Registration Opens for Summer 2005 Workshops and Online Courses

Teachers in Iowa's public or private schools and extension educators who work with youth in 4-H or other community programs are invited to register for the 2005 summer workshops offered by the Office of Biotechnology at Iowa State. Educators who want to update their biotechnology and bioethics teaching skills earn staff development or graduate credits at the workshops.

The workshops will be held in the laboratories of the Biotechnology Outreach Education Center (BOEC) on the Iowa State campus in Ames. Iowa teachers can receive stipends of $50 per day to help cover their costs of attending. ISU Extension educators/personnel can receive travel reimbursements of up to $50 per day to help cover their expenses.

Upon completion of any of the workshops, Iowa teachers are eligible to receive free supplies and equipment for lab protocols available from ISU.

For more information about the biotechnology education workshops, contact Mike Zeller or Lori Miller toll-free in Iowa at 1-800-643-9504, or e-mail mzeller@iastate.edu or lorimill@iastate.edu. For more information about the bioethics workshops, please contact Kristen Hessler at the toll-free number, or e-mail khessler@iastate.edu.

To register for any workshop, please contact Lori, use the form on p. 7, or use the online registration or pdf forms available at http://www.biotech.iastate.edu/ed_resources/ed_resources/regis_form_summer2005.html. Submit your registration to arrive by June 3.

June 14-17
Biotechnology Education Workshop 1 for Science Educators
Iowa State University, Ames, Iowa
2 staff development credits - $20 and/or 1-2 ISU graduate credits - $318 per credit $200 stipend available for Iowa school-teachers ($50 per day)
Travel reimbursement available for ISU Extension educators/personnel (up to $50 per day)

This workshop course is directed at teachers who want to gain a basic knowledge of biotechnology. Teachers will learn how to prepare and instruct the laboratories in DNA extraction and quantification from various sources, DNA transformation, DNA fingerprinting, bioinformatics, and more. Educators will prepare and perform the lab protocols as the students would do in class. Techniques for encouraging classroom bioethics discussions will be featured.

June 22-24
Bioethics Workshop 1
Iowa State University, Ames, Iowa
1 staff development credit - $20 and/or 1 ISU graduate credit - $318 per credit $100 stipend available for Iowa school-teachers ($50 per day)
Travel reimbursement available for ISU Extension educators/personnel (up to $50 per day)

This course is designed for educators who are interested in discussing bioethics with their students or extension audiences. The focus will be on ethical issues in biotechnology, especially agricultural biotechnology, but other topics relevant to both agriculture and human health will be covered. Students will work through

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(continued on p. 2)
activities and case studies that they can take home and use with their classes. Pedagogical issues in teaching bioethics also will be covered, including appropriate objectives for bioethics units; various approaches to bioethics pedagogy; how to relate bioethics issues to personal ethical issues familiar to students; how to help students identify ethical issues; how to address bioethics while respecting diversity of views in the classroom; and assessment for bioethics units.

**June 27-29**

*Biotechnology Education Workshop I for Family and Consumer Sciences Educators*

Iowa State University, Ames, Iowa  
1 staff development credit - $20 and/or  
1 ISU graduate credit - $318 per credit  
$150 stipend available for Iowa schoolteachers ($50 per day)  
Travel reimbursement available for ISU Extension educators/personnel (up to $50 per day)

This workshop course focuses on the basics of biotechnology and how it can be applied in human nutrition and health. The basic technical knowledge and skills in this workshop will be useful in helping family and consumer sciences educators better understand and deliver information about biotechnology to their students. Techniques for encouraging classroom bioethics discussions and information about GMO testing in food will be featured.

**June 30-July 1**

*Biotechnology Education Workshop I for Agriculture Educators*

Iowa State University, Ames, Iowa  
1 staff development credit - $20 and/or  
1 ISU graduate credit - $318 per credit  
$100 stipend available for Iowa schoolteachers ($50 per day)  
Travel reimbursement available for ISU Extension educators/personnel (up to $50 per day)

This course is a workshop focused on the basics of biotechnology and how it can be applied to agriculture. The basic technical knowledge and skills in this workshop will be useful in helping agricultural educators better understand biotechnology and how it will affect their curriculum and profession. Laboratory investigations and instruction will give educators experience with DNA extraction and transformation, DNA fingerprinting, chymosin, Bt corn, GMO testing, marker-assisted selection, and more. Techniques for encouraging classroom discussions of bioethics and issues surrounding biotechnology will be featured.

**July 11-14**

*Biotechnology Education Workshop II – Advanced Workshop for Science, Agriculture, and Family and Consumer Science Educators*

Iowa State University, Ames, Iowa  
2 staff development credits - $20 and/or  
1-2 ISU graduate credits - $318 per credit  
$200 stipend available for Iowa schoolteachers ($50 per day)  
Travel reimbursement available for ISU Extension educators/personnel (up to $50 per day)

This advanced workshop is open to science, agriculture, and family and consumer sciences educators who have attended one of the previous biotechnology workshops. Educators will learn how to prepare and instruct advanced laboratories in biotechnology. Activities will include showing marker gene expression, DNA isolation, recombinant DNA techniques, DNA amplification, restriction analysis of DNA, bioinformatics, sequencing, genomics, and more. Educators will prepare and perform the lab protocols that their students could do in class. Techniques for encouraging advanced classroom bioethics activities will be featured.

**July 20-22**

*Bioethics Workshop II – Advanced*

Iowa State University, Ames, Iowa  
1 staff development credit - $20 and/or  
1 ISU graduate credit - $318 per credit  
$100 stipend available for Iowa schoolteachers ($50 per day)  
Travel reimbursement available for ISU Extension educators/personnel (up to $50 per day)

This advanced workshop is open to educators who have attended one of the previous bioethics workshops. Assuming familiarity with ethical arguments, utilitarianism, and rights-based theories, this workshop will focus on substantive analysis of current controversies in bioethics. We will also discuss bioethics pedagogy, including strategies for encouraging students to participate in bioethics units, scholarly debates about teaching bioethics, and empirical research about the impacts of bioethics education on student learning.

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**Educational Opportunities**

**Register for Online Bioethics Courses**

This summer, the Office of Biotechnology at Iowa State University is offering three online bioethics courses: Teaching Bioethics, Ethics and Biotechnology, and Ethics and Animals. The courses are designed for teachers,
extension personnel, and others who educate youth and adult audiences about life sciences, including biotechnology, and who are interested in incorporating bioethics into their life sciences education.

Each course requires a minimum of 15 hours online, plus an additional 15 hours of reading, writing, and research. No prerequisites are required. Course participants can earn one graduate credit for each course from Iowa State University. Two staff development credits for each course are available for participants from Iowa and may be available for those from other states. The courses are being offered in cooperation with Area Education Agency 11, Johnston, Iowa, and Iowa State University in Ames. Dr. Kristen Hessler, bioethics outreach coordinator at Iowa State University, will instruct the courses.

To register for one or more courses, please contact Lori Miller, 515-294-9818, toll-free in Iowa 800-643-9504, e-maillorimill@iastate.edu. You also may register by using the online registration or pdf forms available at http://www.biotech.iastate.edu/ed_resources/ed_resources/regis_form_summer2005.html. Class enrollment for each course is limited to 20.

Brief descriptions of each course are below. For more information about course content, please contact Hessler at 515-294-7576, e-mail her at khessler@iastate.edu, or visit the web page: http://www.bioethics.iastate.edu/activities/biotechnology_ethics.html.

Teaching Bioethics
Date: June 13 - July 1, 2005
Registration deadline: June 3

This course is designed for any science or social studies teacher interested in teaching bioethics. Topics include advantages of incorporating bioethics in science and social studies courses, appropriate objectives for bioethics units, a brief study of ethical theory, various approaches to bioethics pedagogy, how to relate bioethics issues to personal ethical issues familiar to students, how to help students identify ethical issues, how to address bioethics while respecting diversity of views in the classroom, and assessment for bioethics units.

Ethics and Biotechnology
Date: July 11-29, 2005 (offered concurrently with Ethics and Animals)
Registration deadline: June 30

Modern biotechnology is as controversial as it is promising. Teaching the associated ethical issues can help engage students to learn the relevant science concepts and to learn the skills necessary to contribute to ongoing social dialogue about science and society. Topics include an overview of ethical controversies about biotechnology and specific ethical issues in plant, animal, and human biotechnology.

Ethics and Animals
Date: July 11-29, 2005 (offered concurrently with Ethics and Biotechnology)
Registration deadline: June 30

This course will enable participants to recognize and distinguish views about the moral status of animals; to articulate and defend their own ideas about the moral status of using animals for food, research, and education; and to incorporate ethical issues concerning animals in their courses. This course will benefit educators who discuss or use animals in their courses or outreach efforts, as well as social studies teachers interested in current controversies about society's uses of animals.

BioRenewable Resources Workshop

Iowa high school science teachers, social science teachers, agriculture teachers, and their students are invited to attend a BioRenewable Resources workshop on April 12 from 8:30 a.m.-3:00 p.m. The event, to be held on the ISU campus in Ames, is free to students, teachers, and chaperones.

For more information about the workshop and how to register, visit the web site at http://www.agstudent.iastate.edu/biorenewables/ or contact Leah Hansen, Agriculture Student Services, 23 Curtiss Hall, Iowa State University, Ames, IA 50011-1050, phone 515-294-8653, lhansen@iastate.edu.

Career Conferences for Young Women

Young women in grades 6-12 attending the Taking the Road Less Traveled conferences can interact with women who are professional scientists, engineers, mathematicians, or work in other technology fields. Career conference dates for grades 6-9 are April 14 and 21, 2005. For grades 9-12, the spring conference date is April 7. The conferences also are offered in October. The conference is sponsored by ISU's Program for Women in Science and Engineering (PWSE).

Registration forms and details will be available on the PWSE web site at http://www.pwse.iastate.edu/outreach/trlt.html. For more information, e-mail Kristin Menning at trlt@iastate.edu or contact her at PWSE, 210 Laboratory of Mechanics, ISU, Ames, IA 50011-2131, ph. 515-294-5319.
With all the school interruptions brought on by the weather, it is hard to imagine spring is just around the corner. Now is a good time to start planning for those biotechnology activities you want to do in your classrooms and possibly a field trip to the BOEC this spring. The weather has slowed the flow of visitors into the BOEC, but not the requests for supplies. Spring traditionally is our busiest time, so plan ahead to guarantee that equipment and supplies will arrive before the dates you plan to use them in your classrooms. If you are planning a field trip to the BOEC for activities, schedule your trip as soon as you can. The BOEC schedule fills up fast after spring break.

BOEC in Action
Even though the winter can make travel difficult, many schools and other education groups made visits to campus. Aurelia High School, Des Moines Christian High School, Guthrie Center High School, Johnston High School, Marshalltown High School, St. Augustin School in Des Moines, and Women in Science and Engineering at ISU scheduled one or more visits to the BOEC.

In the early part of the spring semester at ISU, the departments of agricultural studies, biology, and engineering will once again bring their pre-service teachers to the BOEC for training in how to incorporate biotechnology principles and techniques into their future classrooms.

The BOEC has made or will make visits to the FFA Middle School Conference in Johnston; Central Campus in Des Moines for four Saturdays; Ames Northwood Elementary Science Night in Ames; Granville Spalding High School in northwest Iowa; Shenandoah Middle School in southwest Iowa; and finally to Dallas, Texas, to attend the National Science Teachers Association national convention.

Summer Workshops
The Office of Biotechnology and BOEC will offer six workshops on the ISU campus in Ames (see p. 1 for details). First-time workshop participants or teachers who have attended previous workshops and want to update their knowledge and skills are welcome to attend one or more workshops. New materials, activities, and content are constantly being added to the workshops. Mark your summer calendars with the dates for the workshops, and share this newsletter with colleagues you think could benefit from attending one or more of our workshops. To register for the workshops, contact Lori Miller or complete the registration form on p. 7. Please check our web site at www.biotech.iastate.edu/ed_resources/Workshops.html for updated information about registering and attending our summer workshops. Have a great spring semester!
Grants/Competitions

State Science Fair on April 1-2

April 1-2 are the dates for the 2005 State Science and Technology Fair of Iowa (SSTFI) to be held in Ames. The SSTFI is affiliated with the Discovery Channel Young Scientist Challenge and the Intel International Science and Engineering Fair. All high school exhibitors at the fair are eligible for scholarships. The top biological and physical high school projects will represent the SSTFI at the Intel International Science and Engineering Fair in Phoenix, Arizona, in May.

All exhibitors in grades 6-12 are eligible for trophies, medals, and other special awards. About the top 10% of participants in the 6th-8th grades have a chance to win a Discovery Channel Young Scientist Challenge nomination that includes a lapel pin, certificate of recognition, and an entry booklet to enter the national competition.

The Iowa Biotechnology Association will provide five tuition scholarships to be awarded at the 2005 fair. The scholarships will be awarded to the five students who exhibit the best use of biotechnology with their projects. All Iowa high school students who exhibit in a life science category at the fair are eligible for the IBA scholarships. Each scholarship is $1,000 if used toward tuition at an Iowa-based college or university or $500 if used at an out-of-state institution.

For more information, visit http://www.iastate.edu/~isssti/ or contact fair director Andrea Spencer c/o SSTFI, 52653 160th Street, Gilbert, IA 50105; phone 515-233-6512 or cell 515-460-5559; or e-mail spencer2@prairieinet.net.

Grants, Awards, and Competitions

Visit the Office of Biotechnology's educational funding web site at http://www.biotech.iastate.edu/publications/ed_resources/Ed_funding.html for information about science-related competitions for students or educators. Opportunities with a March 15, 2005, deadline include the Award for Excellence in Encouraging Equity, sponsored by Science Kit and Boreal Laboratories and National Association of Biology Teachers' (NABT) Role and Status of Women in Biology Education Section; the Biotechnology Teaching Award, sponsored by the NABT; the Outstanding New Biology Teacher Achievement Award, sponsored by the NABT; and the Craftsman/NSTA Young Inventors Awards Program, sponsored by Sears, Roebuck and Co.

A Middle School Science Bowl sponsored by the U.S. Department of Energy's Ames Laboratory and Iowa State University will be held on Friday and Saturday, April 8-9, on the Iowa State campus in Ames. For more information, visit the web site at http://www.external.ameslab.gov/community/ScienceBowl/MSScibowlhome.htm, phone Deb Samuelson at 515-294-9557, or e-mail her at debsam@ameslab.gov.

Tip for Teachers

The Cat Thief Mystery

The following DNA fingerprinting scenario was developed by science teacher Richard H. Keilig, Jr., Centerville High School, Centerville, Iowa, based on a protocol from the Office of Biotechnology at Iowa State University. If you have questions, you can contact Richard at 641-856-0810 (school) or e-mail him at keiligr@aea15.k12.ia.us.

A teacher owned four cats, Ted, Tom, Tuxedo and Cocoa. The cats were taking a nap in the sunroom after discussing the technique of DNA fingerprinting. The teacher's wife was preparing lunch for her husband who was mowing the lawn.

The phone rang, and the caller wanted her husband so she left the house to get him. On the table she had prepared a delicious ham sandwich. When she came back in and saw the half-eaten sandwich, she yelled “thief!” She went to the sunroom and all the cats were sound asleep, dreaming of DNA – except one that was thinking of the DNA he had just devoured!

The teacher's wife wanted to put the thief in the “cage,” but did not know which cat it was. Fortunately, the culprit left some strands of hair on the plate. She put the hair in a plastic bag and labeled it “Hair of the thief.” She then took hair samples from each of the sleeping cats, making sure each hair contained a follicle (the part of the hair in which you find DNA). She then took hair samples from each of the sleeping cats using a pair of clippers. She labeled the samples “Cat 1” (Ted), “Cat 2” (Tom), “Cat 3” (Tuxedo), and “Cat 4” (Cocoa). She gave the samples to her scientist husband to take to the school to determine which cat had...
eaten the sandwich. The scientist extracted DNA from samples of hair from each cat and labeled them with the cat number. The sample from the crime scene was labeled “T” for thief. (Note: In the original DNA fingerprinting protocol from the Office of Biotechnology, the sample tube was labeled “C.”)

The scientist is providing you and your helpers with the samples and wants you to determine which cat was the thief. He is not happy about losing the sandwich and wants to find out which cat is responsible. Each group up to five students will have the specimens to analyze as a team. Below you will find the seven steps needed to accomplish this lab. If you are an educator in Iowa, the lab procedure (with a few modifications), the materials, and equipment can be provided by Iowa State University’s Office of Biotechnology.

**DNA Fingerprinting Procedure**

**Step 1.** Put on medical gloves and wear them throughout the lab to protect the DNA samples from contaminants that may be on the hands.

**Step 2.** Your group has a sample of the “thief” DNA in a 1.5 microcentrifuge tube labeled “T” and samples from each of the four cats labeled with the cat number. Keep the tubes upright throughout all the steps of the experiment to keep the DNA off the sides of the tube. Into each of the five tubes, pipette 3 μl of the restriction enzyme Bgl 1 (Bacillus globigi) labeled “N.” Use a fresh pipette tip when adding Bgl 1 to each tube. To rinse the pipette tip and mix the DNA and Bgl 1, fill and expel the pipette tip with the sample three times. Label the five tubes with the letter assigned to your team and written in the upper right-hand corner of your instruction sheet. Now, let’s bag the “thief.”

**Step 3.** Place the tubes in a rack provided by the instructor and incubate at 37 degrees Celsius in a water bath or incubator for 30 minutes. The Bgl 1 restriction enzyme will cut the DNA up at specific sites (5′ -GCCNNNN *NGGC-3′ and 3′ -CGGN*NNNCCG-5′) by attacking the phosphate group bonds on the sides of the DNA. The reaction involves the enzyme and the addition of water. Thus, it is a hydrolysis reaction.

**Step 4.** Remove the tubes from the incubator or water bath and keep them upright. Into each of the five tubes, pipette 4 μl of blue dye from the tube labeled D. Use a fresh pipette tip when adding dye to each tube. To rinse the pipette tip and mix the DNA and the dye, fill and expel the pipettor tip with the sample three times. The blue dye will be used to monitor the migration of the DNA during electrophoresis.

**Step 5.** Go to the electrophoresis box and record the identity of each sample before loading it on the gel. The gel has lanes in which individual samples will be run. Therefore, there are numbered lanes on the sheet of paper. Record on the sheet the identity of the sample that corresponds to the lane into which the sample will be loaded.

**Step 6.** Using a pipettor set for 20 μl, transfer your sample into the appropriate lane in the gel. Place the top of the pipette tip into the top of the well and dispense the 20 μl of solution into it slowly. Do not let the pipette tip touch the bottom of the well because it will puncture the gel. Discard the pipette tip in the designated container after the sample has been put in the well and use a new one for the next sample. The instructor will then subject the gel to electrophoresis and staining.

**Step 7.** After the gel is stained, the bands on it will be viewed. From the DNA patterns on the gel, determine which cat (Ted, Tom, Tuxedo, or Cocoa) ate the sandwich.

**Analysis Questions**

1. Which cat ate the sandwich? How do you know?
2. Explain the theory behind the process of gel electrophoresis (DNA fingerprinting). What is the electrical charge of DNA? What chemical groups are responsible for this property? Why does the DNA move through the gel? What do the bands represent?
3. Describe what restriction enzymes are. What organisms produce them? What is the role of these enzymes?
4. Explain what Bgl 1 is. At what sequence of DNA does it attack? What bonds are broken?
5. What is the purpose of a migration dye?
6. What are some possible uses for the technique of DNA fingerprinting?

**Review Questions**

7. What does the human genome consist of? In other words, how many different chromosomes are in humans? What is the number of base pairs in the human genome?
8. Explain at least three differences between the prokaryotic and eukaryotic chromosomes (arrangement, association with protein, size and location). For example, compare the size of the genomes of *Escherichia coli* and the human genome.
9. What is the building block of nucleic acids? List the three components of this building block.
10. In what direction does the DNA molecule run? What are the three main enzymes involved in DNA replication? How do they function? One of these enzymes operates in a certain direction. What is that direction?

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**Photos courtesy of Richard H. Keilig, Jr.**

Ted  Tom  Tuxedo  Cocoa
Registration Form for 2005 Biotechnology Education Summer Workshops and Summer Online Bioethics Courses

Registrations due by JUNE 3, 2005, for biotechnology education workshops. Registrations due by JUNE 3 and JUNE 30, 2005, for summer online courses.

Name ___________________________________________________________________________________________________

School district or extension area ____________________________________________________________________________

Subject areas taught_______________________________________________________________________________________

Home (summer) mailing address ____________________________________________________________________________

Work phone ____________________    E-mail__________________________________    Home phone __________________

I would like to register for the following Biotechnology Education Workshop(s) to be held at ISU in Ames:

_____ Workshop I for Science Educators, June 14-17

_____ Bioethics Workshop I, June 22-24

_____ Workshop I for Family and Consumer Science Educators, June 27-29

_____ Workshop I for Agriculture Educators, June 30 - July 1

_____ Advanced Workshop II for Science, Agriculture, and Family and Consumer Science Educators, July 11-14

_____ Bioethics Workshop II – Advanced, July 20-22

I would like to register for the following online course(s) that I can take on the Internet from home:

_____ Teaching Bioethics, June 13 - July 1

_____ Ethics and Biotechnology, July 11-29

_____ Ethics and Animals, July 11-29

Registration deadline:  June 3

Registration deadline:  June 30

Credit available: 1-2 staff development credits AND/OR 1-2 graduate credits

(See workshop descriptions on p. 1 and online course descriptions on p. 3 for details.)

Credit payment and housing information will be sent to you when your registration is received.

Register early! Class sizes are limited. Return this registration form by mail or fax before the deadlines to:

Lori Miller
Office of Biotechnology
1210 Molecular Biology Building
Iowa State University
Ames, Iowa  50011-3260

Fax: (515) 294-4629 • Phone: (515) 294-9818 or toll-free in Iowa 1-800-643-9504 • E-mail: lorimill@iastate.edu

Publicity/Image/Voice Permission

The Office of Biotechnology normally takes photographs, video, and/or tape recordings of our programs. During these workshops, a photograph or video/audio recording may be taken of you. Unless you request otherwise, your application will be considered permission for Iowa State University and the Office of Biotechnology to photograph, film, audio/video tape, record and/or televise your image and/or voice for use in any publications or promotional materials, in any medium now known or developed in the future without any restrictions. If you object to ISU using your image or voice in this manner, please notify the Office of Biotechnology, in writing, at the time of your application.
About the ISU Public Education Program in Biotechnology.

Iowa State University's Public Education Program in Biotechnology is supported by Ajinomoto Food Ingredients, LLC/Ajinomoto Heartland, LLC; Bayer CropScience; Cargill; Genencor International, Inc.; Golden Harvest Research; Growmark; The Greater Cedar Rapids Foundation–Diamond V Mills Donor-Advised Fund; the Iowa Biotechnology Association; the Iowa Farm Bureau Federation Agricultural Foundation; the Iowa Soybean Promotion Board; Kemin Americas; MBS Genetics, LLC; Pioneer Hi-Bred International, Inc.; the Roy J. Carver Charitable Trust; Syngenta Seeds, Inc.; West Central Cooperative; and private individuals.

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