Courses in the Education 6000 Hands-On Science K-8 series link science content, teaching strategies, and free materials. For all fall 2005 courses, the following details apply.

**Location:** Washington University Hilltop Campus, 151 Busch Lab

**Credit:** Three graduate credits in education

**Cost:** $200 registration plus optional parking; all fees due the first class day

**Register:** Contact Paula Smith, (314) 935-6846, psmith@biology2.wustl.edu

Education 6000 classes are supported by the Howard Hughes Medical Institute and the National Science Foundation.

**New Course!**

**for K-8 teachers**

**Education 6016**

**Diversity of Life**

Help your students master the Missouri grade level expectations (GLEs) in life science, through a study of taxonomy and the characteristics of the major groups of protists, plants, and animals. Topics include biodiversity in genetics, species, and ecosystems.

**Dates:** Thursdays, Sept. 1-Dec. 15, 4:30-7 p.m.

**Instructors:** Stan Braude, biology instructor; Jim Jordan and Sharon Kassing, Saint Louis Zoo

**for K-8 teachers**

**Education 6011**

**Sound and Light**

Elementary and middle school students can explore how wave patterns occur in sound, light and water using everyday materials. Activities include demonstrations of sound sources, media, and detectors; light explorations using lenses, mirrors, and pinhole viewers; and discussions of how people see color and light.

**Dates:** Tuesdays, Sept. 6-Dec. 20, 4:30-7 p.m.

**Instructors:** Pat Gibbons, professor of physics; Jack Wiegers, instructor

**for K-8 teachers**

**Education 6009**

**Matter and Energy**

Help your students understand the properties of matter and basic chemistry. Activities include classification, determining states of matter, kitchen chemistry, basic nanoscience, and lessons from the American Chemistry Society’s “Chemistry for Kids” series.

**Dates:** Wednesdays, August 31-Dec. 14, 4:30-7 p.m.

**Instructor:** Kristin Sobotka; guest lecturers include Kevin Moeller, professor of chemistry
Customized, Interdisciplinary School Programs Link Curricular Areas

for younger elementary classes

Connect science, social studies, and language arts

Significant historical and scientific concepts come to life through hands-on, minds-on exploration at Tyson. Cost per student is $5 for two or three hour programs; $6 for four hour programs. Create a field trip for your elementary class by mixing and matching from the following:

Animal characteristics and interactions:
What are the special adaptations that allow animals to live in water, caves, or trees? Choose the pond, cave, or forest for study. Focus on one or compare two sites.

Earth materials:
Dig in the soil, and share your findings. What inland sea plants thrived at Tyson millennia ago?

Language and fine arts:
Create a class poem, song, or scent map as you explore the forest.

Native American life:
How did native people live at Tyson, 1,500 and 200 years ago? What did they trade, and with whom? Learn the secrets of finding fresh water in the forest, and use geography skills to answer questions on a forest trail.

for upper elementary classes

Integrate Missouri history with ecology and geology

Design your own field experience to match your curriculum and meet your learning goals. Pre-trip primary readings and assessment assistance are available. Cost per student is $5 for two or three hour programs; $6 for four hour programs. Select from the following elements:

Missouri stories:
Learn how Native Americans, farmers, miners, and ecology researchers have used the land at Tyson from 1775 to present day through an exploration of archaeological sites.

Forest ecology:
How does the oak-hickory forest at Tyson support a community of insects, animals, and decomposers? How do biotic and abiotic factors influence the forest?

History and economics:
Explore a quarry cave and a ghost mining town. How did Tyson’s rivers, springs, and train access influence the economic viability of Mincke Hollow, Missouri, in the late 1800s and early 1900s?

Geology:
Collect and learn how to identify rocks and minerals. Find out how limestone is altered in a rainwater solution.

Cave ecology:
Find the consumers, producers, and decomposers in the cave. How did the quarry operations affect the natural community? Role play as conservationists, quarry owners, tour guides, developers, or military officers.

Science and math extensions:
Explore Tyson’s stream table, karst topography (springs and sinkholes), fossils, cave, and working quarry to learn how math and science apply to the study of ecology.

for middle school classes

Combine ecology with science, language, and history

Custom-design a field experience for your class or team. Tyson educators will work with you to help you meet your learning goals in a meaningful way. Interactive instruction helps students build interest, ask questions, and make observations. Follow-up visits are encouraged. Cost per student is $6. Choose from the following elements:

Earth systems/geology:
Use fossil indicators to prove an ancient sea existed at Tyson. Find evidence suggesting formation of new sinkholes, springs, and hollows.

Water/geology/climate:
Examine topographic maps and use a stream table to explore river formation, watersheds, flooding, force and motion. How has climate affected settlement over 1500 years at Tyson?

Ecology:
How do adaptations, populations, and limiting factors affect food webs and communities? Use a dichotomous key to solve a skull maze.

Language/fine arts:
Hike in the forest, then create a botanical sketch and a key to medicinal and edible plants. Use natural objects to explore the concept of personification.

World history/culture:
Apply geology and forest ecology concepts to the Native American archaeological sites at Tyson. What were the tools and practices of the Archaic, Mississippian, or Woodland cultures at Tyson?
for ages 6-14

Tyson Field Science
Summer Day Camps

Day camps require a preregistration deposit. Call (314) 935-8430 or e-mail tyson@biology.wustl.edu.

Forest fun

Experience a variety of outdoor summer adventures at Tyson, exploring the cave, forests, ponds and creeks. Learn what scientists are studying at Tyson, do a cave scavenger hunt, solve animal and plant mysteries, and create native crafts. All camps include a Wolf Sanctuary tour on Thursday evening at 7 p.m. Cost is $105. Camps are sponsored by the Tyson Field Science Program and the Wolf Sanctuary.

Ages 6-9: choose one of two 9 a.m.-3 p.m. camps, June 13-16 or June 20-23.
Ages 10-14: choose one of two 9 a.m.-3 p.m. camps, July 11-14 or July 18-21.

Nature creation

Use items from nature to make wreaths, baskets, jewelry boxes, magnets, and more. Spend mornings outdoors, and afternoons on projects. Cost is $20 for one-day camps; $100 for four-day camp.

Ages 6-9: June 24, 9 a.m.-3 p.m.
Ages 10-14: Choose one of two 9 a.m.-3 p.m. sessions, July 15 or July 22.
Ages 6-13: June 27-June 30, 8 a.m.-2 p.m.

Wilderness survival

Learn the techniques of survival in the forest. Create your own compass and survival kit, build a shelter, and learn knot tying. What decisions would you make (and when) if you were alone in the wilderness? Cost $20.

Ages 8-9: June 24, 9 a.m.-3 p.m.
Ages 10-14: Choose one of two 9 a.m.-3 p.m. sessions, July 15 or July 22.

Tyson Field Science Family Fun Programs

for ages 3-10

Stream Ecology, May 25, 1-3 p.m.
Explore a dry creekbed and identify organisms who live there.

Pond Ecology, May 25, 6:30-8:30 p.m.
Locate, examine, and identify organisms from Tyson’s pond.

Ancient Crafts, July 6. Choose one of two sessions: 1-3 p.m. or 6:30-8:30 p.m. How did ancient people use natural materials to create useful and beautiful items?

Cave-in Scavenger Hunt, July 27.
Choose one of two sessions: 1-3 p.m. or 6:30-8:30 p.m. Stay cool and discover clues that reveal how caves have been used and lived in throughout history.

Who’s the Scientist? August 3, 1-3 p.m.
Participate in an experiment based on the work of famous naturalists.

Famous Women in the Field, August 3, 6:30-8:30 p.m.
Join the ranks of famous women botanists, wildlife photographers, chemists and inventors by conducting your own research at Tyson.

for ages 3-6

Pioneer Days at Tyson, April 5, 9:30-11:30 a.m. What was life like at Tyson more than 100 years ago? Share a story and make a toy and candle.

What’s in a Pail of Water? May 24, 9:30-11:30 a.m. Meet tadpoles, salamanders, dragonfly larvae, crayfish and more who live in Tyson’s ponds and streams.

Worms Aplenty! Choose one of two sessions: June 27, 1-3 p.m.; or July 27, 9-11 a.m. Do worms have eyes? Do they eat? Build a composter to take home.

Hug a Tree, June 29, 9-11 a.m. Take a hike, play a game, and learn up close about trees and leaves.

All Abuzz, choose one of two sessions: June 29, 6:30-8:30 p.m.; or July 6, 9-11 a.m. Learn how bees see the world, why they are important, and how to be safe around them.

You’re the Scientist, August 3, 9-11 a.m. Use all your senses to make observations like scientists do.

for ages 8-12

Wilderness Survivor, June 29, 1-3 p.m.; 6:30-8:30 p.m. Create a compass and shelter, learn how to tie knots and create a survival kit.

for K-8 teachers

Start your master’s degree with a graduate certificate in science education

Washington University’s graduate certificate in science education is a 15-credit hour post-bachelor’s program designed for teachers of grades K-8. Any teacher who has completed one semester of Education 6000 courses with a grade of B or better is eligible to apply.

Teachers accepted to the program may take Education 6000 courses and other qualifying Washington University courses at a reduced cost. Credits earned for the certificate are applicable to a master in the arts of education. A separate application process must be completed for the degree.

Acceptance to the certificate program is competitive. Applications may be downloaded at www.so.wustl.edu. The deadline for spring program entry is April 15; or Nov. 15 for fall entry. Contact Amy O’Brien, (314) 935-6846, aobrien@wustl.edu, for information.

The certificate program is supported by the Howard Hughes Medical Institute.
The St. Louis Math and Science Partnership is a joint effort between the districts of Ferguson-Florissant, Maplewood-Richmond Heights, Riverview Gardens, University City, and Webster Groves. Now more than halfway through its third year of five, the project continues to work with building teams at the elementary and middle school levels to improve planning, teaching, and learning in math and science.

The St. Louis MSP also supports an after school program for high school students, and after school science clubs for elementary and middle students. Washington University, the St. Louis Science Center, and the Saint Louis Zoo work with the partner districts to provide professional development, classroom materials, and student programs.

**Teacher programs**

One of the St. Louis MSP’s goals is to help districts build their capacity to teach inquiry based math and science. As more teachers become involved, the MSP partners are taking a team approach to curriculum planning, and to learn from other districts about what works and what doesn’t.

The Knowing Math program is a successful intervention that has spread among St. Louis MSP districts. In 2003, Ferguson-Florissant and Riverview Gardens teachers took training from the program’s publisher. This fall, teachers in the other partner districts asked to receive the training.

Karen Brannon, math coordinator, offered a summer training and a fall session for interested teachers. She is now encouraging a group of experienced users of the program to take the trainer course for Knowing Math. She explains, “This program has been effective in helping elementary students who have fallen behind catch up. As more teachers show an interest, it makes sense to have local trainers who can help more schools use it.”

Brannon is also working with MSP teachers to start a Connected Math Program (CMP) users group. In February, a group of Webster Groves teachers traveled to Michigan State University to attend a conference on the middle school math curriculum.

Ferrell Roddy, seventh grade math teacher, uses CMP at Hixson Middle School. He says, “Michigan State is looking at developing a sort of targeted user group for the Connected Math Program to take the trainer course for Connected Math. It gives me a lot of desire to teach, seeing all the great modifications they’re planning.” Roddy is also interested in being part of an area-wide group of CMP users. He says, “Other districts have been impressed with our MAP scores, so we’ve opened our doors so anyone can come observe what we can do with the curriculum. I love it when people come visit. And I need to get out and see what others are doing as well.”

The Science Leadership Academy, a group of MSP elementary and middle school science teachers, has been meeting since summer 2004. In February, the group met to look at student work, and discuss how trends in student understandings and misconceptions develop.

Kary Brenton, science teacher at McNair Sixth Grade Center in University City, explains how the academy has helped her team assess student progress in informal ways. She says, “We’re learning how to ask a question that kids can actually understand and respond to. So often we just ask a question and kids don’t know what we’re talking about.” Brenton is also taking Edu 6004 Hands-On Science K-8: Biological Form and Function this semester. She says, “It’s great to be able to talk to other adults about science — that’s fun.”

**Student programs**

In addition to teacher programs, the St. Louis MSP also supports student programs. These include after school science clubs for elementary and middle students, and the Ascend high school program. In 2004-05, Ascend began its first full year, and the science clubs expanded from five to 10.

Science clubs offer after school structure and help kids get excited about science. For some, a first exposure to a concept in science club can help a student feel more comfortable when they encounter the terms in class. Many of the clubs offer parent nights once a month. Club coordinator Caroline Steinhauser says, “We try to do special stuff on parent nights. We’ve had showcases of science fair projects, and an interactive program about developing good life habits.”

The St. Louis Science Center, Saint Louis Zoo, and volunteers from Washington University coordinate the clubs for elementary and middle school students. (See related story about Adam Schickedanz.) The 2004-05 science clubs are: robotics and math clubs at Maplewood-Richmond Heights Middle School.
The Monsanto Fund awards $3.7 million to Science Outreach for mobile program

The Monsanto Fund has awarded Washington University $3.7 million to develop, build and operate two custom mobile classrooms. Washington University Science Outreach will lead a partnership, including the St. Louis Science Center, the Missouri Botanical Garden, the Saint Louis Zoo, and the University of Missouri-St. Louis, to create and provide programming on the vehicles.

The program will help young elementary school students develop enthusiasm for learning and doing science, through interactive experiences and exhibits. It will also assist teachers in doing classroom science investigations through workshops and materials loans. The program is designed to reach underrepresented public schools, and districts that have low average scores on the third grade science Missouri Achievement Program (MAP) test.

Deborah Patterson, president of the Monsanto Fund, explained the idea behind the project. “We wanted to bring a new level of excitement to science education by creating something that doesn’t currently exist,” said Patterson. “We came to Washington University because of their experience working hand-in-hand with teachers to effect positive change in the classroom, as well as their research and evaluation expertise.”

Development of the first vehicle, which will be designed for grades K-2, will take place this spring. The second vehicle will be built next year. The mobile classroom will be out on St. Louis streets in the fall, as it begins making its first school visits.

To create the program concept, Victoria May, director of science outreach, convened a group of local science educators, including Sally Saldaña, Maplewood-Richmond Heights Elementary School; Janice Shayne, Oakbrook Elementary School (Parkway), and Vhaness Brinker, consultant for the St. Louis Public Schools Vashon Education Compact. Educators from other institutions, including Carol Valenta, St. Louis Science Center; Luther Williams, and Barbara Addelson, Missouri Botanical Garden; Jim Jordan, Saint Louis Zoo; and Charles Granger, University of Missouri-St. Louis; provided their experience.

The group agreed that the project had to offer more in-depth content than a single visit could provide. “We didn’t feel it was enough to just go to a school and have kids come in for one activity,” explained May. “We wanted the project to be a starting point so schools could do more investigative science.”

The program includes a pre-visit workshop, where teachers can learn the basics of doing science that allows students to explore and ask questions. This type of teaching, called inquiry, can be challenging because it is time consuming and requires teachers to prepare materials. The Monsanto program will help bridge these constraints by allowing teachers to borrow a science materials kit to use in their classrooms.

“By the time the mobile classroom comes to the school, the kids will be ready to do an extension of the activities they did in class,” said May. A program coordinator will be based at a warehouse at the St. Louis Science Center’s Taylor Community Science Resource Center, and will provide scheduling support, teacher assistance, and science kit refurbishment.

The Monsanto program also will help teachers align their curriculum with Missouri standards. “We realized that we could provide hands-on activities around the grade level expectations for K-2,” said Mark Kalk, coordinator and instructor for science outreach.

In addition to the science outreach office, other Washington University departments are involved in the project. Graduate students in the department of education did a review of early childhood programs, and will develop evaluation plans. Olin School of Business graduate students researched costs and operations. As the project moves into the design phase, faculty and students from the School of Art will develop visual concepts for the vehicle.
Learn the science and preparation behind the classroom activities in the Modern Genetics for All Students curriculum guide (available at www.so.wustl.edu). The course is designed for high school teachers, and includes guest lectures and a field trip to the Washington University Genome Sequencing Center. Teachers from partner schools are encouraged to take the course; however, all interested teachers are welcome.

Dates: August 8-12, 8:30 a.m.-5 p.m.
Instructors: Susan Flowers, genetics director, and Karen Thompson, consultant
Location: Washington University Hilltop Campus, 151 Busch Lab
Credit: Two graduate credits in biology
Cost: $75 for teachers from partner schools; $350 for others; audit is free
Register: Contact Paula Smith, (314) 935-6846, psmith@biology2.wustl.edu

Modern Genetics is supported by the Monsanto Fund; the E. Reuben and Gladys Flora Grant Charitable Trust; and the Washington University Genome Sequencing Center, through a grant from the National Institutes of Health, National Human Genome Research Institute.

Teachers explore genomics and agricultural biotechnology

How can the smallest variations in gene sequence determine an individual’s susceptibility to disease? How can biotechnology improve our ability to feed a growing population? How can we make decisions about the use and availability of genetic information, as individuals and as a society? As the fields of genetics and genomics continue to advance, these issues are becoming increasingly vital for everyone to understand.

To help high school students understand these new scientific capabilities, the Monsanto Fund has provided support for development of new curriculum in genomics and agricultural biotechnology. A group of high school biology teachers plus genetics and biology faculty have been developing hands-on activities since the fall. The activities will become new chapters in the Modern Genetics for All Students curriculum guide in 2006.

The teacher-writers of the new chapters have been learning about the science, drafting the activities, and field testing them. Thank you to these high school teachers for helping to create the new content and activities: Bruce Chapman, Washington; Janet Eubanks, Francis Howell; Juanita Hartmann, Riverview Gardens; Elmer Kellmann, Parkway Central; John McGrath, Vashon (St. Louis Public); Chuck McWilliams, Maplewood-Richmond Heights; Valerie Mertz, Marquette (Rockwood); Bill Thoele, CBC; and Larry Wegmann, Crystal City. Thanks also to the project advisors: Sandra Clifton, assistant professor of genetics, Carla Easter, outreach director for the Genome Sequencing Center; and Eric Richards, associate professor of biology.

The new Modern Genetics curriculum development is supported by the Monsanto Fund.

for high school biology classes

DNA Science Days preview the university experience for science-minded students

Bridge the gap between high school and college life by bringing your students to Washington University for a DNA Science Day. This free program includes:
• College level genetics lab investigation
• Lunch and campus tour
• Bus transportation

“I encourage students to ask about the science, and also about college, careers, and anything else they can think of,” says Susan Flowers, genetics director. “The day starts out very science-oriented, but when they return from the campus tour, they have more questions about what it’s like to major in science, or to live on campus.”

To book a visit for 2005-06, contact Flowers, (314) 935-4217, flowers@biology2.wustl.edu.

DNA Science Days are supported by the Howard Hughes Medical Institute.
Schickedanz takes science to students

“Ok, everybody, listen up,” says Adam Schickedanz ’03, continuing a discussion as 20 middle school students get settled in a classroom. “If we’re animals, what kind of cell parts do we have!”

Posing questions like these comes naturally for a science teacher, but Schickedanz isn’t one, at least not in the standard sense. He’s a volunteer for Washington University Science Outreach, organizing and leading weekly science clubs at three St. Louis schools.

The club members spread out through the school to collect cell cultures from different locations. It’s hard to tell who moves faster, Schickedanz or the students, as they explore classrooms, hallways, restrooms, the cafeteria, and the gym. Then, Schickedanz and three other volunteers help the students use microscopes to discover how plant and animal cells look and function differently from each other.

Lanesha McPherson, science teacher at McNair Sixth Grade Center in University City, lends her room to the club, but lets the Washington University team lead the activities. She says, “Adam is great, and he’s great with the students. He doesn’t create that barrier. When he comes in, the kids are looking for him.” McPherson adds, “He’s been a really good role model for the other Washington University students who come in. They follow his lead.”

Schickedanz’s comfortable rapport and organized approach have developed with experience. In 2001, he was part of a group of volunteers that started a science club at Webster Middle School, in the St. Louis Public district. Since then, he’s continued to work with the Webster club, bringing in new students after a reorganization doubled school enrollment in 2003.

“We don’t want it to feel like we’re their teachers,” says Schickedanz. “We want to do something fun, and to have a more personal interaction.” As word about the science clubs spread at the university, students in majors besides the sciences got involved. A separate near-peer mentoring program grew out of the club at Webster.

Architecture major Chad Jones ’06 has worked with the Webster club, and now volunteers with the McNair club. “I got involved through a pre-med friend, and the mentoring aspect is rewarding to me,” he says. “Adam is great. It’s great to see someone so passionate about doing something with kids.”

Leading the science clubs involves extensive preparation each week. “Adam gets all the materials ready and plans the activities, says Kristin Sobotka, Teaching Teams coordinator.

Since graduating with a major in biology, Schickedanz has continued to volunteer with the clubs, and to work in a genetics research lab at the School of Medicine. His supervisor, James Skeath, associate professor of genetics, says that Schickedanz has assumed increasing responsibility over the years. “More recently, he’s taken on an independent project looking at a specific protein that regulates how a cell divides,” says Skeath. “He’s played an instrumental role in pushing the project forward.”

Skeath adds, “He definitely has the drive to do whatever he wants. He’s driven by a social conscience. It’s not about him, which is nice. It’s about helping people; that’s his driving force.”

Schickedanz’s fourth year of involvement with science clubs will likely be his last. He’s considering offers from four medical schools, including Washington University. Although he has not yet decided on a specialty, he’s leaning toward pediatrics. “I’ve thought about teaching [as a career],” he says. “Education is something I want to incorporate into medical practice. There are a lot of programs that look at pediatric health from the perspective of the whole child, that suggest you can’t just treat a sore throat or give a kid an inhaler and expect that everything will be great. I’ve thought about going into education for a long time, and medicine for a long time, but at the end of the day I’m going to try to do both in a certain sense.”

Schickedanz got an early exposure to teaching from his parents. His mother is a professor of education who specializes in preschool, and his father is a clinical psychologist who works in alternative high schools. He grew up in Boston and attended public schools, where he began playing lacrosse. At Washington University, Schickedanz played defense on the club lacrosse team for four years. He stays involved with the team as an assistant coach.

Schickedanz gives credit to his club co-mentors, who are in various undergraduate programs at Washington University. He says, “Each of them knows they are responsible for making the most of the opportunity they have to educate kids. When you have that kind of responsibility, you have to take it seriously. They make the most of every hour with kids they have. They’re all very mature, very smart, just good people who want to make a difference.” — a description that certainly applies to Schickedanz himself.
Spring 2005

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Keeping Busy
Rosie Koch, graduate student, and Stan Braude, lecturer in biology, have won the 2004 Jack Ward Film Award from the Animal Behavior Society of America, for their short documentary, “All the Trappings.” The film, which was featured at the St. Louis Film Festival, explores the life of the African naked mole-rat, and how to safely and humanely study them. Koch and Braude were involved in the development of the Outreach Partnership curriculum, “The Ethogram and animal behavior research: in your classroom and at the zoo,” sponsored by the National Institutes of Health, Science Education Partnership Award.

Sarah C.R. Elgin, professor of biology, received the 2004 Governor’s Award for Excellence in Teaching from former governor Bob Holden. Her work as the founder of Science Outreach and the project director for many of its efforts led in part to her nomination for the honor. “She has been enormously important to a great number of our students for more than two decades, and has made a major impact on K-12 science education,” said Edward S. Macias, dean of Arts & Sciences.

Learn how the sciences can inform creative writing at the Poetry and Gardens Celebration, Saturday, April 9, noon-2:30 p.m., at the Missouri Botanical Garden. Poets, writers, and musicians will join students from Mitchell Elementary School (St. Louis Public), senior residents from Tower Grove Manor, and DeLois Buckley’s students from Riverview Gardens High School for readings, music, and storytelling. The event is free and open to the public. For information, call (314) 991-1529, or visit www.elders-probe-the-arts.org.

John McGrath, biology teacher at Vashon (St. Louis Public), left, looks on as Carla Easter, outreach director for the Genome Sequencing Center, middle, and Bill Thoele, biology teacher at CBC High School, right, test a simulation of selective breeding. McGrath devised the simulation using a deck of cards. McGrath, Easter, and Thoele are part of a group that is developing new high school genetics curriculum. To learn more, see page 6.