Deep roots

The biological sciences support a variety of disciplines at the University from medicine to environmental sciences.

*story on page 8*
The worst of times and the best of times

When I listened to Barack Obama’s inaugural speech in January, I was struck by the encouragement his words offered for the University and the College of Biological Sciences:

“The state of our economy calls for action: bold and swift. And we will act not only to create new jobs, but to lay a new foundation for growth. We will restore science to its rightful place, and wield technology’s wonders to raise health care’s quality and lower its cost. We will harness the sun and the winds and the soil to fuel our cars and run our factories. And we will transform our schools and colleges and universities to meet the demands of a new age. All this we can do. And all this we will do.”

There were more encouraging words from Speaker of the House Nancy Pelosi. When asked about the priorities in the federal economic stimulus package, Pelosi responded: “There are four words—science, science, science and science.”

The new era we are entering is fraught with paradoxes. Our country is in the throes of economic uncertainty and we have visionary new leadership at the helm. The University is facing serious challenges created by the economic downturn and demand for CBS educational programs is skyrocketing. We are modeling reductions to the CBS budget and Congress has approved massive increases to the budgets of National Institutes of Health, National Science Foundation and Department of Energy.

One thing is certain. We need to seize opportunities for growth while recognizing opportunities to pull back. By doing so, we can maintain our momentum along the trajectory of excellence we have enjoyed for the past decade and keep our vision within sight.

Together, we can continue to thrive—in good times and in bad.
In Every Issue

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Cellulosic ethanol has health benefits

[Proceedings of the National Academy of Sciences | 2.09]

Filling our fuel tanks with cellulosic ethanol instead of gasoline or corn-based ethanol may have health as well as environmental benefits, according to a study co-authored by Jason Hill and Stephen Polasky from the Department of Applied Economics and David Tilman, Regents Professor in the Department of Ecology, Evolution and Behavior.

The study finds that cellulosic ethanol is less detrimental to human health because it produces smaller amounts of fine particulate matter, a harmful component of air pollution. Earlier work showed that cellulosic ethanol and other next-generation biofuels also emit lower levels of greenhouse gasses.

“Our work highlights the need to expand the biofuels debate beyond its focus on climate change to air quality and other effects,” says Hill, lead author of the paper and a resident fellow in the University of Minnesota’s Institute on the Environment.

The study is the first to estimate the economic costs to human health and well-being from gasoline, corn-based ethanol and cellulosic ethanol made from biomass. The authors found that depending on the materials and technology used in production, cellulosic ethanol’s environmental and health costs are less than half the costs of gasoline, while corn-based ethanol’s costs range from roughly equal to about double those of gasoline.

Important protein structure captured in 3-D

[Structure | 12.12.08]

Anja Bielinsky was part of a collaborative effort, along with researchers at Vanderbilt University, to produce a detailed three-dimensional image of the structure of the Mcm10 protein, which is integral to molecular machinery used for cell reproduction. Bielinsky’s lab handled the functional validation of the structural data. “We introduced mutations at sites where the structure would predict impediment in DNA binding and tested these predictions in a biological assay,” she says.

Bielinsky’s group had previously shown that inhibition of Mcm10 drives proliferating cells into apoptosis (cell death), a finding that suggests the protein might make a good drug target in cancer cells. “I think the most important implication,” she says, “is that we could now design small molecule inhibitors and test whether they are effective at inhibiting proliferation.” Bielinsky is an associate professor in the Department of Biochemistry, Molecular Biology and Biophysics.

Study to measure tropical forests’ role in global carbon budget

George Weiblen, associate professor of plant biology, received a $400,000 grant from the National Science Foundation to establish a study in Papua New Guinea. The study looks at how forests maintain biodiversity over time and how much carbon they remove from the atmosphere.

Weiblen and colleagues will survey a 125-acre plot located in Wanang. Every tree will be mapped, tagged, identified and measured every five years. Insects such as termites, moths, butterflies, ants and bees will also be inventoried. Much of the work will be carried out by local scientists and villagers. The plot will be part of a global network representing 18 forests worldwide established by the Center for Tropical Forest Science, which is part of the Smithsonian Tropical Research Institute.
Packer discovers sleeping sickness vaccine strategy

[PLoS Neglected Tropical Diseases | 12.9.08]

A study authored by Distinguished McKnight University Professor Craig Packer suggests a new strategy for vaccinating humans and animals against sleeping sickness (trypanosomiasis), which is a major health threat in Africa. Development of a vaccine has been hampered by the diversity of surface proteins of T. brucei, a parasite that causes the illness. Packer and colleagues found that lions might gain cross-immunity to T. brucei from repeated exposure to the more genetically diverse T. congolense through frequent consumption of infected prey animals. Packer is a professor in the Department of Ecology, Evolution and Behavior.

Bacteria from Soudan mine piques interest

Jeff Gralnick, an assistant professor with the BioTechnology Institute, is among several University of Minnesota scientists researching bacteria found at the lowest levels of the abandoned Soudan mine in northern Minnesota. Extremely salty oxygen-less water is seeping out of the bedrock and producing dynamic, colorful iron-oxide structures after contact with air. “This ancient water is teeming with bacteria, and we suspect bacteria may be playing a role in the formation of these iron structures,” says Gralnick, who sees potential to develop commercial applications based on further research.

New Grants

$3 million in grants buys robotic system to study protein structures

Two grants totaling $3 million—one from the University of Minnesota and Mayo Clinic for $1.8 million and a large-equipment grant for $1.3 million from the National Institutes of Health—were used to purchase a Rigaku robotic protein crystallization system. The new system allows U researchers to automate the process of growing crystals of proteins in order to study their structures.

Douglas Ohlendorf, who led the effort, says that the new system is much faster, more efficient and cost-effective than manual protocols. He notes that it requires a much smaller protein sample and automates experiments from beginning to end. This will allow U researchers to quickly determine if their protein can be easily crystallized using samples consisting of less than one milligram of protein. Ohlendorf is a professor in the Department of Biochemistry, Molecular Biology and Biophysics and director of the Kahlert Laboratory for X-Ray Crystallography.

Grooming your way to the top

[American Journal of Primatology | 2.09]

Among most mammals, the biggest and fiercest male claims the role of alpha male and gets his choice of food and females. But a new study led by students and faculty in the Jane Goodall Institute Center for Primate Studies shows that smaller males employ political strategies, such as grooming other chimpanzees, to achieve alpha status.

The finding was gleaned from 10 years of behavioral data on three alpha male chimpanzees in Gombe National Park, Tanzania. Frodo, weighing in at about 112 pounds, achieved his status through bullying and aggression. Wilkie, who weighed only 82 pounds, obsessively groomed male and female chimpanzees to gain broad support. And Freud, who weighed about 99 pounds, used a combination of the two strategies. The findings are reported in the American Journal of Primatology and cited in Nature News.

While other primatologists have shown that grooming plays a role in chimpanzee social interaction, this study is the first to show that dominance style is closely related to body size. The study was led by former undergraduate student Mark Foster. Anne Pusey, director of the Goodall Center, which is housed in the College of Biological Sciences, was senior author. Graduate students Ian Gilby, Carson Murrow and Emily Wroblewski also contributed to the study.

Study examines evolutionary response to climate change

Jeannine Cavender-Bares is leading an international research study investigating the evolutionary potential of trees to respond to climate change. The research team, which includes investigators from Cornell and the University of Minnesota-Duluth, was recently awarded a five-year grant from the National Science Foundation. The project examines short-term physiological changes as well as the potential for long-term evolutionary changes in response to experimental manipulations of precipitation in populations of a Central American tropical oak species. Cavender-Bares is an assistant professor in the Department of Ecology, Evolution and Behavior.
Regents Professor of Ecology David Tilman received the 2008 International Prize for Biology at a ceremony in Tokyo in December. Emperor Akihito of Japan presented Tilman with a medal and a cash prize. The award, which is one of the most prestigious honors a scientist can receive, is given to one individual in a different field of biology each year. Tilman was selected based on his seminal findings, published in Science and Nature during the 1990s, which prove that biodiversity makes ecosystems more productive and resistant to drought, disease and pests. More recently, Tilman has applied his discoveries to renewable energy, showing that biofuel created from diverse prairie grasses is more efficient and far better for the environment than fuel made from food crops such as corn and soybeans.

“This is one of the most prestigious scientific prizes in the world,” says College of Biological Sciences Dean Bob Elde. “And no one deserves it more that Dave Tilman. His stature as a scientist honors the university, the college, his colleagues and our students. We are very fortunate that he has chosen Cedar Creek Ecosystem Science Reserve as his laboratory.”

CBS undergrads place at iGem competition

Students from the College of Biological Sciences and the Institute of Technology teamed up with faculty advisers from both colleges to develop projects for the International Genetically Engineered Machine (iGem) competition held annually at MIT. It was the first time that students from the University of Minnesota have entered the popular competition. The U of M team received second place for one of its “BioBrick” designs. BioBricks are standardized parts used to design and build genetic machines. iGem participants explore the potential for building simple biological systems from these standard, interchangeable parts.

O’Connor takes on new role

Professor Michael O’Connor, Ordway Chair of Developmental Biology, took the helm as head of the Department of Genetics, Cell Biology and Development in January. O’Connor joined the University of Minnesota faculty in 1997. He has contributed to more than 80 peer-reviewed publications in the fields of developmental biology and molecular genetics. As a Howard Hughes Medical Institute senior investigator, O’Connor studies the molecular genetics of development, focusing on growth-factor signaling and gene regulation. O’Connor succeeds Brian Van Ness, who was the founding head of the department. After serving in that role for nine years, he has returned full time to teaching and research.
Powers named McKnight professor
Jennifer Powers, an assistant professor in the Department of Ecology, Evolution and Behavior, has been named a Minnesota McKnight Land-Grant Professor for 2009-11. The award includes a research grant of $32,500 in each of the two years plus a paid research leave. Powers’ research explores the relationships among ecological processes, the patterns they generate and the effects of anthropogenic environmental changes across a range of spatial and temporal scales.

Sadowsky named AAAS fellow
Michael Sadowsky was recently named a 2009 fellow by the American Association for the Advancement of Science (AAAS). The AAAS chose Sadowsky based on his contributions to the field of environmental microbiology, noting his work in molecular plant-microbe interactions, biodegradation of chlorinated herbicides and in determining sources of fecal bacteria. Sadowsky is a professor in the BioTechnology Institute.

Students spotlighted with SEED awards
Three College of Biological Sciences students received 2008 Scholarly Excellence in Equity and Diversity (SEED) Awards, which honor outstanding diverse undergraduate students. Desiree Abu-Odeh [Neuroscience], Daniel Martig [Biochemistry] and Anh Tran [Neuroscience] were among only eleven recipients from across the Twin Cities campus.

Longtime Cedar Creek naturalist passes
Cedar Creek Ecosystem Science Reserve naturalist John Haarstad died November 17. He was 62. Haarstad had been affiliated with the University since 1975. A nature trail at Cedar Creek was recently named the “Dr. John A. Haarstad Interpretive Trail” in his honor. The 2.5-mile trail around Fish Lake was one of his favorite hikes.

Former students, faculty mourn Douglas Pratt
Longtime CBS faculty member Douglas Pratt died November 6. He was 77. Pratt, who spent 30 years as a member of the college’s plant biology faculty, pioneered groundbreaking research on the use of wetland vegetation as a renewable biomass crop. He was also an award-winning teacher who played a leading role in the development of the university’s environmental sciences curricula.

Institute on the Environment fellows announced
Five College of Biological Sciences faculty members are among the first 20 Institute on the Environment (IonE) resident fellows. The new resident fellows, all associated with the Department of Ecology, Evolution and Behavior, include Jeannine Cavender-Bares, Clarence Lehman, Stephen Polasky, Jennifer Powers and David Tilman.

“The fellowships will give both up-and-coming and established leaders the opportunity to work together on finding ‘outside the box’ solutions to the world’s biggest environmental problems,” says Jonathan Foley, director of the Institute on the Environment. IonE is dedicated to discovering solutions to the Earth’s most pressing environmental problems through cutting-edge research, leadership development and collaboration. The fellows will begin their three-year appointments in June.

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Jonathan Foley approaches global ecological issues such as climate change with the eye of an astronomer.

“One of the primary criteria for Institute on the Environment projects is ‘does it have a chance of getting out into the world?’”
—Jonathan Foley

The Accidental Ecologist
The Institute on the Environment’s Jonathan Foley looks at the big picture

Jonathan Foley didn’t set out to study ecosystems. He was more interested in planets. But, as it turns out, the two pursuits aren’t mutually exclusive.

As the first permanent director of the University of Minnesota’s Institute on the Environment, which launched in 2008, Foley’s tendency to think big comes in handy. “When people mention the difficulty of thinking on a planetary scale,” says Foley, “my reaction is, ‘What’s so hard about that? It’s only one planet.’”

Foley, whose academic appointment is in the College of Biological Sciences Department of Ecology, Evolution and Behavior, started out studying physics and astronomy. “The beauty of being trained in physics is that you simplify, you look for the common elements,” says Foley. “The scale becomes less relevant. It works from molecules to galaxies.”

From astronomy, the transition to atmospheric sciences came naturally. After all, atmosphere is the first thing scientists see when looking at a distant planet. “A lot of what happens in the atmosphere is dictated by biology,” says Foley. “so I started research on global ecosystems.”

Foley’s own research revolves around understanding large-scale ecosystem processes, global patterns of land use, the planet’s water and carbon cycles, and interactions between ecosystems and the atmosphere. While at the University of Wisconsin-Madison, he helped found the Center for Sustainability and the Global Environment. That experience prepared him for the daunting task of positioning the Institute on the Environment in a crowded field.

While in some respects the Institute on the Environment is late to the party—many similar undertakings got started 20 or even 30 years ago—Foley considers it an advantage. The Institute has the chance to see what’s worked and what hasn’t, and bypass the anti-establishment sentiment that permeated many earlier efforts. Foley sees an opportunity to break from the well-worn path and find an undiscovered niche for the University. “This is a good historical moment to do something fresh and leapfrog the others,” he says.

Foley’s vision for the Institute hinges on the same kind of interdisciplinary thinking and big picture approach that has propelled his own academic pursuits. But he also sees a need for pragmatism and an entrepreneurial spirit. “One of the primary criteria for Institute on the Environment projects is ‘does it have a chance of getting out into the world?’” says Foley.

The University of Minnesota is at an advantage in this regard. “People here want to do good science but also science that does good,” Foley says. He notes the close ties that already exist between the basic sciences and the applied sciences at the University. But interdisciplinary thinking isn’t enough. “It’s great that we’ve found the stairways that connect within the ivory tower, but we also need to find the doors to the outside,” Foley says. “We need a new vision of outreach that’s more global.”

Part of that vision involves reaching out to the community, which in the U of M’s case includes a number of Fortune 500 companies. Minnesota is among the top 10 states in terms of the number of such corporations headquartered here. Foley points out that the research supported by the Institute may help solve the state’s economic problems as well as climate change. And, characteristically, he’s thinking big. “Why can’t Minnesota be the Silicon Valley for sustainability?” —Stephanie Xenos
You know that feeling you get when someone is watching you? Daniel Voytas and his colleagues should be getting that feeling a lot these days. The eyes of molecular biologists around the world are on them as they forge ahead on what could well be the next big breakthrough in genetic engineering.

A professor of genetics, cell biology, and development, Voytas came to Minnesota a year ago to head the Center for Genome Engineering. Today, he and his colleagues are hot on the trail of a powerful new approach to singling out genes within an organism’s DNA.

The tool that’s captured their attention uses a type of protein segment known as a zinc finger. Found naturally in some proteins that regulate DNA transcription and other cellular activities, zinc fingers are adapted to target and bind to precise DNA sequences in the genome. For genome engineers, that’s a marvelous capability: If you can figure out how to custom-make zinc fingers that latch onto a specific gene of your choice, there’s virtually no limit to what you can do with that gene, from learning what it codes for to boosting its capabilities to—in the case of genetic disorders—replacing a faulty version with a corrected copy.

Voytas became interested in zinc fingers in 2003, when investigators reported using them to modify specific genes in fruit flies and humans. One point of frustration in developing the technology has been finding a robust method for making proteins containing zinc fingers that target specific genes. Last year, Voytas and his colleagues published a report of a new technique for custom-making DNA-cleaving, zinc-finger-containing proteins called zinc-finger nucleases (ZFNs), along with specs on 37 ZFNs his team had constructed to alter genes at 11 sites in humans and other species. In March, he and his colleagues published a report in *Nature* showing that the method could be used to make specific changes to plant genomes with high efficiency.

U of M scientists and others are now lining up for tailor-made zinc fingers that fit their own research needs. In model organisms such as fruit flies and zebrafish, ZFNs could enhance basic understanding of gene function. ZFNs also hold promise for engineering plant genes for better food, fiber, or fuel production and repairing faulty human genes such as those that cause cystic fibrosis or create a predisposition to cancer.

With colleagues at Harvard, Voytas has established an international Zinc Finger Consortium to allow scientists to share information that will hasten the application of zinc fingers to real-world problems. In addition, he and colleagues at the University of Minnesota are setting up capacity within the center to custom-make ZFNs.

“There are still a lot of challenges,” says Voytas. “But it’s worth the frustration to work out the bugs. Our method clearly opens a door.” — Mary Hoff
The 1999 biological sciences reorganization transformed the way basic sciences support human health, the environment, renewable energy, agriculture and biotechnology at the University of Minnesota.

CBS is a relatively small college. But it makes a big difference through basic research that supports medicine, the environment, renewable energy, biotechnology and agriculture.

That role grew out of a sweeping, University-wide reorganization of the biological sciences 10 years ago that is reflected in the quality of basic research, facilities, faculty and students.

“It’s hard to point to specific benefits because virtually everything has changed,” says David Bernlohr, head of the Department of Biochemistry, Molecular Biology and Biophysics.

Before 1999 there were separate departments in Minneapolis and St. Paul. The fragmentation kept the University from competing effectively with other public research institutions for stature, funding, faculty and students.

To reverse that trend, President Nils Hasselmo initiated the reorganization in 1996, tapping CBS Dean Robert Elde and Medical School Dean Al Michael to lead it. Administrators and faculty alike saw a wealth of opportunities to improve biology research and education by eliminating duplication, sharing resources and encouraging collaboration.

When Mark Yudof became president in 1997, he knew that Minnesota needed to strengthen molecular and cellular biology research. He used the reorganization as a platform for his Molecular and Cellular Biology Initiative and secured $110 million from the state to construct the Molecular and Cellular Biology (MCB) Building and hire talented young faculty. The Regents approved the plan in October 1998 and in 1999 four consolidated departments began to take shape:

- Biochemistry, Molecular Biology and Biophysics (BMBB)
- Genetics, Cell Biology and Development (GCD)
- Neuroscience
- Plant Biology

The new departments reported jointly to CBS and the Medical School and/or the College of Food, Agricultural and Natural Resource Sciences, creating a kind of family tree. The reorganization culminated with the opening of the MCB building in October 2002. And the new faculty arrived between 2000 and 2005.

“The new structure created a massive root system to support growth of some of the University’s most essential endeavors,” Elde says. “And it’s really just beginning to bear fruit.” —Peggy Rinard
CBS faculty give the Biological Sciences Reorganization an “A.”

Kate VandenBosch  
Professor and Head of Plant Biology

VandenBosch became head of Plant Biology in 2000, when the reorganization was in full swing. Using funds created by the MCB Initiative, she hired eight young faculty with stellar credentials. Now well into their careers, these faculty have dramatically increased federal funding to the department and routinely publish research in peer-reviewed, high-impact journals.

“It’s been very gratifying to me to see faculty hired at the assistant professor level flourish. I’m very proud of what they have accomplished and what their accomplishments mean for the University.”

Judy Berman  
Distinguished University McKnight Professor  
Genetics, Cell Biology and Development

Berman appreciates the contact with other faculty who conduct yeast research, opportunities for collaborating with faculty in other fields, the open labs, and access to seminars and students. She has collaborated with faculty in the Institute of Technology and College of Pharmacy and has gone on rounds with Medical School faculty.

“I’ve only moved my lab a few miles, but I feel like I’m working in a different world,” she says. Since the reorganization, Berman has published a number of articles in Science and other leading peer-reviewed journals, won several million dollars in federal funding, and been named a fellow of the American Association for the Advancement of Science.

Gary Nelsestuan  
Professor of Biochemistry, Molecular Biology and Biophysics

“Consolidating the two biochemistry departments was probably the best thing that happened to biochemistry at the U in the 37 years I’ve been on the faculty because our research spans plants, animals and humans,” says Nelsestuan.

“We recently acquired new metabolomics equipment when Adrian Hegeman was hired to study plant metabolomics. But the technology is also getting lots of use from other BMBB faculty to identify biomarkers of human health involved in obesity, kidney disease, lung disease and organ and bone marrow transplantation. That alone shows how much sense it makes to have a seamless basic sciences organization.”

Ross Johnson  
Professor of Genetics, Cell Biology and Development

“It brought many developmental biologists together on the Minneapolis campus, which really paid off for my research. One outcome was discovering how cells pattern the left and right sides of a developing zebrafish embryo. It was an important finding we couldn’t have made otherwise.”

Johnson has also collaborated with Mark Herzberg’s lab in the Dental School. The two groups discovered that oral bacteria have an effect on communication mediated by epithelial cells lining the mouth.

Measures of Success

Prior to the reorganization, the National Research Council (NRC) ranked the University’s biosciences graduate programs in the mid 30s compared to 50 research universities in the U.S. Raising these rankings was a key motivation for the effort. Although the NRC hasn’t released rankings since 1995, a variety of measures clearly indicate that the University’s national position has improved dramatically.

- The Plant Biological Sciences Graduate Program was ranked sixth in the U.S. for 2007 by the Chronicle of Higher Education.
- Plant Biology’s funding increased from $500,000 to $3.75 million annually between 1999 and 2008.
- The Department of Genetics, Cell Biology and Development ranked 4th among public universities and 12th among all universities in 2008 for NIH funding. ($9 million)
- The Department of Biochemistry, Molecular Biology and Biophysics ranked 11th among public universities and 18th among all universities in 2008 for NIH funding ($10 million).
- The Department of Neuroscience ranked 5th among public universities and 10th among all universities for NIH funding ($8 million).

Between 2003 and 2008 faculty in CBS departments published 40 papers in Science and Nature—more than any other college and a third of all papers published by U of M faculty.

- Annual production of Ph.D.s has increased from XX to XX since XXXX.
- The average CBS freshman is now in the top five percent of his or her high school graduating class and has an ACT score of 29.
“Junior” faculty hit their stride

The crop of talented young faculty who joined CBS, the Medical School and the College of Food, Agricultural and Natural Resource Sciences as a result of the Molecular and Cellular Biology Initiative are now seasoned scientists making valuable contributions to the University and beyond.

Michael O’Connor
Professor and Head of Genetics, Cell Biology and Development. Howard Hughes Medical Institute Professor

O’Connor’s lab studies the role of signaling molecules in development using fruit flies and mice as model systems.

“I was attracted to the University of Minnesota by the great diversity of research, which has provided many opportunities for me to expand my research and establish new collaborations.”

Notably, O’Connor has collaborated with Hans Othmer in the Department of Mathematics to develop quantitative models of developmental processes, which have helped O’Connor understand signaling networks that pattern tissues during development. His lab has also collaborated with the Department of Neuroscience to explore new roles for signaling factors in regulating synaptic plasticity in the mammalian brain.

Daniel Bond
McKnight Land-Grant Assistant Professor, BioTechnology Institute

Bond’s lab studies the ability of microbes called geobacters to produce electricity. He came to Minnesota from the University of Massachusetts, Amherst to pursue research opportunities emerging at the interface of microbiology and energy.

“I knew much of this research would have to be interdisciplinary, requiring as many students with engineering backgrounds as molecular biology. Coming to Minnesota meant access to faculty and core facilities that would help us invent new approaches for studying microbial electricity production.”

Bond’s lab now hosts biochemistry, chemistry, electrochemistry, microbiology, and engineering students and he has collaborated with faculty from microbial biochemistry to civil engineering to electrical engineering.

Carrie Wilmot
Associate Professor and Director of the Kahlert Structural Biology Lab

Wilmot’s lab uses X-ray snapshots of enzymes to create movies showing how they catalyze chemical reactions in biological systems. Her lab studies enzymes that require copper or iron-containing heme to function. She was drawn to the U from the University of Leeds, UK by the world-renowned Center for Metals in Biocatalysis.

“I have the most wonderful colleagues in structural and chemical biology, microbial biochemistry and biotechnology. The facilities are state of the art. Everyone in CBS is excited by all the fantastic science going on around them, and the atmosphere is very upbeat. It is a terrific place to do great science.”

Peter Tiffin
Associate Professor of Plant Biology

Tiffin is interested in the evolution of species interactions and adaptation to novel environments, including elevated CO2 and other conditions created by human activities. He is currently investigating ecological and evolutionary forces that limit species ranges, genetic consequences of rapid range expansion, and adaptation that accompanies species migration into high-latitude environments.

“I was excited about the U’s offer because the diversity of biological sciences, which in CBS ranges from molecular biology to ecosystem science, fosters interaction among biologists with very different perspectives. Most of the research I have conducted over the past few years would not have happened without these interdisciplinary collaborations.”
A Question of Scale

Biology research goes global and so do opportunities for CBS students

Study abroad is a rite of passage for many college students: Learning a language, immersing oneself in a different culture, experiencing culture shock, enlarging one’s sense of the world. But for biology students, experiencing other cultures goes beyond seeing the Eiffel Tower for the first time. It’s an opportunity to work with world-class researchers in the field and within far-flung academic communities.
Experience abroad is becoming increasingly valuable as biologists address global-scale problems such as infectious disease and climate change. Biology students who venture abroad come back with a trove of political, cultural, personal and scientific knowledge that positions them well to take on those challenges.

Soon, that unique blend of experience could translate into an academic opportunity. College of Biological Sciences Dean Robert Elde envisions a certificate in global biology for students who spend time conducting research in at least three different countries. "Scientific innovations often are rooted in a specific community even in this globalized world," says Elde. "Spending time abroad on scientific pursuits is a lesson in the culture of science and what it means to be a scientist in a global sense."

One way for students to gain that kind of experience: work with CBS faculty on location. "The college is trying to boost connections between students and faculty who already do research abroad," says Robin Wright, associate dean for faculty and academic affairs. "It's about more than just research. It's about an appreciation of the global nature of the scientific problems we face."

Ecology research provides a case in point. CBS faculty conduct field work in locations around the world from Papua New Guinea to Costa Rica. Jennifer Powers, an assistant professor in the Department of Ecology, Evolution and Behavior, regularly brings undergraduate and graduate students along to help with her field work in Panama and Costa Rica. Powers notes that the realities of working in locations even within one region of the globe can be strikingly different. "When I started out I’d only dug holes in the soils of North Atlantic Costa Rica. But in Panama it’s totally different," says Powers, in regard to navigating the politics and the ecosystems. "The idea of having people visit multiple places is fantastic."

Jeannine Cavender-Bares, an assistant professor in the same department as Powers, sees multiple benefits in immersing students in an international research experience early. She was recently awarded a five-year grant to continue field work in Costa Rica and Honduras, and plans to bring undergraduate and graduate students along.

"A lot of the biodiversity in the world is at lower latitudes," says Cavender-Bares. "And if we’re interested in trying to play a role in preserving that diversity and conserving ecosystems it makes sense to collaborate with our partners in other parts of the world." Conducting research abroad provides real-world lessons in how to do that effectively. "You definitely work with a different rhythm and set of expectations. … You have to deal with all sorts of unexpected things. Insect attacks, washed out roads, destroyed experiments from pathogens and outbreaks."

Cavender-Bares and Regents Professor David Tilman, a world-renowned ecologist, are working to set up a special seminar that would help connect the dots of global-scale ecology. "It’s becoming clear that it’s not possible to solve problems in isolation," says Cavender-Bares. "We’re trying to set up a distributed seminar across multiple institutions to look at major environmental issues in the context of complexity, then develop field courses in Mexico and China where we can apply that framework to a regional situation."

Conducting research abroad is commonplace for many ecologists, but says Robert Elde, lab-based biology research—especially in a developing country—provides a firsthand lesson in the ways science and scientific research supports society. "Students observe firsthand the stark contrast between less developed countries and ours in terms of resources and investment in science and technology, and how that connects to the economy."

At the other end of the spectrum, some countries are gaining momentum in scientific research, boosting competition as well as potential for collaboration. "We don’t live in the same world we did even 10 years ago," says Robin Wright. "As a country we’re competing with people all over. We have to ensure that our students develop a global understanding and appreciation. Having the skills to work with people who think differently will be increasingly important." —Stephanie Xenos
Paul Gugger  
**Adviser:** Jeannine Cavender-Bares  
(Ecology, Evolution and Behavior)

“One important benefit to biology students who study abroad is gaining the ability to understand and communicate with other cultures about their natural heritage. Generally, this could benefit research into the medicinal use of plants, broaden our agricultural horizons, and promote conservation and sustainable resource use here and in other countries. My first research abroad experience was in Mexico in fall 2007. I was based at the Universidad Nacional Autónoma de México-Morelia. I traveled through the remote mountainous parts of the central and northern states in search of Douglas fir, a common tree in the United States and Canada, but rare and threatened in Mexico. My second experience was in Cuba, where I accompanied my adviser [Jeannine Cavender-Bares] last October to study the origin of oaks on the island. Beyond the scientific merits of the research, I found great value in the cultural experiences in each place. Mexico was my formal introduction to Latin America. But for me, even more profound than my trip to Mexico was my experience in Cuba because I was able to reconnect with family. My mother was born and raised in the city of Cienfuegos on the southern shore of Cuba. Shortly after the Cuban Revolution, in 1962, they were forced to flee to the United States, where they were naturalized as refugees, eventually settling in New Jersey.”

Annika Moe  
**Adviser:** George Weiblen  
(Plant Biology)

“I volunteered on a biodiversity study in Madagascar as an undergraduate and I’ve been to Papua New Guinea twice, including for six months this past summer and fall. I’m looking at the relationship between figs and pollinating wasps—a well-known topic of co-evolution. It’s been a model of specificity, but that’s coming into question. Papua New Guinea is definitely much different than anywhere else I’ve been. There are a lot of social dynamics going on. You have to become much more than a scientist. You have to be a politician, a linguist, an educator. You have to play a lot of roles you’re not used to playing. It’s challenging but also rewarding. While I was there I got involved in local conservation efforts and taught lessons at the local school. You become invested in the area. Being in ecology and seeing where the jobs are going—climate change, global issues—having these research experiences means I can be marketable to any global ecology project. If I can work in Papua New Guinea, I can work anywhere.”

Stefani Salute  
**Adviser:** Jennifer Powers  
(Ecology, Evolution and Behavior)

“I spent the summers of 2007 and 2008 living and working in the tropical dry forests of the Guanacaste province of Costa Rica. I feel that having the opportunity to work, live and conduct research abroad has shaped me into a much more confident and ambitious student and person. It’s amazing to experience the people and culture of a country different than your own. You realize that your existence on earth is so small in relation to not only all that has come before you and all that will follow you, but all that is going on around you in the present. Conducting research abroad forces you to be more independent and self-sufficient. The luxury of a safe, warm, dry laboratory doesn’t exist in the field. You’re confronted with unique and difficult challenges at every turn; however, you know that struggling through them and finding ways to solve them will make you a much stronger person and a much more determined scientist. It’s one thing to learn concepts and theories from a textbook, but it’s a completely different thing when you get a hands-on, first-person encounter with what you’re studying.”

See an audio slideshow of Anika’s fieldwork in Papua New Guinea and read more about Paul’s reunion with his Cuban relatives at www.cbs.umn.edu.
When College of Biological Sciences Dean Robert Elde offered Scott Lanyon the opportunity to head the Department of Ecology, Evolution and Behavior (EEB) last summer, the former director of the Bell Museum of Natural History was ready for a new challenge. And the department, where he is a professor, needed his leadership.

While EEB is ranked among the top departments of its kind, it was at a critical juncture after former department head Claudia Neuhauser and several faculty had moved on or retired over the course of a year. The departures didn’t reflect a problem with EEB, but the department had taken an intellectual hit that concerned the remaining 27 faculty members and had been noted in academic circles beyond the University.

“I want to ensure that EEB remains a top department,” says Lanyon. “While the departure of colleagues represents a challenge, replacing them also provides opportunities to shape the department’s future and make it even better.”

Lanyon’s priority is to hire faculty in a way that strengthens the cohesiveness of the department’s three disciplines: ecology, evolution and behavior. He is conducting searches for two scientists who are leaders in one of the three disciplines and also exploring connections with one of the other disciplines.

Lanyon was also lured to the post by the prospect of becoming more involved with education. The fields of ecology, evolution and behavior have been advancing rapidly to meet global environmental challenges such as climate change and loss of biodiversity. This growth is creating new career opportunities, and the curriculum needs to catch up.

“We’re still preparing students the same way we have in the past even though a variety of new career paths have emerged,” Lanyon says. “I want to change the curriculum to prepare students for the future.”

Moving from the Bell Museum to his department also allows Lanyon to spend more time on his own research. He is involved in the National Science Foundation’s Tree of Life project, which aims to show how all forms of life are genetically connected through time. Lanyon studies how certain characteristics (such as vocalization, appearance, mating habits and nest building) evolved in different species of blackbirds, a large and diverse group of songbirds.

Asked if his research on evolution gives him insights into shaping EEB’s future, Lanyon says, “Oh, I think we’re going to move much faster than avian evolution.”

Lanyon’s father was curator of birds at the American Museum in New York. Lanyon grew up at the museum’s field station on Long Island, where he used to tag along with undergraduate students during the summer. So it’s not surprising that when he left the nest, he migrated toward a career in ornithology.

After earning his Ph.D. at Louisiana State University, Lanyon held positions as a scientist and curator at the Field Museum of Natural History in Chicago. He came to the University of Minnesota in 1995 as director of the Bell Museum of History and an associate professor in EEB. During his 13 years at the Bell, he improved collections and strengthened research and outreach programs. He also led the museum through planning for a new building and increased private support. —Peggy Rinard
When Bill Hilton Jr., who earned a master’s degree in ecology, evolution and behavior in 1982, found himself at the airport with a few minutes to kill last November, he figured he’d drop by the newsstand. Imagine his shock when he thumbed through a copy of Discover magazine’s just-published article on the “50 Best Brains in Science”—and found himself listed as one of them.

“I had no idea,” he says. “I had gotten a phone call last summer from someone saying they were doing an article about amateur scientists … I sent them a link to my biography and that was it. It was a total surprise.”

An educator and naturalist, Hilton is founder of a York, South Carolina, environmental learning center, the brains behind an international citizen science project known as Operation RubyThroat—and a man on a mission.

Hilton came to the University of Minnesota in the late 1970s as a high school science teacher interested in bolstering his knowledge of natural history. He says the experience—which included three years studying the behavioral ecology of blue jays—was transformational.

“I became a much better naturalist. I became a much better scientist, I know I became a better teacher,” he says. “What more could you ask from a university?”

After finishing his degree Hilton returned to South Carolina and the classroom. But the field research bug would not let go. Curious about the ruby-throated hummingbirds that frequented the old farmstead where he and his family lived, he applied for and received special federal authorization to capture and band hummingbirds. Within a week he had banded 75 of the birds.

“Since then I’ve just continued at a pretty steady pace,” he says. He continued banding—some 52,000 birds of 124 species to date, including nearly 4,000 hummingbirds. He built trails through his 11-acre property, incorporated it as the nonprofit Hilton Pond Center for Piedmont Natural History, and started guiding field trips literally in his own backyard. In 1996 he established Operation RubyThroat, a citizen science/nature education program revolving around hummingbirds that eventually was funded in part by National Science Foundation.

“One of my great joys in life is that I can’t separate my professional life from my personal life,” Hilton says. “I get up in the morning, catch birds, write about it on my Web site, go out in the evening and lecture to people. I live where I work and I do what I am.”

As part of Operation RubyThroat, for the past five years Hilton has led groups of teachers and citizen scientists on expeditions to Costa Rica to study ruby-throated hummingbirds on their wintering grounds. “As the only scientist looking at ruby-throats on the other end of their migratory path,” Hilton says, “I’m learning some very interesting things about these birds that spend half their year in the tropics.”

Hilton says that although he appreciates the validation the Discover article gave to his life work, that’s not what makes him most proud.

“Even though I’ve spent my life learning about nature, there’s no sense learning unless you share with other people. I feel like my greatest accomplishment is sharing that knowledge with others so they become as excited about nature as I am.”

Learn more about Bill Hilton Jr.’s efforts at www.hiltonpond.org —Mary Hoff
Earlier this year, the college ventured into social networking. CBS launched a Fan Page on Facebook for Itasca Biological Station and Laboratories and in no time alumni, faculty and others with a connection were busy posting photos and memories.

Choosing Itasca for our first foray into social networking was a no-brainer. So many students and faculty, past and present, have stories to tell about this vital outpost of the biological sciences. For those of you who have spent time at Itasca, the value of the station is obvious.

In recent years, it’s been the first stop for new biology students at the U. Itasca creates a sense of community and serves as a living laboratory for students and researchers alike.

For several years now, CBS has been working hard to raise funds to update the facilities and pay for much-needed repairs. The vision is to create a world-class research facility at the headwaters of the Mississippi that attracts researchers from the U and beyond, and provides biology students with up-to-date labs in which to learn.

It will take millions of dollars to achieve the goals set out in the Itasca master plan. While it would be easy to give up on these big, far-sighted goals given the state of the economy, to do so would mean undercutting our ability to compete and provide a high-quality biology education in the long run. The good news is we’re close to achieving a small part of our goal.

To complete renovations on one of our cabins, we only need $150,000. The cabin will provide researchers with housing year round—something that wasn’t possible with the old structures. It may seem like a small thing, but finishing even one cabin brings us a step closer to our goal of positioning Itasca as a critical hub for biology research and education.

Please consider making a donation to the Itasca Centennial Fund. Go to www.giving.umn.edu and follow the “Give Online Today” link, or contact me directly at hennen@umn.edu.

—Laurie Hennen, Director of Development
hennen@umn.edu

A little goes a long way

Four Questions for Imee Combronero

Imee Cambronero (B.S., Biology ’03), now a graduate student in the School of Public Health, recently returned from India where she worked on a documentary about family planning. Cambronero also serves as a College of Biological Sciences “ambassador” for the University of Minnesota Foundation.

When did you first become interested in public health?

“I got interested in public health after the hockey riots at the U when binge drinking came into the spotlight. I began looking into alcohol consumption on campus. I saw how a public health issue tied into biology at a macro level.”

After graduating, you worked for Rep. Betty McCollum both in Washington, D.C. and in Minnesota. How did that experience feed your interest in public health?

“I wanted to understand the political side of public health policy. In D.C. there’s always a reception, always a briefing. You get thrown into the pot of all the issues important to the public. ... I also worked on grass-roots campaigns in Minnesota where I got to observe cycles of public health policy in the making and how big policy translates to the local level.”

You are making a documentary about family planning in India. Why there?

“India has one of the oldest family planning policies, but also one of the highest populations.”

You spent time in health facilities trying to unravel that contradiction. Any surprising conclusions?

“I found that wives are responsible for family planning but they aren’t the decision-makers. The mother-in-law often dictates.”
Postcards From Alumni Abroad

After receiving his teaching certificate last spring, Matt Kuehl (B.S. Ecology, Evolution and Behavior ’06) accepted a position as an assistant language teacher at Sieryo Junior and Senior High School in Akita, Japan. He helps teach English classes, coach speech club and run the English Conversation Club.

“Teaching and living in Japan is a fun and challenging experience,” says Kuehl. “I have never met so many interesting people from around the world. ... It also provides me with the opportunity to stay connected to my ecology roots by learning about such local fauna as the tanuki (raccoon dog), Japanese serow, and the hata-hata (a popular local fish).”

As Monsanto’s technology strategy lead for Latin America, Timothy Conner (Ph.D., Genetics ’87) and his family made a move to Sao Paulo, Brazil in 2007. Conner notes the hardships of adapting to a new language and culture as well as navigating a huge, dense city with extremes of wealth and poverty. “Yet challenging as city life is,” he says, “Brazil is one of the most beautiful, diverse and resourceful countries in the world.”

“Sugar cane, or ‘cana’, as it is referred to here, has experienced tremendous growth and continues to expand investments in biofuels, primarily for the production of ethanol, continue to be driven by local and regional demand,” says Conner. “The central reason that I am here in Brazil is to better understand tropical agriculture ... in this critical time of preparing to double food production on the same acre footprint by 2050 as the demand for feed fiber and biofuels increases.”

Class Notes

Mike Nesheim (Ph.D., Biochemistry ’78) is a professor of biochemistry at Queen’s University in Kingston, Ontario, where he has lived since 1984. Before moving to Canada, Nesheim spent 16 years working at Mayo Clinic.

Mary Jo Lockbaum (B.S. Biology ’90) owns and manages The Sustainability Group, a Denver-based consulting firm that helps organizations “go green” by reducing waste, conserving energy and reducing greenhouse gas emissions. Lockbaum misses Minnesota, but loves skiing and riding her horses in the mountains of Colorado.

After graduating last year, Kevin Schiller (B.S. Biochemistry ’08) moved to Philadelphia to take a position as a microbiologist with the Institute for Environmental Health Laboratories and Consulting Group. He is actively looking for a research position and plans to eventually apply to graduate school at the University of Minnesota.

Camille Bodley Troup (B.S. Biochemistry ’86) lives in Livermore, California with her husband and two young sons. She holds a visiting associate professorship in bioengineering at the University of the Pacific and serves as assay development director of the biotechnology company dVBio, Inc.

Rania Habib (B.S. Microbiology ’04) graduated from the University of Minnesota School of Dentistry last spring and will start on a six-year joint-MD residency in oral and maxillofacial surgery at the University of Maryland, Baltimore this summer.

Currently in her second year as a student in the University of Minnesota School of Veterinary Medicine, Rachel Jones (Weisert) (B.S. Ecology, Evolution and Behavior ’04) plans to practice companion animal medicine when she graduates in 2011. “I absolutely love it,” says Jones, “and cannot imagine doing anything else with my life!”
The new CBS YouTube channel offers a window into what’s going on at the College of Biological Sciences. Some recent video highlights:

- Professor Michael Sadowsky explains the impetus behind an effort to document the biodiversity of the Mississippi River.
- Ecology, Evolution and Behavior graduate students brave the cold to participate in an art project on ice that offers a lesson in limnology.

Are you a fan of Itasca Biological Station and Laboratories or Cedar Creek Ecosystem Science Reserve? Make it official on Facebook. Both field stations have “fan pages” where friends and alumni can stay in the loop about research and events, or just post photos and fond memories.

Just search for the stations by name and click on “Become a Fan.”

If you are interested in networking with other College of Biological Sciences alumni, this group is for you. By bringing alumni together, the CBS LinkedIn group offers opportunities to make professional contacts in fields relating to the biological sciences and beyond.

Search for the “University of Minnesota College of Biological Sciences” group on LinkedIn and start making connections.