateness of procedures and the educational validity for use of animals in a particular course or independent study project will be determined by the faculty member in charge.

When organisms will be used in a course, the faculty member in charge shall inform the students as to the types of organisms that will be used and procedures that will be conducted at the first class meeting. Thus, students shall be fully cognizant of all course requirements and responsibilities at the start of the semester. Accordingly, students have a responsibility to inform the instructor of potential problems at that time (refer to the next section of this policy regarding conflicts of interest between student beliefs and course requirements).

### **POLICY REGARDING STUDENTS WHO CHOOSE NOT TO PARTICIPATE IN CLASSROOM AND LABORATORY EXERCISES BECAUSE OF PERSONAL BELIEFS**

A student who chooses not to participate in a laboratory exercise because it contradicts personal beliefs may do so without grade penalty providing that he or she meet substitute requirements (as determined by the instructor) in lieu of the regularly scheduled work.

When a disagreement arises between a student and faculty member concerning a laboratory exercise, a standard procedure will be followed to reach a satisfactory arrangement that will accommodate the rights and interests of both parties. The principle theme in this regard shall be that the personal rights and beliefs of both student and instructor, and academic freedom of the instructor, shall not be violated.

This procedure shall be as follows.

1. A student that believes that he or she cannot participate in a particular classroom or laboratory exercise because that exercise involves the use and/or death of an animal shall make his or her feelings known to the instructor. This discussion shall take place in private (e.g., in the office of the instructor). Because the instructor will inform the students as to the type of organisms that will be used and the procedures that will be conducted at the first class meeting, it is expected that any refusal to participate shall be stated within the first two weeks of the semester.

2. The faculty member and student shall discuss each other's concerns and views in a constructive manner and in a way that is respectful to the ideas of both parties.
3. During this discussion both parties shall determine whether the student can, in all good conscience, participate in part or all of the laboratory exercise. If the student believes that he or she cannot, then the faculty member and student shall develop a substitute exercise(s) which the student will complete in lieu of the normally scheduled work. In extreme cases there may be no feasible substitute work and the student may opt to drop the course (because students will be made aware of all course requirements and responsibilities at the start of class, they will have the option of dropping the course early enough in the term so that a add/drop does not appear on their transcript).
4. If a compromise cannot be reached, the faculty member and student shall make an appointment with the chair of the Department of Biology (or Animal Rights Officer) so that the three parties can discuss a reasonable alternative exercise(s).
5. If the meeting with the chair does not reach a compromise that is acceptable to all parties (or if the faculty member involved is the chair), then all parties shall meet with the Dean of Faculty to discuss this matter further.

### Literature Cited

Erkenbrack, D.E. 1990. Animal Rights: Responses to "The Domination of Knowledge by Ignorance". *Midwest Bioscene*, 16 (2); October 1990

### Additional Citations

Schrock, J.R. 1990. "Dissection". *The Kansas School Naturalist*, 36 (3); Feb. 1990

Schrock, J.R. 1991. "Animals in the Classroom". *Carolina Tips* 54 (4); April 1991

Schrock, J.R. 1991. "Compelling Lessons". *Carolina Tips* 54 (5); May 1991

**CALL FOR PRESENTATIONS  
1992 AMCBT CONFERENCE**

**October 8-10, 1992  
St. Xavlers College  
Chicago, Illinois**

**Do you have :**

- Labs that work?
- Interesting teaching methods?
- Tips on teaching nonmajors?
- Useful software?
- Exciting demonstrations?

The AMCBT 1992 Meeting will focus on  
**"Biology Teaching: A Scholarship"**  
Papers, Posters, and Workshops are invited.

Application deadline for inclusion in the pre-published agenda - February 15, 1992  
Final deadline - May 15, 1992

Name: \_\_\_\_\_ Institution: \_\_\_\_\_

Address: \_\_\_\_\_

Work Phone: \_\_\_\_\_ FAX Number: \_\_\_\_\_

Home Phone: \_\_\_\_\_ E-Mail Address: \_\_\_\_\_

- Check One: \_\_\_\_\_ Oral Presentation (45 Min. including discussion)  
\_\_\_\_\_ Poster Session  
\_\_\_\_\_ Workshop (2-3 hours)  
\_\_\_\_\_ Other (specify)

Title of Presentation: \_\_\_\_\_

Abstract:

Special equipment or facilities required: \_\_\_\_\_

Return to: Robert Wallace, Biology Dept., Ripon College,  
300 Seward St., P.O. Box 248, Ripon, WI 54971

Application For Membership  
**ASSOCIATION OF MIDWESTERN  
COLLEGE BIOLOGY TEACHERS**

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: \_\_\_\_\_ E-MAIL ADDRESS: \_\_\_\_\_

- MAJOR INTERESTS:**
- 1. Biology
  - 2. Botany
  - 3. Zoology
  - 4. Microbiology
  - 5. Pre-professional
  - 6. Teacher Education
  - 7. Other

**RESOURCE AREAS:**

---

---

---

**RESEARCH AREAS:**

---

---

---

Have you been a member before? \_\_\_\_\_ If so, when? \_\_\_\_\_

**PLEASE MAIL  
MEMBERSHIP APPLICATION  
FORMS TO:**

**Edward S. Kos**  
Executive Secretary, AMCBT  
**AMCBT Central Office**  
Department of Biology  
Rockhurst College  
Kansas City, MO 64110

**CURRENT DUES ARE \$25.00**