Fall 2007

Fall 2007

SOUTHERN ILLINOIS UNIVERSITY CARBONDALE

perspectives

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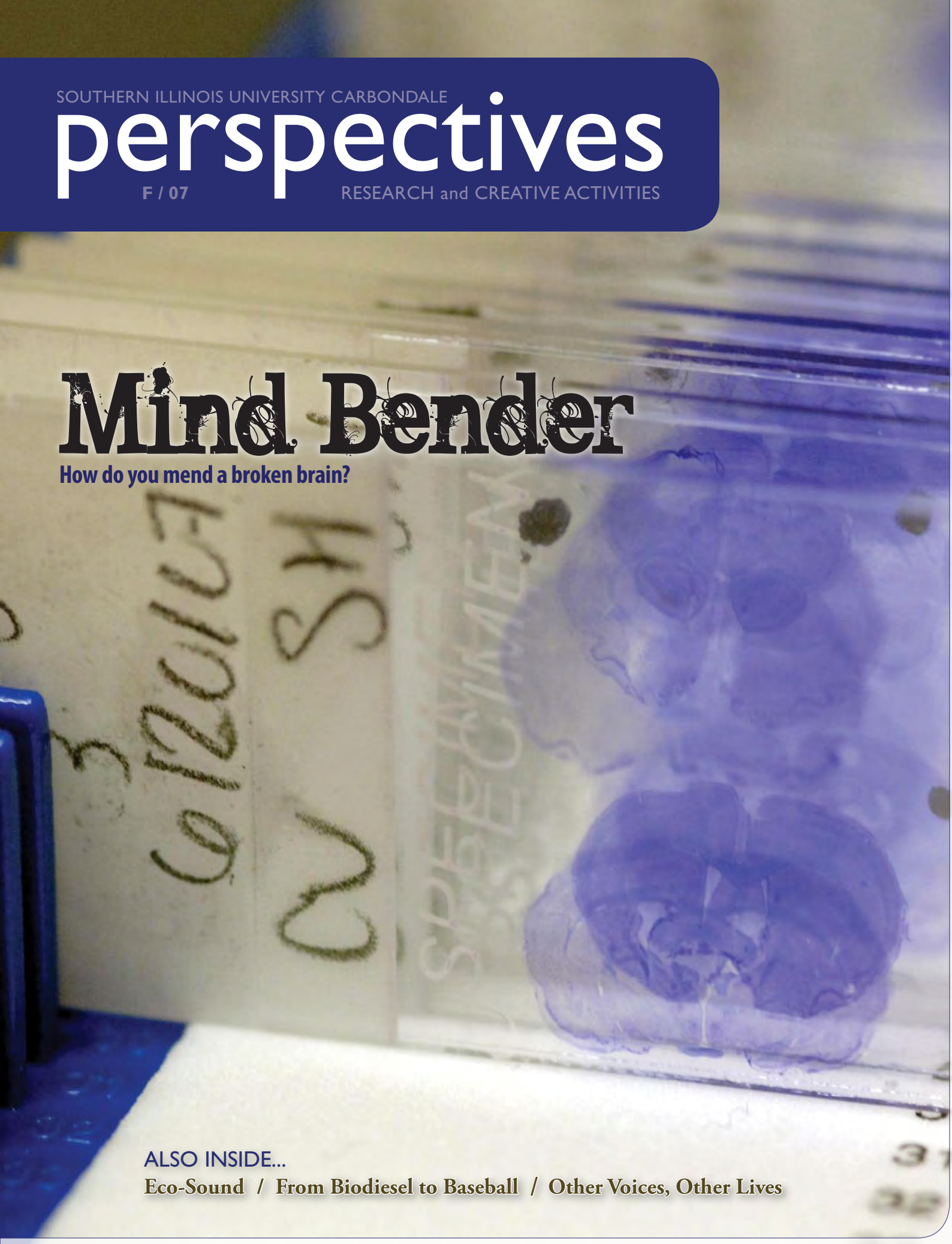
RESEARCH and CREATIVE ACTIVITIES



Mind Bender

How do you mend a broken brain?

ALSO INSIDE...

Eco-Sound / From Biodiesel to Baseball / Other Voices, Other Lives

outlook

The job of a university is not just to pass along the wisdom of the ages, but also to discover, reinterpret, improve, and create. This issue focuses on the new, and thereby hangs a tale: the varied ways that work done at SIUC affects the public.

Our feature articles this time around include a look at potential new therapies for traumatic brain injury; a visit to a new park, established and being surveyed with SIUC's help, to conserve tropical habitat; and a profile of SIUC's resident playwright, whose new dramas have been winning awards and entertaining audiences around the nation.

A fourth feature examines a sampling of recent projects in which new technology developed or refined at SIUC is being patented or marketed, bringing the fruit of University research to society. Four of SIUC's colleges—Agriculture, Education, Engineering, and Science—are highlighted in this article, demonstrating the diversity of technology transfer here.

Several more tech-transfer stories appear in our Research Survey section, with applications ranging from wheelchair control devices to explosives detection. A number of these projects involve nanotechnology, an area of tremendous growth at the University and nationwide.

Finally, to continue the theme of the new, after seven years with the same design *Perspectives* has a fresh look thanks to art director Jay Bruce of University Communications. We hope you find this issue both intellectually and visually engaging.

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Perspectives • Fall 2007

Perspectives: Research and Creative Activities at Southern Illinois University Carbondale is published twice a year, in spring and fall, by the Office of the Vice Chancellor for Research/Office of Research Development and Administration (ORDA).

To be added to our mailing list, obtain back issues, or request permission to reprint material, contact the editor at ORDA, Woody Hall C206 - Mail Code 4709, SIUC, 900 S. Normal St., Carbondale, IL 62901, (618) 453-4540, perspect@siu.edu. Back issues also may be found at www.siu.edu/~perspect.

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COVER: Brain sections from rats, which are used as an animal model to study possible treatments for traumatic brain injury. See pages 12-15.

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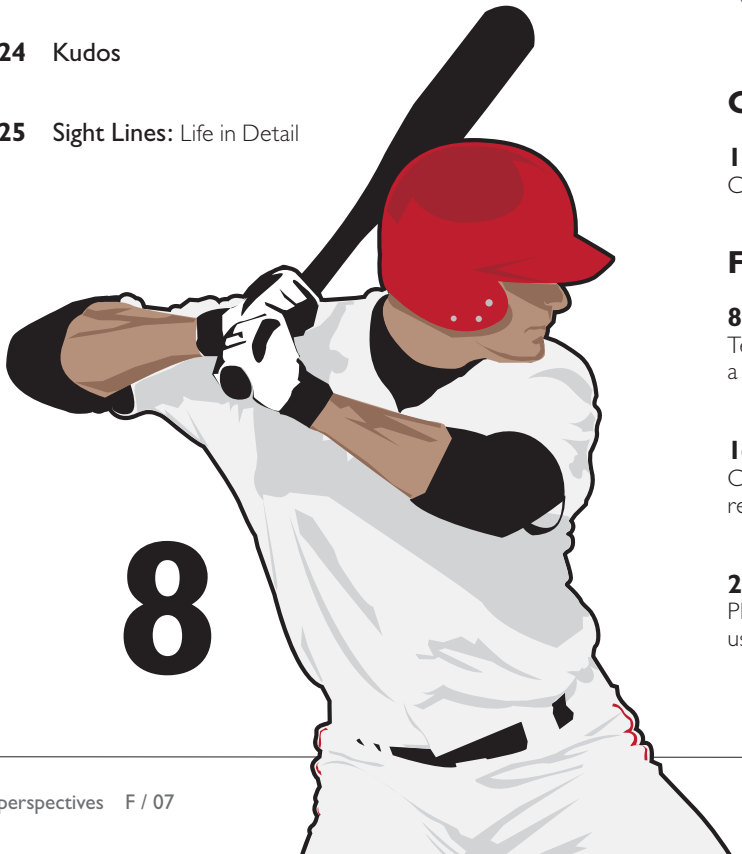


PLAYING IT BY EAR

An SIUC researcher's work on human-machine interfaces might give soldiers and people with profound disabilities more control over their activities and environment.

Lalit Gupta, professor of electrical and computer engineering, is a leader in harnessing signals generated by the human body and using them to control mechanical devices.

The body and brain constantly emit electrical impulses or other signals relative to whatever a person is doing, hearing, or seeing at any given time, Gupta says. Researchers can detect these signals through a variety of methods, including placing electrodes on a subject's head and recording the electrical activity.

The problem for researchers is tuning out the extraneous "noise" and identifying the specific signals they're looking for.

Gupta's work focuses on signal pattern recognition, or discerning the specific voluntary control signals generated by the body or by the brain in response to external audio (tones) or video (pictures) stimuli. Once he detects these patterns he can devise ways for the subject to control a device such as a computer or wheelchair by using those specific signals.

Lalit Gupta demonstrates a device that measures air pressure changes in the Eustachian tube caused by moving one's tongue. A company called Think-a-Move recently began marketing a wheelchair based on the technology.

Recently, a company called Think-a-Move began marketing a wheelchair based on technology Gupta helped perfect. The wheelchair is controlled by the changes in air pressure inside a subject's Eustachian tube that occur when the person moves his or her tongue to different places inside the mouth.

Think-a-Move engineers had suspected that the tongue movements caused changes in the pressure, but needed a researcher to find a way to correlate the pressure changes with the different tongue movements. The company approached Gupta in 2003.

Gupta developed a strategy to filter the signals and to automatically detect, segment, and classify the ear pressure signals associated with moving one's tongue to the left, right, up, or down. SIUC students served as test subjects as Gupta determined the specific air pressure signatures associated with the tongue movements.

The system uses a small hearing-aid–like device that is actually a microphone. Once placed in the ear canal, it can detect the subtle air pressure changes associated with certain tongue movements and send them via a wire to a control unit hooked to the wheelchair.

"We were able to verify this approach works and got to where we could recognize these signals 97 percent of the time," Gupta says. The signals are largely the same for everyone, but the machine can be fine-tuned to the individual using it.

A person can control the wheelchair by moving his or her tongue to different positions. Where a person is capable of more complex tongue movements, such as flicking the tongue up twice, the system can respond to as many as 20 different commands. International media and scientific magazines reported on the technological breakthrough earlier this year.

Gupta also sees other potential applications for such devices and technology, such as devising communication methods for disabled persons who are fully aware but unable to communicate.

"It would help in very simple, binary conversations," he says. "A person would be able to answer yes or no, or communicate other ideas. There wouldn't be a large market for this, but for the people who need it, it would be very valuable."

The U.S. Army also is interested in a related technology as a means of hands-free control for vehicles. Gupta's research has shown that a similar device inside the Eustachian tube can discern spoken words. Because the device is inside the ear canal, it is shielded from the high ambient noise of the battlefield or heavy vehicles and thus is easier to use for voice command driving.

—Tim Crosby

For more info: Dr. Lalit Gupta, Dept. of Electrical and Computer Engineering, lgupta@siu.edu.

CARE SHORTAGE

The SIU School of Law's Center for Health Law and Policy has received grants from the Commonwealth Fund and the California Health Care Fund to study causes of a nationwide shortage of physicians who care for nursing home patients.

The two foundations are finding "it's getting harder and harder for nursing homes to attract physicians to come into their [facilities] and care for their patients," says project director Marshall Kapp, Garwin Distinguished Professor of Law and Medicine and the center's co-director.

With 1.5 million Americans in nursing homes, the issue affects quality of care for a "significant population that often gets overlooked in health policy discussions," he says.

States grappling with the issue include California, Florida, Texas, and, anecdotally, Illinois.

"If you talk with nursing home administrators, particularly the smaller nursing homes, they almost all complain about the problem of getting physicians to come in and follow their patients," Kapp says.

The two foundations want to know the reasons for that reluctance and to come up with some solutions.

Malpractice litigation may be a key factor, Kapp says.

"Up until five to 10 years ago, doctors almost never got sued relating to their treatment of nursing home patients. That has changed to the point that a substantial number of lawsuits are being filed—not just against nursing homes but, we think, and this is what the study will look at, also against physicians who are caring for nursing home patients."

The study aims to separate genuine causes from exaggerated perceptions and unrealistic fears. It will review relevant legal, medical, ethical, health policy, and health services literature, along with legal cases, statutes, and regulations. It will include interviews with officials from relevant organizations, such as the American Geriatrics Society and the American Medical Association. And it will include interviews with physicians involved in caring for nursing home residents, as well as with attorneys who represent and advise nursing homes, residents or their families, and physicians.

The study will also examine if it makes a difference whether a nursing home is a for-profit or not-for-profit facility, Kapp says. Between 75 and 80 percent of nursing homes are for-profit facilities.

The findings, expected in spring 2008, could result in recommendations for more professional education in law schools and medical schools, better risk management by nursing homes, and legislation, if needed.

—Pete Rosenbery

For more info: Dr. Marshall Kapp, School of Law, kapp@siu.edu.

Fathering Problems

A 21-year-old SIUC student explained her research to the country's lawmakers last April on Capitol Hill.

Microbiology major Sara Reardon took second place at the inaugural St. Louis Area Undergraduate Research Symposium in 2006. This year, she was one of 60 students chosen by the Council on Undergraduate Research from a national pool of hundreds of applicants to participate in the group's annual "Posters on the Hill" exhibit in Washington, D.C.

Her work focuses on a gene, called DEAF-1, that when mutated may drive cancer development and impair fertility in mammals, including humans.

Sara Reardon and Michael Collard.

Reardon joined the research team of physiologists Michael Collard and Jodi Huggenvik in her freshman year. She started out by maintaining their mouse colony. Some of these mice lack a working copy of DEAF-1.

"We knew there was this defect in male fertility," Collard said of the mice. "It was Sara who established to what degree this loss occurs and the genetic background that produces it."

Male offspring of these so-called "DEAF-1 knockout" mice often have a normal DEAF-1 gene—yet they still have impaired fertility. Collard, Huggenvik, and Reardon believe the explanation lies with DNA methylation. As part of reproduction and development, methyl groups attach to DNA, affecting gene expression. The team thinks that the absence of the DEAF-1 gene changes the methylation of other genes in a mouse's sperm or eggs.

These methylation abnormalities get passed along to the mouse's offspring. That's why the offspring—even if they have a normal copy of the DEAF-1 gene—can still suffer inherited fertility problems, obesity, and prostate cancer.

Reardon, now working as a graduate student in Collard's lab, is testing that hypothesis, which may have applications to human health. She has invented techniques to look at changes in DNA in 7,000 mouse genes to determine which genes may be affected by methylation abnormalities. After graduate school, she plans on a career in biomedical research.

For more info: Dr. Michael Collard, Dept. of Physiology, mcollard@siumed.edu.

HEALTHIER KIDS

SIUC's Center for Rural Health and Social Service Development will use a recently awarded federal grant to help improve the health of children and adolescents in Southern Illinois.

The $428,560 grant, from the U.S. Department of Health and Human Services through its Delta State Rural Development Network Grant Program, will enable the center to work with other local agencies to provide school-based programming in the southernmost 16 counties of Illinois. The grant is renewable for two more years pending federal funding.

As the designated grantee for Illinois, one of eight states that make up the Mississippi Delta Region, the center has received funding each of the last six years for a variety of programs to improve health care access in the Delta region. Working with 14 subcontractors, it has initiated or assisted with school-based health centers, supported-living programs, emergency medical services, and "healthy communities" coalitions.

With the current round of funding, says center director Tess Ford, the aim is to improve health and reduce obesity among Southern Illinois youngsters by increasing their physical activity and improving their nutrition. Ford is the project director and James Teufel is the project evaluator and grant writer.

The funding will allow for the expansion of physical activity and nutrition programs through the "Coordinated Approach to Child Health" (CATCH). All 105 elementary schools in the Illinois Delta Region will be eligible to participate in CATCH, and Ford expects that about 30 will do so by the end of the grant-funding period in 2010.

CATCH is a nationally recognized, community-based school program that worked well locally in its pilot stage, she says. Now, the program is expanding through a new model, "Catch on to Health," to 13 rural Southern Illinois schools this year. The center will work through the regional offices of education to recruit additional schools.

"Color Me Healthy," another component of the program, is aimed at preschool children. The Child Care Resource and Referral Center at John A. Logan College in Carterville will implement "Color Me Healthy" in local Head Start programs, Ford says.

The Center for Rural Health and Social Service Development will work with Southern Illinois Healthcare, the Southern Seven Health Department, and the Egyptian Public and Mental Health Department, partnering as the Illinois "Catch on to Health" Consortium.

The center also has received a $100,000 supplemental Innovation Grant to provide specialized mental health services for Southern Illinois children through Shawnee Health Services.

Most of the funding for these projects goes to the community subcontractors to provide the much-needed services. The center's primary role is developing, coordinating, and evaluating the projects and providing training and technical support.

"It's really the University reaching out to the community through community outreach and community development inititives," Ford says.

—Christi Mathis

For more info: Dr. Tess Ford, Center for Rural Health and Social Service Development, tessh@siu.edu.

TO CATCH A BOMB

The webs Ling Zang spins are made of fibers thousands of time thinner than a spider's silk, and far more sensitive.

That's because he's not hunting insects; he's using so-called nanowires to snag molecules that indicate the presence of explosives.

An assistant professor of chemistry, Zang has received a five-year, $592,000 grant from the National Science Foundation to further develop his work on the fabrication of organic-based nanowires.

The NSF is funding Zang's research through its CAREER program, which helps promising scholars establish their research a at high level and integrate research with teaching. SIUC faculty have received eight of the prestigious grants over the past few years.

Zang and his students are developing a new generation of extremely acute sensing devices at the nanometer scale. (Generally speaking, nanomaterials have at least one dimension that measures less than 100 nanometers. To put that in perspective, your average human hair measures roughly 100,000 nanometers across.)

The infinitesimally small threads Zang works with are strings of molecules constructed with specific geometries. Together, these so-called nanowires act as a super-fine filter that can catch single airborne molecules from explosives (such as TNT) or poisonous substances (such as hydrazine).

Zang collaborates with University of Illinois chemist Jeff

Ling Zang (right) works in his laboratory with graduate students Kaushik Balakrishnan (left) and Tammene Naddo. Below: This image, taken with an electron microscope, shows the nanowires that could serve as the basis for ultra-sensitive bomb detectors.

Moore, who makes specially functionalized organic molecules. Zang then uses those molecules to fabricate the nanowires at SIUC. The University is patenting the technology on behalf of the two scientists.

The technology could be a vast improvement over current sensors in terms of sensitivity to extremely low levels of telltale molecules. Future research also may improve the selectivity of such instruments, which refers to their ability to detect various substances.

Even though they may be solid substances, bombs and TNT give off trace amounts of vapor—a few parts per billion or per trillion in the atmosphere. For instance, a landmine buried beneath soil emits about 40 parts per trillion of TNT into the atmosphere.

A typical electronic sensor, such as those used in airport screening, can detect vapors at 100 parts per trillion. But Zang has evidence the materials he fabricates can detect levels below 10 parts per trillion.

"This is a newer technology that would provide better sensitivity and minimize problems like having false positives," says Zang. "As you can imagine, you don't want many false positives when you're dealing with explosives."

When the molecules are strung together in nanowire form, sort of like plates in a stack, they can be excited by ultraviolet light. In other words, the nanowires are fluorescent.

But when a TNT molecule lands on the matrix of nanowires, it "quenches," or turns off, the fluorescence. That quenching can be detected by the electronics package with which the nanowire filter is mated.

Another type of nanowire with which Zang is experimenting uses a different approach to detect poisons such as hydrazine, a gas used in submarine environments and rocket fuel.

With the NSF funding, Zang is experimenting with different geometric structures for the nanowires, looking for optimal performance. He and Moore also are working to synthesize organic molecules with improved sensitivity and selectivity—the ability to detect a greater range of substances—for the nanowire building blocks.

Finally, Zang will use the grant to explore marrying two types of sensors—optical and electronic—into a new hybrid sensing technology.

Zang's laboratory includes four graduate students, one postdoctoral fellow, three graduate students he shares with other researchers, and several undergraduate students.

"I see [the CAREER award] as an award for my whole group," he says.

"Without their hard work, I can't do anything. I'm so proud of them."

—Tim Crosby

For more info: Dr. Ling Zang, Dept. of Chemistry and Biochemistry, lzang@chem.siu.edu.

CLUTCH TIME

Carbon nanomaterials developed at SIUC might revolutionize clutches for vehicles and other machinery.

The materials, developed by engineers at the University's Center for Advanced Friction Studies, sustain wear from the inherent friction that clutches endure better than traditional materials such as Kevlar, says Peter Filip, the center's director. Nanomaterials are made of ultra-small structures designed at the molecular level and often measuring only a few molecules across.

SIUC is working with Tribco Inc., of Cleveland, a high-technology company producing advanced friction products for brakes, clutches, and other industrial applications. The new materials contain Kevlar modified with nanoparticles and nanofibers. Filip and SIUC friction researcher Tod Policandriotes, along with two Tribco employees, figured out how to impregnate Kevlar with the nanomaterials, testing the resulting composites both at SIUC and in the Tribco production lines.

"My idea was to incorporate different types of nanomaterials into current Tribco products because (nanomaterials) end up on the friction surface and make the friction layer stronger and more adhesive," Filip explains.

Tribco is working with the University to investigate the new materials' potential in clutches. "Whether they make a good friction material that is safe is something we're trying to determine," says company president David Bortz.

"The materials have properties that lend themselves for use in friction materials, so there's good reason to hope they will work."

Filip notes, "These materials provide a significant improvement in clutch wear—up to 400 percent improvement at elevated temperatures. As the friction is increased, this material actually grabs better, resulting in lower wear with high friction."

The composite materials make the wear surface more thermally stable and may increase the life of a clutch by five times, he says. They could have excellent application in military and heavy vehicles, as well as industrial machines.

Policandriotes conducted much of the development process during the last two years. The center's team of industrial advisers funded the research.

Bortz says Tribco also is working with other industry partners to provide SIUC with additional testing equipment for wet friction applications.

"SIUC, with the Center for Advanced Friction Studies, has the best academic testing base in the country, maybe the world," Bortz says. "We want to help round that out."

—Tim Crosby

For more info: Dr. Peter Filip, Center for Advanced Friction Studies, filip@siu.edu.

Winners

• J. B. Ruhl's dissertation in geography on the economic value of ecosystem services, which was featured in the fall 2006 issue of *Perspectives,* netted him the University's 2006 Outstanding Dissertation Award. Ruhl, geography professor Chris Lant, and agribusiness economics professor Steven Kraft recently published *The Law and Policy of Ecosystem Services* (Island Press, 2007).

• The SIU Alumni Association's 2006 Outstanding Thesis Award went to Jemil Yesuf in civil and environmental engineering (now a doctoral student in engineering science). Yesuf—shown here adjusting a piece of equipment in the fluid mechanics laboratory—improved mathematical modeling techniques for designing GAC (granular activated carbon) systems to remove textile dyes from factory effluent. His research also demonstrated that GAC systems using almond shells, an agricultural byproduct currently disposed of in landfills, can be used for dye removal. Yesuf went on to win the 2007 Midwest Association of Graduate Schools' Outstanding Thesis Award. His thesis advisor was Lizette Chevalier, professor of civil and environmental engineering.

• In 2007 there were two winners of SIUC's annual Outstanding Graduate Student Researcher Award. Kaushik Balakrishnan, a doctoral student in chemistry, fabricates and studies the characteristics of nanowires and "nanobelts" made from organic semiconducting molecules. Such nano-assemblies, he explains, "have now emerged as unique building blocks in the miniaturization of optoelectronic devices." Balakrishnan, who works with chemistry professor Ling Zang (see pp. 4-5), has published several first-authored articles in top chemistry journals. He won his department's teaching excellence award in 2003 and held an internship with Motorola in summer 2006.

The second winner, Abhijit Shukla, also has had several papers published in top science journals. A doctoral student in biochemistry and molecular biology, he works with professor Sukesh Bhaumik to understand the mechanisms involved in gene regulation. For organisms to function normally, genes must be properly "translated" into RNA, which drives protein manufacturing in the cell. When this process goes awry, various diseases, including cancer, can result. Shukla, who concentrates on gene regulation mechanisms implicated in human diseases, holds a two-year, $52,000 fellowship from the American Heart Association to help fund his research.

NANO ANIMATION

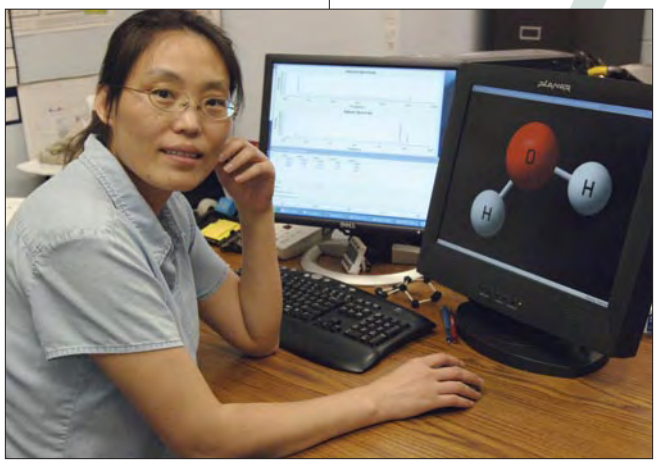
Even the mightiest microscopes cannot peer into the world of molecules and atoms, where the secrets that potentially could unlock unlimited clean energy are thought by many scientists to reside.

But an SIUC researcher is opening a window to that super-small world using computer modeling that can "virtually" bring scientists face to face with chemical reactions at the molecular level.

Lichang Wang, associate professor of chemistry and biochemistry, has received a four-year, $200,000 research grant from the National Science Foundation for her work on "nanostructured" fuel cell catalysts, meaning that their size, shape, and composition are controlled at the molecular level.

Wang and her graduate and undergraduate students are collaborating with a team of researchers from the State University of New York at Binghamton working on catalysts that engineers can incorporate into the design of electric fuel cells for future automobiles and other uses. Using sophisticated software, including some programs developed at SIUC, she will help the other researchers "see" how different atoms would interact under given situations in an effort to help them build the most efficient and effective catalysts.

She'll do this through computer modeling and animation, which allows the researchers to test approaches in cyberspace before going to the time, trouble, and expense of testing them in a real-world laboratory.



Lichang Wang uses computer modeling to save time and money for researchers developing fuel cell catalysts.

"It is very difficult and time-consuming to make and control the various catalysts in the laboratory, as we're talking about nanoscale structures, and controlling variables such as temperature exactly is very important and difficult," Wang says. "But my students and I can make virtual catalysts using the computer relatively easily.

"We can control variables, like temperature, and we can tell the researchers doing experiments, for instance, whether temperature is a very important variable or not in a particular [case], based on our simulation results."

In fuel cell research, finding the best catalyst to turn oxygen to water is critical, Wang says. This "oxygen reduction reaction" is one of the research team's main challenges, along with improving membrane conductivity and hydrogen storage and production methods.

Wang uses theoretical calculations to produce animation sequences that show the reactions happening. Researchers can tell from the movements how to make improvements in catalyst formulations. They can also view the reactions from different angles, picking up further clues.

The way the molecules move when stimulated by light of various frequencies gives the scientists clues on how to break the relevant chemical bonds present. This results in the desired reaction, such as hydrogen production.

"From that perspective, we can actually see what's happening," Wang says. "As we change the variables, the animation changes, too."

With the computer simulations providing pinpoint control over a virtual experiment's variables, the results are "purer" and more reliable, Wang says. The approach also makes the research "greener," in that the scientists don't have to use actual chemicals in the initial stages of work.

—Tim Crosby

For more info: Dr. Lichang Wang, Dept. of Chemistry and Biochemistry, siu29151@siu.edu.

Detective Work

The U.S. Departments of Homeland Security and the Treasury are using crime-fighting software developed at SIUC.

The treasury department recently asked Jake Rose, associate professor of accountancy, to create software that detects fraud in financial and tax data. Rose met the challenge by designing software that identifies irregularities in the distribution of digits in large sets of data—patterns indicative of fraud.

"I designed the software to allow agents with very little technology training to take advantage of the information available in large financial datasets," says Rose, who won the College of Business and Administration's 2007 Research Excellence Award.

He also provided the agency with custom training materials and practice cases.

Federal officials recently announced that Rose's software will also be used for training and field investigations by the Department of Homeland Security and other federal law enforcement agencies.

"Digital fraud detection techniques can greatly increase the efficiency of field investigations," Rose says. "I am very hopeful that the software will allow federal law enforcement agents to prevent and detect financial and tax fraud more quickly and effectively."

—Sun Min

For more info: Dr. Jacob Rose, School of Accountancy, jakerose@cba.siu.edu.

From Biodiesel to Baseball

Story by Tim Crosby, K. C. Jaehnig, and Marilyn Davis; illustrations by Evan Bowers

Technology transfer at SIUC casts a wide net.

What do biodiesel fuel, obesity, equipment operation, and sports training have in common?

All are areas in which SIUC is doing innovative research that may lead to commercialization or is already helping industry.

SIUC's technology transfer portfolio consists of new materials, devices, therapies, processes, and plant cultivars that are being or have been patented, licensed, or otherwise commercialized. These developments and discoveries by faculty and staff run the gamut—from disease-resistant soybean varieties, to super-tough materials for machining (see www.siu.edu/~perspect/05_fall/diamond.html), to a possible medical treatment to prevent or improve hearing loss (see www.siu.edu/~perspect/07_sp/hearing.html).

SIUC is a relative newcomer to tech transfer and commercialization. But our faculty are an enterprising lot: over the past decade, they've disclosed 174 inventions, leading to 47 licenses or options being issued to companies and 77 patent applications filed.

Now a look at those four areas.

Fueling up from the fat of the land

Restaurant owners consider the dark, smelly drippings in their grease traps a liability. After all, they have to pay someone to haul the stuff away.

But Yong Gao sees great opportunities in those grease traps.

Gao, an associate professor of chemistry, believes he's found the chemical means to turn used cooking oil into biodiesel fuel to run automobiles. Biodiesel is becoming more popular worldwide, with some of the biggest potential markets in Europe, where a much higher percentage of automobiles use diesel engines than in the United States.

Gao's process also will turn a useless byproduct of traditional biodiesel manufacturing—glycerin contaminated with sodium hydroxide—into pure, high-grade glycerin sought by the pharmaceutical industry. And, closing the loop, it would solve the disposal problem for used cooking oil, some of which can be "recycled" by feeding it to livestock but most of which simply has to be disposed of.

With the help of the technology transfer program, Gao recently opened Midwest Energy Group Inc. at the SIUC-based Southern Illinois Research Park. A small team there will run tests and do engineering design for full-scale production using Gao's concept, which he says he has proven will work in the lab. Gao, who has filed for two patents related to his novel application of the chemical processes involved, also is negotiating with top chemical industry corporations. He currently holds a Small Business Technology Transfer grant from the National Science Foundation to assist his endeavors.

Traditional biodiesel manufacturing starts with high-grade, pure vegetable oil—soy, palm, etc.—which is almost 100 percent triglycerides. The oil is mixed with methanol and a catalyst, then heated in a reactor. In about 30 minutes, the mixture transforms into two separate layers: biodiesel fuel and contaminated glycerin.

Used cooking grease contains only about 90 percent triglycerides; the remainder is free fatty acids. Such impurities are problematic in traditional biodiesel manufacturing, but not in Gao's new process.

He eliminates the problem by pretreating the waste oil in another reactor with a different catalyst that converts the free fatty acids into biodiesel. When the treated mix goes through the second reactor, the triglycerides are converted into biodiesel as usual, only with high-quality glycerin as a byproduct.

This new process would be cheaper, Gao says, because the source oil is cheaper and the pure glycerin is a value-added product offsetting the cost. The new process also would be more environmentally friendly since it doesn't generate contaminated waste products.

Gao plans pilot production tests this fall. He envisions SIUC becoming home to a biodiesel production demonstration plant, producing fuel while training future engineers in this environmentally friendly process.

"It would be wonderful if we had people from all over the world coming to Carbondale to see how this works," he says.

Fighting fat of a different kind

A synthetic compound could help fight fat and cut the chances of contracting a cluster of other conditions—cumulatively known as human metabolic syndrome—that can lead to heart disease, a team of multidisciplinary researchers spearheaded by SIUC has found.

"A lot of drugs now are treating either obesity alone or the individual conditions of metabolic syndrome—fat around the middle (the classic 'apple' shape), high blood pressure, high cholesterol and triglycerides, and insulin resistance, all of which can lead to heart disease," says team leader William Banz, professor of food and nutrition.

"These drugs are not treating the whole syndrome per se, and some of them can cause a marked weight gain. Treating obesity plus the accompanying metabolic syndrome is novel. A lot of drugs in the pipeline (of development) aren't doing that."

Cal Meyers, an SIUC chemistry professor who holds a weight-loss patent on the compound, began working with its weight-reducing properties in the early 1990s. Meyers heads the University's Meyers Institute for Interdisciplinary Research in Organic and Medicinal Chemistry.

After finding that the compound decreased weight significantly in both male and female rats, Banz and his team decided to take a closer look at what else the compound might do. Follow-up research conducted at SIUC suggests it may also help treat adult-onset diabetes as well as insulin resistance, which characteristically precedes the disease.

"Being overweight or obese is definitely part of metabolic syndrome," Banz says. "However, metabolic syndrome as a whole is the real culprit when it comes to increased risk for heart disease and adult-onset diabetes. That's why we needed to further test this compound.

"What we found was that it was beneficial in reducing body weight and risk factors for metabolic syndrome and diabetes." The research team published those findings in the journal *Obesity Research* in November 2005.

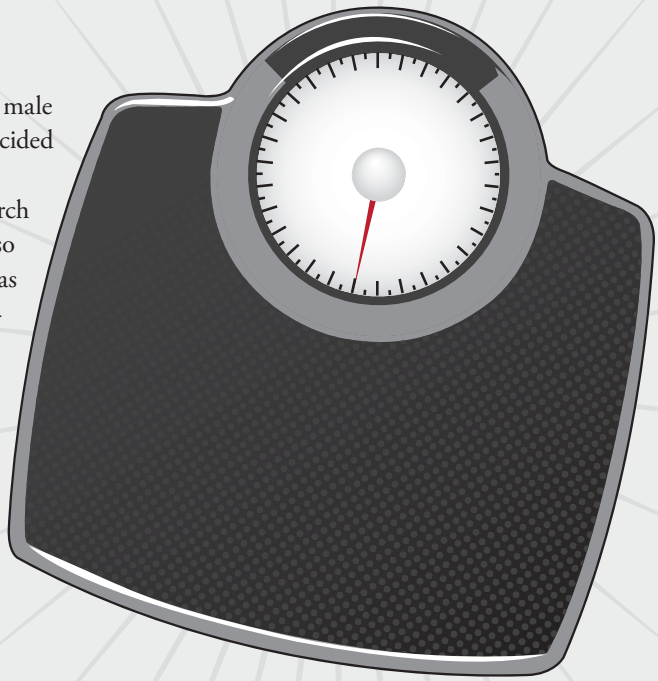
Most recently, Banz and his colleagues, along with assistant professor of physiology April Strader, have studied how the compound does in treating glucose intolerance, a key factor in the development and progression of diabetes.

"We found extremely encouraging results," Banz says. "It improved glucose tolerance and decreased other risk factors associated with metabolic syndrome." The researchers presented these additional findings last April at a national conference on experimental biology.

Funding for the project has come from Charles River Genetic Models in Wilmington, Maine; PreClinOmics Inc. in Indianapolis; the Fraternal Order of Eagles; and the Meyers Institute.

The next step, Banz says, will require an industry partner.

"We would like for a drug company to pick up the intellectual property option and develop it (as an experimental drug for use in treating human metabolic syndrome)," he says.



Making machines more user-friendly

Companies spend large sums of research and development money studying how the machines they build interact with human beings. The more natural the interface, the more comfortable the experience for the equipment operator, and the lower the chance of injuries, such as those caused by repetitive motion.

Ajay Mahajan is developing technology that will allow companies to study a human's motion in such an environment in a much more accurate and timely manner. A professor of mechanical engineering and energy processes, Mahajan initially developed his 3-D ultrasonic location-finding system for use in brain surgery, where accuracy down to 1 millimeter is essential. (See www.siu.edu/~perspect/05_sp/neuronavigation.html.)

Mahajan's system is much less expensive and more robust than existing brain surgery systems, which rely on stereoscopic cameras and electronics to orient the surgeon. It uses sensors on a surgeon's probe that transmit ultrasonic signals to an array of receivers, which can pinpoint exactly where the probe is in relation to the patient's brain in near real time. A patent is pending for the technology.

Mahajan is working with manufacturers to find ways to interface his technology with current systems, improving its reliability and accuracy. His system also might work as a low-cost alternative to existing technologies.

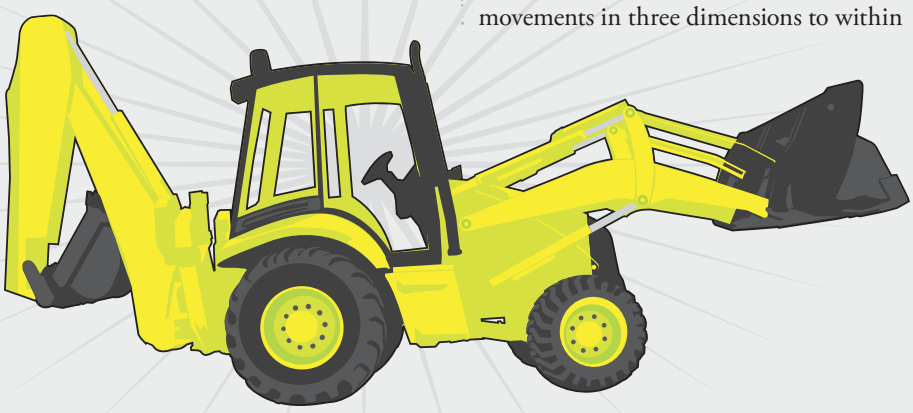
But it also quickly became apparent that the system had other applications. Caterpillar Inc. contacted Mahajan early in 2006 about using the system to improve its ergonomics program, which examines how operators of the heavy equipment it manufactures move about in the driver's seat as they control the powerful machines.

To do this, the company was using a stereoscopic-based system that tracked the action as an operator worked the machine while wearing a suit with brightly colored circles placed in key positions around the body (think Hollywood or video-game digital animation).

The system worked, but not as well as the company wanted. The accuracy was passable—it could detect positions to within about 1 inch—but the turnaround time between tests and actual data analysis took weeks.

Last summer, the Peoria-based company awarded Mahajan a grant to examine the feasibility of adapting the brain surgery technology to Caterpillar's needs. It didn't take long for Mahajan and his team—Haibo Wang, associate professor of electrical and computer engineering, doctoral student Sanjeevi Chitikeshi, and undergraduate Chris Jenkins—to prove it would work, even in the small, uncontrolled, and often harsh environment of a tracked or wheeled front loader.

The system, which the team is building and testing in a lab at the Engineering Building at SIUC, uses a network of 15 ultrasonic transmitters sewn into a suit worn by the operator and 10 receivers placed at various points throughout the cab. Engineers can record the operator's movements in three dimensions to within about 1.3 millimeters during a test. They can then easily download the information into a computer, where it is filtered using error-correcting algorithms and organized with specialized software the SIUC team also is developing.



Ultimately, the Caterpillar engineers will have quick access to accurate data—a big improvement over their current tools.

"Caterpillar has been a great blessing to us because it helped us take the technology in a new direction," Mahajan says. "We know now we can do it, we're just in the process of designing and turning this"—he sweeps his hand over the area of his lab covered with wires, circuit boards, and an array of transmitter/receivers—"into a set of simple black boxes. That's what Caterpillar will get when we are finished."

Knocking one out of the park

The legendary baseball pitcher Cy Young once said that pitchers, like poets, are born, not made.

Batters are another story.

Drawing on research techniques originally developed to study chess expertise, Peter Fadde has created video-based training drills that can transform a very good batter into an excellent one in no time at all—and he has the stats to prove it.

"It's no different than drilling in math," says Fadde, an assistant professor of curriculum and instruction who recently published an article on his training program in the journal *Technology, Instruction, Cognition and Learning.*

Batters need to automatically, not consciously, gauge where a pitched ball is headed so they know whether, when, and where in the strike zone to swing at it. Major-league batters make this decision in less than a quarter of a second—literally, the blink of an eye.

But a decision is a decision, even in such a short time frame, and that fact is key to understanding how Fadde came up

with his drills. He aimed to train batters to recognize what different pitches look like at the moment the ball begins rocketing toward them and to deduce from that where the ball is heading. The ability to recognize a pitch, he says, has much more to do with picking up clues from the pitcher, such as stance and hand position, than with sharp eyesight.

Fadde, who in 2003 was at Purdue University, tried out his first pitch-recognition training program that year with the school's baseball team. Batters watched videotaped clips of easy, medium, and hard versions of pitches thrown toward the camera. Easy clips showed about 150 milliseconds of ball flight—about one-third of the distance to the plate. Medium clips showed about 65 milliseconds of ball flight. The most difficult video clips cut to black immediately after the ball left the pitcher's hand, showing no ball flight at all.

Starting with the easiest clips and moving on to the most difficult, batters would call out the type of pitch thrown, and Fadde would tell them whether they'd made the right call.

"The essential elements of the drill-and-practice instructional method are repetition, immediate feedback, and progressive difficulty," Fadde says.

"The ballplayers would look at the zero-ball-flight clips and say, 'I feel like I'm just guessing.' 'Yes,' I would say, 'but now you're "guessing" 90 percent right instead of 25 percent.'" Expert batters usually report that they "just guessed" at the pitches they hit, Fadde adds.

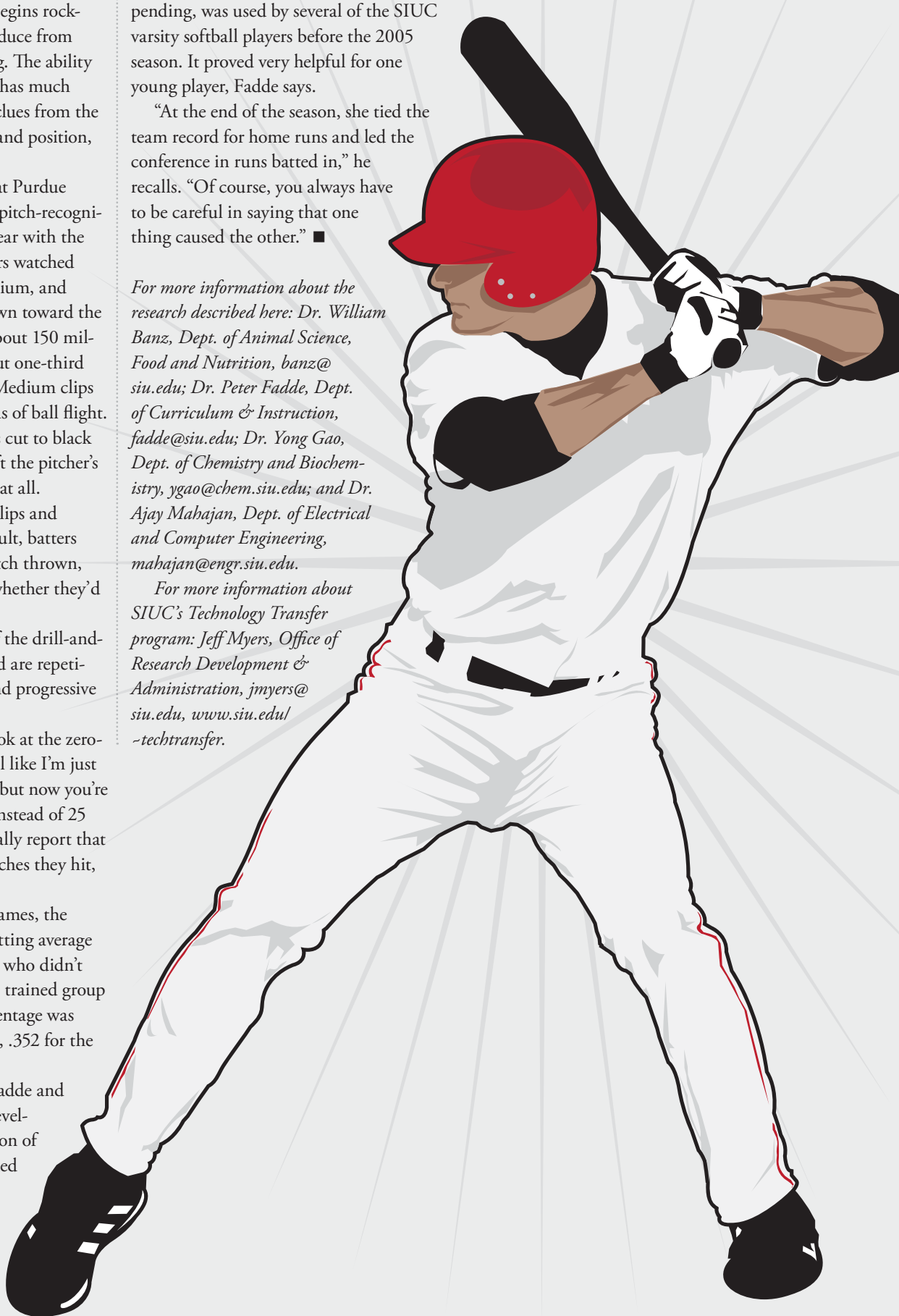
Over a test period of 18 games, the program scored a hit. The batting average for a control group of players who didn't receive training was .187; the trained group averaged .274. On-base percentage was .284 for the untrained group, .352 for the trained group.

Since coming to SIUC, Fadde and his graduate students have developed a laptop computer version of the program and have switched from baseball to softball. The program, for which SIUC has a patent application pending, was used by several of the SIUC varsity softball players before the 2005 season. It proved very helpful for one young player, Fadde says.

"At the end of the season, she tied the team record for home runs and led the conference in runs batted in," he recalls. "Of course, you always have to be careful in saying that one thing caused the other." ■

For more information about the research described here: Dr. William Banz, Dept. of Animal Science, Food and Nutrition, banz@siu.edu; Dr. Peter Fadde, Dept. of Curriculum & Instruction, fadde@siu.edu; Dr. Yong Gao, Dept. of Chemistry and Biochemistry, ygao@chem.siu.edu; and Dr. Ajay Mahajan, Dept. of Electrical and Computer Engineering, mahajan@engr.siu.edu.

For more information about SIUC's Technology Transfer program: Jeff Myers, Office of Research Development & Administration, jmyers@siu.edu, www.siu.edu/~techtransfer.



Mind Bender

How do you mend a broken brain? Neuroscientist Michael Hoane and his team of undergraduate and graduate students have made it their mission to find out.

Story by Marilyn Davis; photos by Russell Bailey and Jeff Garner

Literally and figuratively, traumatic brain injury is a killer. Each year in the United States it causes about 50,000 deaths, results in a quarter of a million hospitalizations, and permanently disables 80,000 to 90,000 survivors.

It's also a risk factor for depression, Parkinson's disease, and Alzheimer's disease. And it's become an even more pressing problem because thousands of Iraq War veterans are returning with often-undiagnosed brain injuries from explosions and accidents.

Yet doctors have few tools to fight TBI. Medical intervention focuses on reducing swelling of the brain in the days after injury to save lives and limit damage.

"TBI survivors have permanent disabilities—motor, sensory, cognitive, affective [emotional]," says Michael Hoane, an assistant professor of psychology who heads SIUC's Restorative Neuroscience Lab. "It's a socially and economically debilitating condition, and all potential treatments for it have failed in Phase III clinical trials" (the final stage of testing before a drug can be approved by the FDA).

When a person takes a punishing blow to the head, the trauma sets off a cascade of biochemical effects—swelling, inflammation, oxygen deprivation in the brain, and eventually neuron death—that can lead to short- or long-term impairment. The time course of this cascade varies, but the die is cast within a week or two of the injury. Beyond that, little can be done medically, although rehabilitation facilities can help disabled patients function better.

In fall 2001 *Perspectives* reported on research to improve learning and memory in TBI survivors by using a small implant that delivers mild electrical impulses to the body's vagus nerve (www.siu.edu/~perspect/01_fall/vagus.html). Hoane is pursuing another avenue: testing substances that might be able to prevent, reduce, or repair the post-injury flood of damage. He thinks that something as simple and inexpensive as mega-vitamin "cocktails," if given within a few hours of the injury, could change the outlook for TBI patients.

Hoane's lab team induces brain injuries in anesthetized rats, either unilaterally (on one side of the cortex) or bilaterally (like the frontal injuries so often caused by car accidents). Then they try to minimize or repair the resulting damage, restoring lost function to the injured animal. The information they're gaining will be critical to designing eventual clinical trials in humans.

By using rats as a laboratory model for traumatic brain injury, an SIUC team is finding some promising treatments and is generating data for future testing of compounds in humans. Part of the research involves comparing brain sections (left) from treated and untreated animals.

One of the most promising substances they've tested is nicotinamide, a form of vitamin B3. Given in massive amounts shortly after an injury, it seems to protect the brain from damage.

"With different types and severities of brain injury, animals treated with B3 are no different from controls on many measures," Hoane says. "The first time I saw those effects, I didn't believe them." But repeated trials convinced him.

Hoane's team has many ways to assess injury and recovery. Physiological measures look at changes in the brain: the size of the lesion caused by the injury, the extent of swelling and cell death, the amount of inflammation. "B3 has strong effects on all these pathophysiological markers," Hoane says. In rats injected with B3, "the lesions are smaller, sometimes hardly observable" when compared to those of injured rats given a saline (placebo) injection.

Behavioral tests measure changes in function. In rats as in humans, an injury to one side of the brain causes motor problems on the opposite side of the body. When you hold a rat up to a table edge and tickle its whiskers, for instance, it normally will place its forelimbs on the table—but a rat injured on the left side of the brain can't do that with its right forelimb. Likewise, a normal rat placed in a glass tank will rear up and use both forepaws to explore the sides of the enclosure; an injured rat won't use the afflicted forepaw.

Part of Hoane's research involves finding the best ways to test potentially therapeutic compounds: "How can we make the animal models more representative of what we might see in humans?"

Michael Hoane (center) with his team of student researchers. Even undergraduates in Hoane's lab get the chance to run their own projects, once they've had sufficient training.

If a high dose of B3 is given to the animal shortly after it's injured, however, it will act like a normal rat on both of these measures.

Other TBI impairments include sensory deficits. Some TBI patients will pay less attention to one side of their body or even lose awareness of it, for example. This "sensory neglect" is studied in rats with a simple test that involves putting adhesive dots on a rat's forelimbs and seeing whether he pulls them off with his teeth.

"Rats are naturally clean, just like cats; they don't like things on their fur," Hoane explains. A rat with a left-brain injury may ignore dots placed on his right forelimb, but after treatment with B3, he'll once again be able to notice and remove those annoying stickies.

Other tests, such as negotiating a water maze, gauge the animal's ability to form new memories. B3 improves injured rats' performance on this test as well, though to a lesser degree.

Despite these hopeful indicators, Hoane cautions, "Whether [B3 therapy] will translate to humans is hard to say."

Before coming to SIUC three years ago, as a professor at East Carolina University, he and his students found that giving magnesium to brain-injured rats facilitated recovery. Physicians at the University of Washington later ran clinical trials with TBI patients based on these data. "An early study found some reduction in mortality," Hoane says, "but a later, larger study found no benefit. It was very disheartening."

Part of his research at SIUC, he says, involves "how best to test these compounds. How can we make the animal models more representative of what we might see in humans?"

For instance, whereas most of the lab's research has been done using young male rats, graduate student Alicia Swan is now testing middle-aged rats. ("They show an age-related vulnerability," Hoane says.) The team plans to run tests with female rats too.

One of the most important things they're doing is to give B3 at different times post-injury. In their initial, proof-of-principle studies, they administered the vitamin only 15 minutes post-injury. That's an ideal scenario, one that would seldom be possible for injury victims in the real world.

"Now we test giving B3 six, eight, 24 hours after injury and try to optimize those treatments," Hoane says. Promisingly, B3 "still has very strong effects, even given in a low dose at late onset."

The University of Washington team, which hopes to test B3 in TBI patients, is working closely with Hoane to determine the type of lab data that will be most useful to them. "Those conversations have helped us a lot (in planning experiments)," Hoane says. "One of the things that's of great interest to them is how the presence of alcohol would interact with B3 treatment, since 40 to 50 percent of TBI patients have alcohol in their system when they arrive in the emergency room.

"We're also trying to figure out ways to test the animals to [assess] more human-like deficits [resulting from TBI]. A major one in humans is impulsivity. No one has studied that in rats. Also emotionality and depression. We try to test across the whole spectrum of behavior. We're even looking at anxiety in some studies."

Hoane's lab has tested two B3 dosages: 50 versus 500 milligrams per kilogram of body weight. The higher dose works better, but the differences aren't huge, Hoane says, and "most clinicians would prefer 50 milligrams per kilogram for humans."

His lab is now testing the 50 mg/kg dose in rats over a longer time period to see if that boosts effectiveness. And graduate student Andrea Goffus is treating rats with a time-release capsule that will continuously infuse B3. This is a particularly interesting study, Hoane says: "Most drugs have never been tested this way in animals."

The University of Washington team has an investigational new drug license from the Food and Drug Administration to test tolerance of the 50 mg/kg dose in people. Note, this is not a try-it-yourself treatment. The dose far exceeds the recom-

mended daily intake; it is given by IV; and it requires a sterile, medical-grade formulation of vitamin and solution media. And of course no one knows yet if B3 will work in humans with TBI.

The Washington group has shown, however, that this dosage does cross the blood-brain barrier in humans—an important hurdle. "We think a lot of failed treatments [for TBI] have failed because they haven't crossed into the brain," Hoane says. Such pilot data are critical if the group is to win a grant for clinical trials.

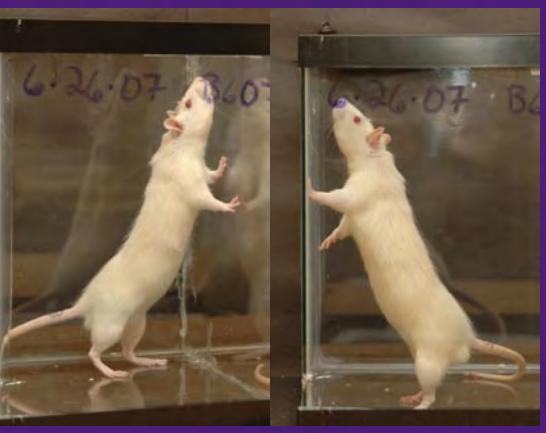
Meanwhile, Hoane's lab has seen benefits from giving high doses of vitamin B2 to injured rats, and is testing B6 as well (undergraduate Nick Kuypers is running these studies). Jeremy Pierce, another undergraduate, explains that the lab is analyzing urine from injured rats to see what vitamins are being metabolized more—used more by the body—after brain injury. That could give clues as to which other vitamins might help recovery.

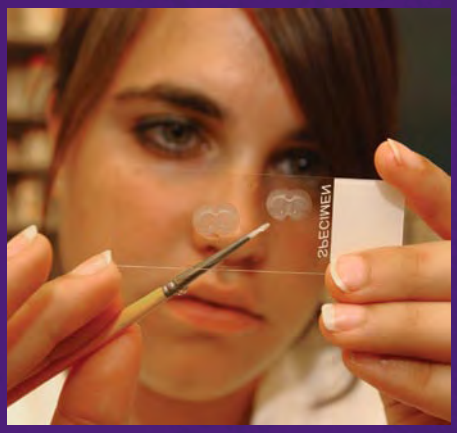
The team is guessing that a combination of nutrients may work better than any one alone. Since TBI involves multiple types of damage in the brain, says Hoane, "You may need a cocktail therapy."

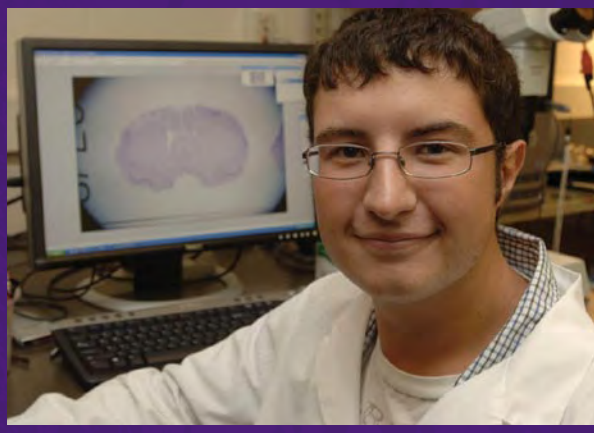
Vitamins aren't the only substances Hoane's lab is testing. In a project funded by SIUC's undergraduate research program and by a company called Cognosci Inc., Pierce and fellow undergrads Nicholas Birky, Michael Holland, and Tan Dang got good results with a compound called COG1410, a snippet of a fat-transporting protein. Former graduate student Olga Kokiko showed that raloxifene, a drug that acts on estrogen receptors, may hold promise too.

And in other work done at East Carolina, Hoane found "immediate improvements" when he transplanted a certain type of neuron derived from mouse embryonic stem cells into rats one week after injury. This result was startling, he explains, because "it couldn't be due to cell replacement by the stem cells—it takes weeks for them to actually integrate with the body's tissue. We think it's due to some kind of growth factor or neuroprotective chemical that these cells are producing."

Although he'd like to continue research with stem cells if he can get funding, he remains most interested in vita-nutrient therapy. "It seems logical that if you're putting something in the body that it's used to using, it should be able to handle that in a crisis," he says. "There's a whole field of nutritional neuroscience, and I'm evolving in that direction."







Left: A normal rat (left) will use both forepaws to explore a glass enclosure, whereas a rat with an induced brain injury won't use the paw on the side of the body opposite the injury. **Middle:** Undergraduate Sarah Heck mounts brain sections in preparation for microscopic analysis. **Right:** Nicholas Birky and several other undergraduates showed that a compound called COG1410 has a significant therapeutic effect on brain-injured rats.

Hoane's research has been funded by the National Institute of Neurological Disorders and Stroke—specifically, by a type of grant aimed at getting undergraduates involved with research. Since joining SIUC, Hoane has hired more than a dozen undergraduates to work with him and his graduate students. This fall, he has four upper-level undergraduates running their own projects, plus another four to five undergraduates at the beginning stages of lab work.

He believes that undergraduates can usually get more extensive research experience at SIUC than at bigger institutions.

"My senior undergraduates are working at the same level as graduate students," he says. "I put a lot of responsibility on their shoulders. You have to take the risk of giving them an important project to do. Mistakes happen, but we deal with that."

Hoane finds both the interaction and the research fun. "It comes naturally to me," he says. "As a small child I liked to take things apart and put them back together.

"We're [investigating] how to put the brain back together." ■

Research done in Dr. Michael Hoane's lab has been published in the ***Journal of Neurotrauma, Brain Research, Neuroscience Letters,*** *and other science journals. For more information: mhoane@siu.edu.*

ECO-SOUND

Through acoustic ecology, science and art can work together for environmental conservation.

Story by Marilyn Davis; photos by Andrew Carver and Jerry Bauer

The call of a toucan. The gruff, startling cries of howler monkeys. A chorus of cicadas. The percussion of bamboo canes clattering against each other in the wind.

A warning horn far in the distance, followed by the bass rumble of dynamite blasts. The crescendo of a jet coming in for a landing a few miles away.

All are part of the "soundscape" of EcoParque Panama, where the manmade world presses up against a largely pristine lowland tropical rainforest. In an innovative interdisciplinary venture, forestry professor Andrew Carver and radio-television professor Jay Needham spent last spring break recording some of the ambient sounds of the park, which occupies about 1,000 acres of ridges and valleys on the west side of the Panama Canal, almost directly across from Panama City.

SIUC is heavily involved in the park's exploration, development, and conservation. The site is home to harpy eagles, two- and three-toed sloths, titi monkeys, ocelots, margays (similar to but smaller than ocelots), jaguars, kinkajous, and many other fascinating species, some of which are threatened or endangered.

"This is an ecological treasure, one of the most biologically diverse areas in the world," says Carver, who specializes in land use planning and was instrumental in the park's establishment. "You can have more than 10 times the number of tree species per acre than in Illinois forests."

Left, background: A container ship in the Panama Canal, seen from EcoParque Panama, illustrates the proximity of wilderness and civilization here. Sound surveys can reveal much about the park's animal population and how manmade noise is affecting species such as jaguars and (upper right) three-toed sloths. Photo montage by Jay Bruce.

For their initial sound survey, Needham and Carver spent 15 to 16 hours daily on site, at all hours.

"You have to be there when the sounds are," Carver says. "If you aren't out there at 5 a.m., you'll miss the howler monkeys. And there's a lot of activity at night."

Needham, an artist, producer, and composer who specializes in radio documentaries and other forms of sound art, is especially interested in what he calls "long-form listening": monitoring the sounds of a place—be it a busy city street or an isolated wilderness—over days, weeks, and seasons to catch the full texture of that place and how it changes over time. Documenting the environment of sounds that people and animals inhabit, he explains, is a well-developed discipline called acoustic ecology.

Many of us have benefited from one product of acoustic ecology: "natural sound" CDs for relaxation or meditation. But the field has a surprising number of branches and applications.

Among them: It studies how ambient noise affects individuals, culture, and society. It underlies policy decisions regarding noise abatement programs.

It provides raw material for composers and sound designers, allowing those artists to create works using the sounds of a given environment. To preserve a record of our natural heritage, it documents "endangered soundscapes," like that of the tropical jungle, before they disappear.

Acoustic ecology also enables research on animal communication, as well as animal surveys like those being done in EcoParque. And it offers a way to track ecosystem health over time. Sound studies, for example, have documented the decline of amphibians in many areas worldwide.

Carver and Needham will be using the EcoParque recordings to identify species and learn about species abundance. They also want to study the intensity, duration, and location of manmade noise (the jets, blasting for the Panama Canal expansion, etc.) and how that is affecting the park's animals and visitors.

"Listening to the sounds of an environment can reveal a great deal about the ways that nature and our technologically driven culture have intermixed," Needham says.

The park evolved out of the final handover of Canal Zone land by the United States to the Panamanian government in 1999. Jerry Bauer, an SIUC forestry alumnus and assistant director of the U.S. Forest Service's International Institute of Tropical Forestry, invited Carver down in 2001 to assess the institute's ecotourism programs in Panama. While there, Carver recruited Nestor Correa, the director of one of Panama's most important national parks, to come to SIUC for his master's degree in forestry.

Carver also met Ricardo Barria, an SIU-Edwardsville alumnus from Panama who belonged to a local civic group interested in conservation—the Panama Northeast chapter of Rotary International. The efforts of these four people helped lead to the designation of part of a former U.S. military base as EcoParque Panama.

Left: The original planning team—from left, Andrew Carver, Ricardo Barria, Jerry Bauer, and Nestor Correa—stops to review aerial maps of the park.

Below: A remote camera catches an ocelot on the move.

With the exception of some roadways, most of the site was undeveloped. Because it had been off-limits to Panamanians, Carver says, no one knew what incredible biodiversity the site had—diversity that, ironically, had been preserved as an accident of politics.

Carver's research in Panama began with a social-science project co-led by forestry professors Jean Mangun and Cem Basman. Two graduate students in forestry, Brooke and Richard Thurau, went to Panama to survey cruise ship passengers about their interest in ecotourism activities, which could help support conservation efforts. "On average, these tourists really desired adventure and ecotourism—more than we thought they would," Carver says.

The push for the park began in earnest when, for his master's thesis, Correa conducted a needs assessment of nonprofit conservation organizations in Panama. He looked at the problems they face and what they need to succeed at environmental preservation.

Then, on behalf of the Panama Rotary chapter, he and Carver put together a proposal to establish the park. They had the backing of the chancellor of the University of Panama, who headed the government agency responsible for the disposition of former U.S. land within the Canal Zone.

In 2004, Panama issued two resolutions creating and protecting the park. With Panama City expanding rapidly, the government wanted to preserve the land as a buffer between the canal and the much larger extent of tropical forest to the north and west.

"By protecting the park, they felt they could better protect the rest of the forest," Carver says. If the land were deforested, the seasonal rains would stop—and the rains are crucial to the viability of the canal.

Although the park is expected to draw eco-tourists, Carver stresses that it will be developed so that Panamanians, most of whom "can't afford tourist prices," will have a place to go for environmental learning, recreation, and solitude.

Panama City, he notes, offers few green spaces for its citizens.

With funding from the International Institute of Tropical Forestry, SIUC has been doing research to document the park's wildlife. In 2005, zoologists Eric Schauber and Clay Nielsen assisted with the installation of a network of remote cameras on site. When an animal trips a camera's motion or heat sensors, the camera begins taking pictures at regular intervals.

But remote cameras have limitations. In the dense rainforest vegetation, lines of sight are narrow and patchy. And that's where sound has an advantage: 360-degree coverage over a wide area. It can go a long way in telling you "who's there and how many," Needham says.

After a successful pitch to SIUC's Global Media Research Center for some startup funding, he and Carver began their collaboration with the sound-survey trip over spring break. "It's the first project of this kind for the center," says Needham, who received seed funding from his department and college as well.

Besides research, the two plan to use the recordings to advance environmental education. By the time this issue of *Perspectives*

comes out, a CD titled "Dry Season—Edition 1," drawn from the recordings done last March, will have been produced by the Global Media Research Center. "It's a sound portrait of the park at a particular time of year," Needham says, adding that the CD will be packaged with explanatory notes in Spanish and English.

The idea is that conservation organizations in Panama could use the CD as a fundraising tool. It also could be used as a teaching tool on site, Needham says, in classes or community-based environmental workshops. He's donating the sound files to the Pan-American Conservation Association (APPC), which manages the park in cooperation with the Panama Rotary.

Many of the Panamanians with whom the team is working have a nostalgic response to the recordings, which contain sounds they remember from their childhood but haven't heard in years, due to development. "These sounds are very specific to Central America and are part of a cultural and natural heritage that is quickly changing," Needham says. "To visitors, they're very unique."

While Needham was editing the raw sound files, Carver was spending part of the summer in Panama—analyzing data, installing new cameras, and working closely with the International Center for Sustainable Development, the APPC, and other partners in the project.

He and Correa, who's now a doctoral student in zoology, are developing plans for trails, facilities, and an interpretive center for the park. Needham's sound recordings can help here, too—for example, in the development of "sound walks" where people are likely to hear certain kinds of animals.

Both Carver and Needham are invigorated by this scientific/artistic collaboration between SIUC's College of Agriculture and College of Mass Communication and Media Arts and are working to broaden it.

Top: A rare black-and-white eagle being rehabilitated by the Pan-American Conservation Association.

Middle: Jay Needham and Yiscel Yángüez, a staff member with the association, record sounds during the dry season in EcoParque Panama.

Bottom: Burgeoning Panama City as seen at sunrise from the park.

Brooke Thurau, who will be MCMA's first interdisciplinary doctoral student in many years, will create a documentary video about the park and will do social-science research on conservation issues associated with it. Carver and John Downing, director of the Global Media Research Center, will co-chair her dissertation committee. And Needham and Carver are developing a dual-listed field course focusing on how conservation science and media arts can join forces for environmental activism.

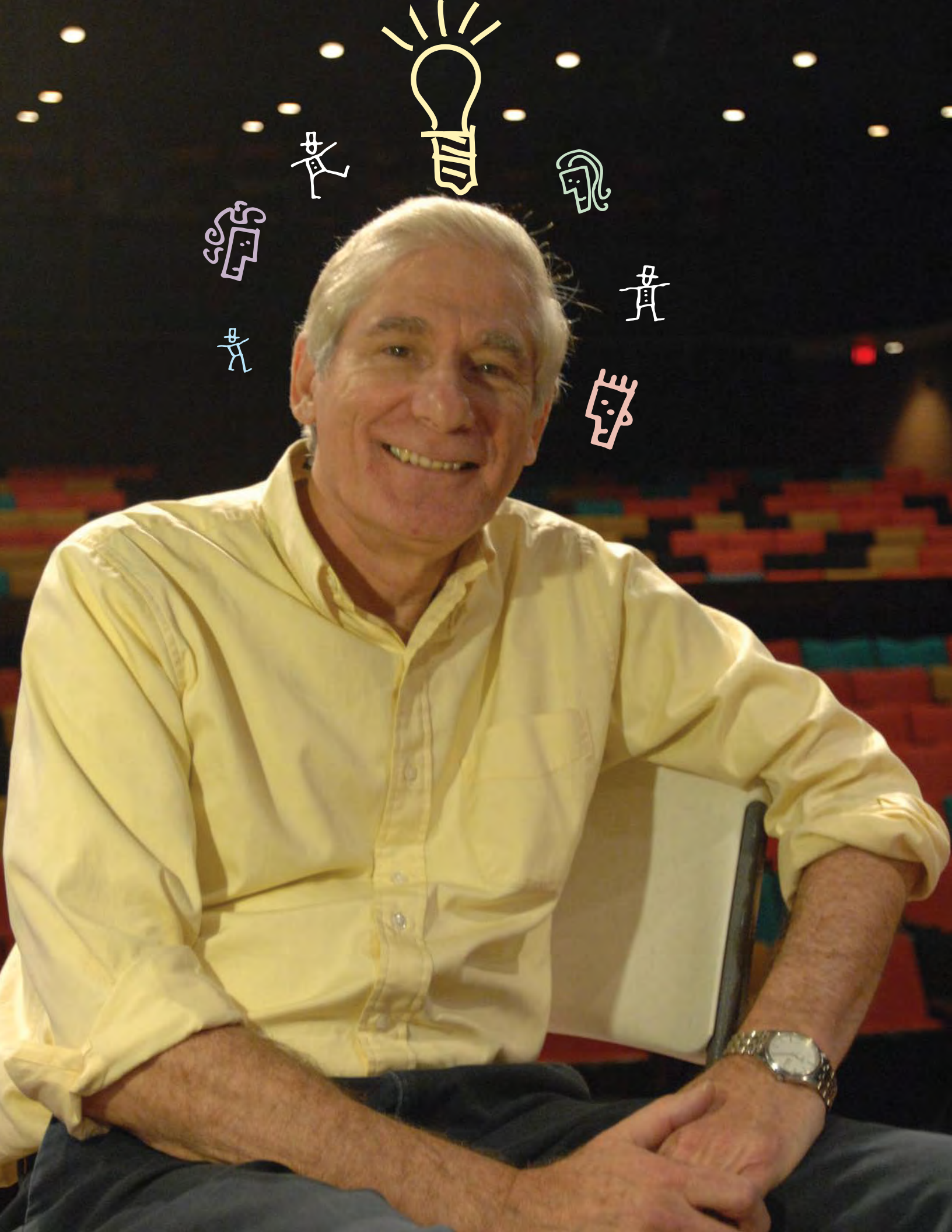
Needham and Carver plan to return to EcoParque Panama to make more recordings at different times of the year. They and their students will work with local Panamanian conservation organizations to catalog the insects, birds, and mammals heard on the recordings.

"Some of these animals are so rare," Carver says. "Capturing these sounds is an important contribution for future study."

Even though Carver had visited the park many times over the years, he found he had a lot to learn about its acoustic environment.

"I got a crash course in listening," he says. "By partnering with Jay, I was forced to concentrate on the sounds, and it was an amazing experience." ■

For more information: Dr. Andrew Carver, Dept. of Forestry, acarver@siu.edu, or Jay Needham, Dept. of Radio/TV, jayneedham@neondsl.com. Needham also collaborates on acoustic ecology projects with fellow radio/TV professor Phylis Johnson.



OTHER VOICES, OTHER LIVES

A playwright's gift is creating new worlds

by Marilyn Davis

David Rush is comfortable with characters crowding his mind. Figures from the past and figures from the present, everyday folks and strange ducks, even characters—like Lewis Carroll's Jabberwock—who aren't human at all: he's put quite a throng on paper over the years.

When he recently suffered a case of writer's block, one imagines he felt abandoned. But he was overdue for a breather.

Rush has written nearly 20 full-length plays and musicals. In just the past few years, he finished three dramas that won national new-play contests in 2005 and 2006, plus a fourth that received a staged reading at the 2006 Orlando Shakespeare Festival. He wrote the book and lyrics for a musical called *Feathers in the Wind,* based on Eastern European Jewish folk tales, and has been writing lyrics for another, *Whirlybirds,* about two parents serving in the Iraq war. And he published a textbook—*A Student Guide to Play Analysis* (SIU Press, 2005).

"I think I needed to fill up the well again," he says of those scary months when inspiration wasn't striking.

A practicing playwright for more than 25 years, David Rush has won awards both for his dramas and for his teaching.

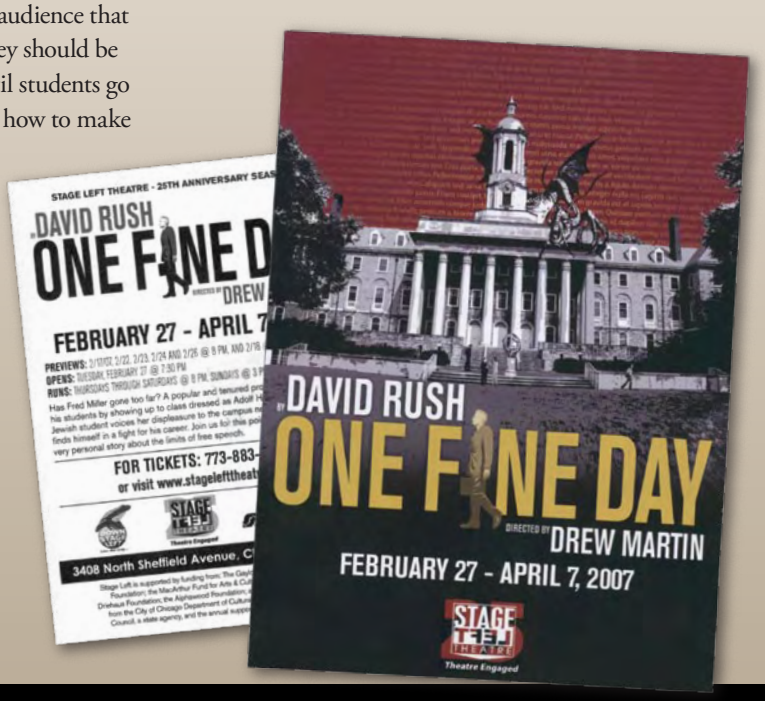
Rush is professor and head of the playwriting program in SIUC's well-respected theater department. His M.F.A. students just closed out a banner year, winning several honors at the 2007 regional Kennedy Center American College Theater Festival in Milwaukee. But Rush credits the entire theater faculty for their success.

"We give a lot of production time to the students, which is somewhat unusual among playwriting programs," he says. "Everyone here agrees that the only way to learn is to get experience, experience, experience."

Students can write prolifically in the privacy of their room. But until they face a director who explains why a scene is unstageable, or an actor who repeatedly muffs a bit of clunky dialogue, or an audience that sits stone-cold-silent when they should be laughing (or vice versa)—until students go through such trials and learn how to make their material work as they intended, they won't be successful playwrights.

Rush, who grew up in Chicago and earned his doctorate in theater from the University of Illinois, has had plenty of such experience. His plays have been produced in venues around the country for more than 25 years. He's affiliated with Chicago Dramatists, a new-play development group, and with Chicago's Stage Left, whose mission is to produce plays that "raise the level of political debate."

For Rush, inspiration often comes from political topics and the daily headlines. His current work-in-progress, which is in the research stage, deals with elder abuse. *Police Deaf Near Far,* based on a real event, involves a fatal misunderstanding between a deaf activist and a cop. And in *One Fine Day,* a professor moves beyond the boundaries of political correctness and is accused by a student of anti-Semitism. (Rush recently sold an option on the play to Trendline Films.)



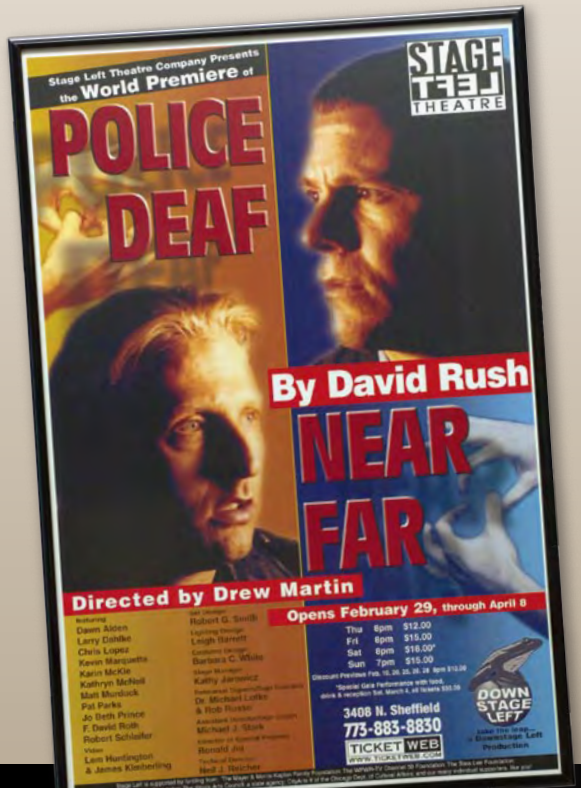
In *Police Deaf Near Far,* a fact-inspired drama about a tragic encounter between a deaf man and a police officer, the dialogue is both spoken and signed. This production took place at SIUC's McLeod Theater; the play has been performed in Chicago as well and won a Jeff Award for the best new work of Chicago theater in 2000. *Photo by Bob Holcombe.*

Headlines from the past have inspired him, too. For instance, *The Prophet of Bishop Hill* looks at what led to the 1850 murder of Eric Jansson, a messianic figure who founded a collectivist religious community in northwestern Illinois. *Leander Stillwell* was based in part on the memoirs of a Union soldier in the Civil War.

Other plays of Rush's are more personal, and they often grow out of his Jewish background. Take the award-winning *Estelle Singerman,* in which a friendless Jewish widow seeks someone to say *kaddish,* the Jewish prayer of mourning, for her after she dies. She finds an unlikely candidate named Warren, a widower who's renounced Judaism, tucking into a cheeseburger and fries at a local McDonald's.

Estelle escorts Warren on a surreal journey through Chicago at night, during which they consult an irascible tarot-card reader, seek information from a judgmental talking giraffe at Lincoln Park Zoo, and finally meet Death himself, who turns out to be not the Grim Reaper but a white unicorn. But the essence of the play—Estelle's commitment to her faith and her ability to rekindle Warren's—is a down-to-earth matter of heart and soul.

Rush's identity as a gay man also drives some of his work, such as his latest drama, *Tying the Knot,* whose theme is same-sex marriage. Rush was a tenured faculty member at Southwest Texas State University in the late 1970s when he came out, got divorced (he remains close to his ex-wife and two children), and ultimately quit his job, having grown convinced that teaching and playwriting were incompatible. (This painful period in his life was reflected in a one-act play written several years later.) He moved back to Chicago, where he and a friend launched a new musical he'd written. They figured they'd become producers, he says.



The show closed the day after it opened. The experience devastated him, emotionally and financially. "It was a long time before I got back into playwriting," Rush says. "It took a couple of years to get my writing legs back."

To support himself and his family, he forged a freelance career. For 17 years he wrote commercial scripts for industrial shows, sales training, new-product launches, and so forth—and it made him a better dramatist.

"I had to learn to write tight, fast, compressed," he says. "I learned a lot about life, self-discipline, negotiations with people. All of that fed into my [playwriting]."

During those freelance years, Rush eventually began writing plays again. He also occasionally taught playwriting and screenwriting classes at various institutions, including Northwestern University and Columbia College.

"Once I began to realize I could be both a teacher *and* a playwright, I began to miss the teaching part of my life," he says. The first thing he did when he got Internet access in 1995 was to search for academic positions, and the first job that popped up was at SIUC. He joined the University in 1996.

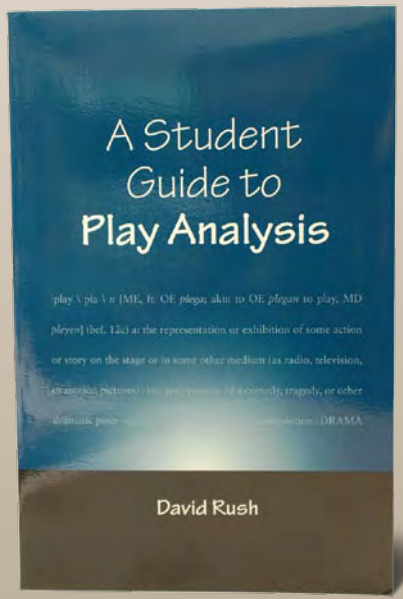
During his angst-ridden few months of writer's block, Rush didn't just sit around and fret. Instead, he wrote another textbook, *The Second Draft: What to Do When Your Play Doesn't Work,* which he's now submitting to publishers. "There are plenty of playwriting texts, but they don't tell you how to fix problems," he explains.

A moment of reconciliation between a beleaguered professor and the student who accuses him of anti-Semitism occurs at the end of *One Fine Day,* Rush's most recent play, which has been optioned by Trendline Films. *Photo by Bob Holcombe.*

Rush has inaugurated a couple of summer programs to give theater students more experience in new-play development. In an intensive one-week workshop, M.F.A. students are paired with professional directors who help them revise scripts they've written for full-length plays. A longer workshop involves shepherding a small group of students through the process of creating and performing a 30-minute ensemble play.

He's also launched a popular September event called "The One-Day Play," in which student teams made up of a writer, director, and actors have 24 hours to write and rehearse a 10-minute play. At the end of the 24 hours, all of the plays are performed on campus in an evening of theater.

In 2002 Rush was named Playwriting Teacher of the Year by the Association for Theater in Higher Education, in only the second year the award was given. Yet he refuses to take much credit for his students' considerable achievements.



"I can teach technique and theory," he says, "but I can't put thoughts into their heads. I think what they learn from me is to have fun [writing], to be disciplined, to follow their own vision, and to bring their life into their work."

Rush's favorite playwrights, those who have influenced him the most, include Chekhov, Eugene O'Neill, Tennessee Williams, and Lanford Wilson (*Balm in Gilead; Hot L Baltimore*). These are "writers of poetic realism" who explore "the geography of the human heart," he says.

"You must write [from] your pain," he adds. "You have to be prepared to go into the dark jungle. For example, O'Neill and Williams were both writers who brought their pain to the stage. Their plays are about people who are tormented by their inner demons."

Rush's own characters, he says, generally are "people whose lives are in chaos because of the world they find themselves in."

Rush's plays tend to be dark, but also darkly funny. "Because I'm Jewish, I have this mordant sense of humor," Rush says. Thus *Estelle Singerman,* which is about life, death, God— the whole serious shebang—is shot through with comic elements and one-liners. "I like to describe my style as Eugene O'Neill Simon," Rush quips.

Writing a play is a leap into the unknown, and that's what makes it fun, he says: "I know generally where I'm going, but I don't know how I'm going to get there." It's a long process, and the ending can be quite different from what he'd envisioned when he started.

Rush began writing plays at age 10. But not until the advanced age of 16 was his future set in his own mind.

"The play that made me a playwright was Thornton Wilder's *The Skin of Our Teeth,"* he says. "I skipped school to see a matinee of a touring production in Chicago. There's a bit of stage magic in the third act, where the hours are represented by philosophers' voices. Something about the lighting, the set, the words, the mood was poetical and entrancing.

"I said, 'This is what I want to do with my life. I want to create that kind of magic.'"

He's been striving to do that ever since. And when he contrives a bit of magic, or when, in the heat of writing, he discovers something unexpected about one of his characters—well, he says, "Those are the moments that we live for, aren't they?" ■

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kudos

History professor Holly Hurlburt, whose research concerns women and political power during the Renaissance, was awarded a prestigious one-year Villa I Tatti Fellowship in Florence, Italy, through the Harvard University Center for Renaissance Studies. Hurlburt's first book, published last year, examined the private and public identities of the dogaresse, wives of the elected doges of medieval and early modern Venice.

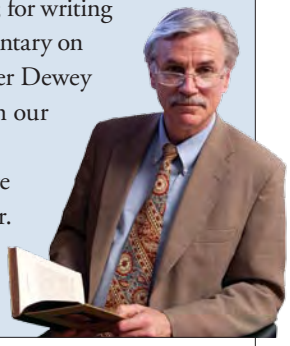
What began as a thesis project nearly five years ago has wound up as an HBO documentary for SIUC graduate Hilla Medalia. "Daughters of Abraham," which won the 2004 Angelus Award and the SIU Alumni Association's 2004 Outstanding Thesis Award, concerned a March 2002 suicide bomb attack that killed two 17-year-old girls, one Palestinian (the suicide bomber) and the other Israeli. Film producers John and Ed Priddy financed a reworking and expansion of the documentary as "To Die in Jerusalem," which is airing on HBO in November.

Medalia, who earned her master's degree in professional media practice under the mentorship of radio/television professor Jan Thompson, did additional research, re-shot interviews and scenes, and after many efforts arranged for a meeting—the film's emotional highlight—between the mothers of the two girls.

Ike Mathur, Henry J. Rehn professor of finance, will be managing editor of the *Journal of Banking and Finance,* a highly respected world economic and financial research publication, beginning in 2008. In addition, a research article co-written by Mathur was named the *Journal of Financial Research's* Outstanding Article for 2006.

The National Institutes of Health has awarded pharmacology professor Donald Caspary a $1.5 million grant to study the impact of aging on changes in the brain related to tinnitus (ringing in the ears), a condition that plagues many people. Caspary and colleagues at the SIU School of Medicine study the biochemical and neural mechanisms of tinnitus in animal models and patients, working toward the development of new therapies.

Larry Hickman, philosophy professor and director of SIUC's Center for Dewey Studies, was named the 2007 Phi Kappa Phi Scholar. The national scholastic honor society gives the award only once every three years. Hickman was named for overseeing the editing of philosopher John Dewey's correspondence and for producing electronic editions of Dewey's writings; for his several books; for writing and narrating an award-winning documentary on Dewey; and for helping to establish other Dewey centers abroad. Hickman was profiled in our fall 2002 issue.



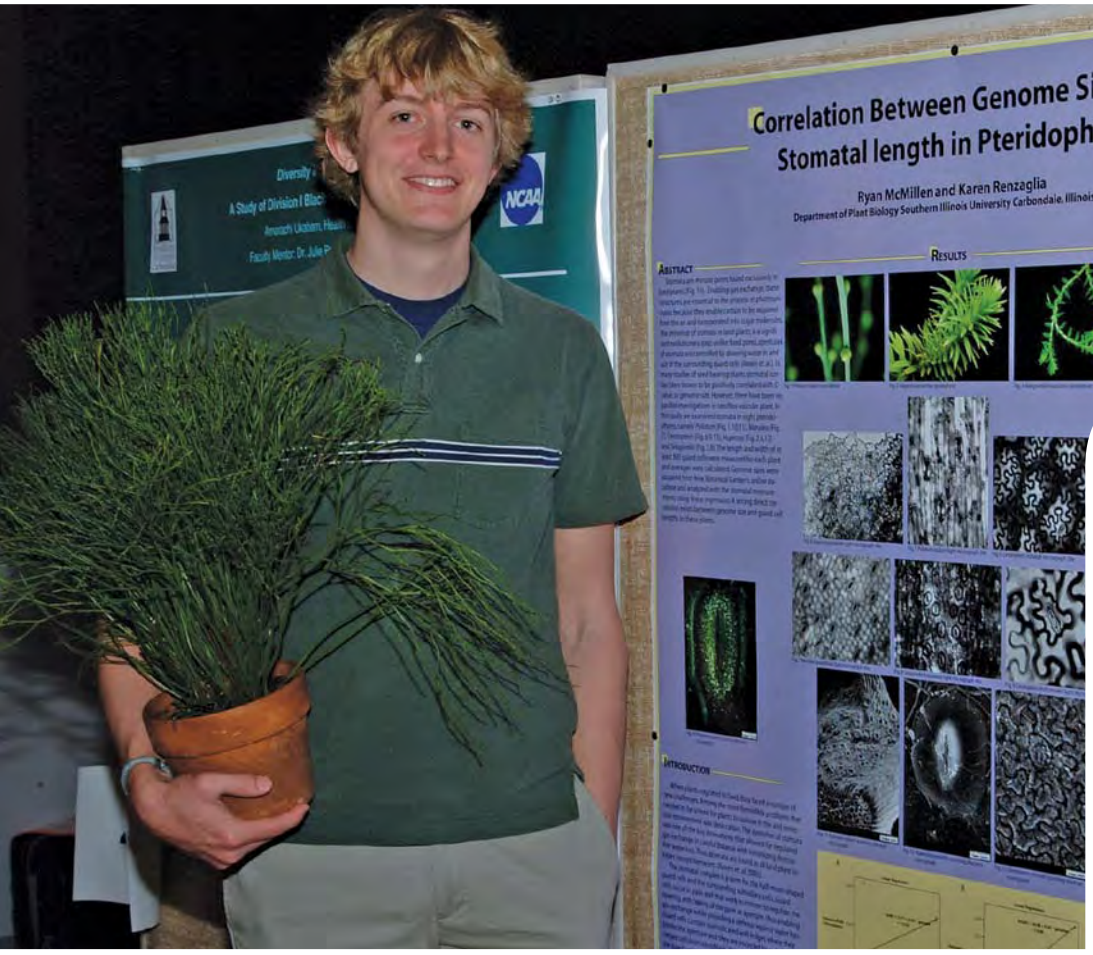
SIUC is the only university with more than one national Phi Kappa Phi Scholar. In 2001, physiology professor Andrzej Bartke received the honor.

Archaeologist Izumi Shimada was named SIUC's Outstanding Scholar for 2007 for his nearly three decades of work unearthing clues to pre-Incan cultures in Peru. His research, which was featured in *Perspectives'* spring 2002 cover story, established the evidence for the beginning of the Bronze Age in the Americas, says colleague Anne Marie Hocquenghem of the French Institute of Andean Studies.

Shimada also helped establish a museum in northern Peru showcasing this heritage and the artifacts found over the course of the project. He received Peru's Congressional Medal of Honor in December 2006.

A visiting assistant professor in SIUC's Cinema and Photography Department has been awarded a 2007 Guggenheim Fellowship. Bruce Charlesworth, internationally known since the 1980s for his photographs, films, and multimedia installations, was among 189 artists, scholars, and scientists selected from nearly 2,800 applicants. Part of his $40,211 stipend, he says, will go toward research for the development of a new multiroom, multimedia installation about anticipation and the passage of time in which viewers will be active participants as they move through the exhibit.

Life in detail



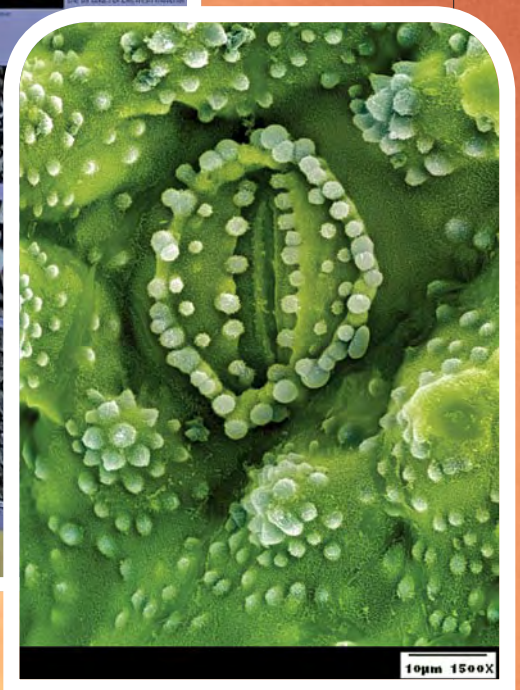


Photo by Cheryl Broadie, IMAGE. Electron micrograph by Ryan McMillen.

The evolution of early land plants is the research focus of Ryan McMillen, who works in the laboratory of plant biologist Karen Renzaglia on a National Science Foundation project called "Assembling the Tree of Life." The lab traces evolutionary relationships in part by using electron microscope images to study minuscule plant structures.

Scientists knew that, in seed-bearing plants, the length of tiny pores called stomata correlates to the size of the plant's genome (its total DNA package). But no one knew if the same was true for seedless plants such as ferns and mosses, which evolved earlier. With funding from an SIUC Undergraduate Research/Creative Activity Award, McMillen made electron micrographs of stomata from various species and compared measurements with genome size. He found a direct correlation. This means that stomatal length in fossilized seedless plants could indicate relative genome sizes among the earliest land plants—a key to establishing evolutionary events and relationships.

McMillen presented his findings at the Plant Biology and Botany 2007 Joint Congress in Chicago, and one of his electron micrographs (inset) won third place in a student plant-imaging competition sponsored by the Botanical Society of America. The photo, published in the *American Journal of Botany* in September 2006, is of a stoma in a horsetail fern native to Illinois.

Note: The Spring 2003 Perspectives cover story featured the Tree of Life project. See www.siu.edu/~perspect/03_sp/plants.html.

—Marilyn Davis

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